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काशी हिन्दू विश्वविद्यालय पत्रिका

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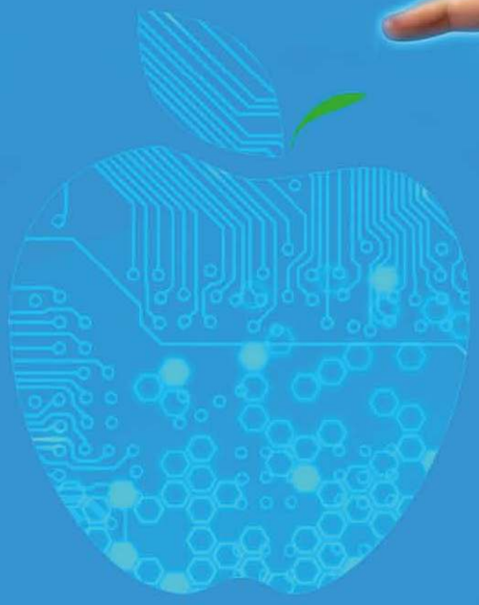

"विज्ञान एवं प्रौद्योगिकी विशेषांक"

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सम्पादक

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हिन्दी विभाग, कला संकाय

अतिथि सम्पादक

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न त्वहं कामये राज्यं न स्वर्गं नाऽपुनर्भवम् ।
कामये दुःखतप्तानां प्राणिनामार्तिनाशनम् ।।

पं० मदन मोहन मालवीय जी

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कुल-गीत

मधुर मनोहर अतीव सुन्दर,
यह सर्वविद्या की राजधानी।

यह तीन लोकों से न्यारी काशी।
सुज्ञान धर्म और सत्यराशी।।
बसी है गङ्गा के रम्य तट पर,
यह सर्वविद्या की राजधानी। मधुर.।।

नये नहीं हैं ये ईंट पत्थर।
है विश्वकर्मा का कार्य सुन्दर।।
रचे हैं विद्या के भव्य मन्दिर,
यह सर्वसृष्टि की राजधानी। मधुर.।।

यहाँ की है यह पवित्र शिक्षा।
कि सत्य पहले फिर आत्म-रक्षा।।
बिके हरिश्चन्द्र थे यहीं पर,
यह सत्यशिक्षा की राजधानी। मधुर.।।

वह वेद ईश्वर की सत्यबानी।
बनें जिन्हें पढ़ के ब्रह्मज्ञानी।।
थे व्यास जी ने रचे यहीं पर,
यह ब्रह्म-विद्या की राजधानी। मधुर.।।

वह मुक्तिपद को दिलाने वाले।
सुधर्म पथ पर चलाने वाले।।
यहीं फले-फूले बुद्ध शंकर,
यह राज-ऋषियों की राजधानी। मधुर.।।

सुरम्य धाराएँ वरुणा अस्सी।
नहाए जिनमें कबीर तुलसी।।
भला हो कविता का क्यों न आकर,
यह वागविद्या की राजधानी। मधुर.।।

विविध कला अर्थशास्त्र गायन।
गणित खनिज औषधि रसायन।।
प्रतीचि-प्राची का मेल सुन्दर,
यह विश्वविद्या की राजधानी। मधुर.।।

यह मालवी की है देशभक्ति।
यह उनका साहस यह उनकी शक्ति।।
प्रकट हुई है नवीन होकर,
यह कर्मवीरों की राजधानी।

मधुर मनोहर अतीव सुन्दर,
यह सर्वविद्या की राजधानी।।

(डॉ. शान्ति स्वरूप भटनागर द्वारा रचित)

वेणु राजामणि
राष्ट्रपति के प्रेस सचिव
Venu Rajamony
Press Secretary to the President

सत्यमेव जयते

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संदेश

भारत के राष्ट्रपति, श्री प्रणब मुखर्जी को यह जानकर हार्दिक प्रसन्नता हो रही है कि काशी हिंदू विश्वविद्यालय, बनारस द्वारा प्रकाशित 'प्रज्ञा जर्नल' के आगामी अंक को 'विज्ञान एवं प्रौद्योगिकी विशेषांक' के रूप में किया जा रहा है। आशा है जर्नल में प्रकाशित सामग्री संकाय सदस्यों एवं विद्यार्थियों के लिए ज्ञानवर्धक एवं उपयोगी तथा विद्यार्थियों में वैज्ञानिक मनोवृत्ति का विकास करने में सहायक होगी।

राष्ट्रपति जी प्रज्ञा जर्नल के 'विज्ञान एवं प्रौद्योगिकी विशेषांक' के प्रकाशन के लिए अपनी शुभकामनाएं प्रेषित करते हैं।

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अध्यक्ष, लोक सभा
SPEAKER, LOK SABHA

इन्दौर, दि. 06 जनवरी 2015

सन्देश

मुझे यह जानकर खुशी हुई है कि काशी हिन्दू विश्वविद्यालय (बी.एच.यू.) द्वारा सन् 1958 से निरंतर प्रकाशित हो रही पत्रिका "प्रज्ञा जर्नल" का आगामी विज्ञान एवं प्रौद्योगिकी विशेषांक शीघ्र ही प्रकाशित होने जा रहा है। इस विशिष्ट अंक में विज्ञान एवं प्रौद्योगिकी से संबंधित कई स्तरीय लेख एवं शोध प्रपत्र छपेंगे जिनसे विद्यार्थियों के साथ-साथ सभी पाठकगण लाभान्वित होंगे। विज्ञान की शिक्षा एवं 'वैज्ञानिक सोच' किसी भी समाज अथवा देश की प्रगति का आधार-स्तम्भ होते हैं। महामना पंडित मदन मोहन मालवीय जी का स्वप्न था कि हमारे देश की युवा पीढ़ी के पास उच्च तकनीकी शिक्षा, विज्ञान और प्रौद्योगिकी संबंधी जानकारी हो तथा वे विज्ञान की शिक्षा में विशारद हों। मुझे हर्ष है कि उनकी यह इच्छा वास्तविकता में परिणत हो गई है। उनके रोपे गए पौधे ने आज वृक्ष का आकार ग्रहण कर लिया है।

मैं आशा करती हूं कि इस विशेषांक के प्रकाशन से दो हित सधेंगे। एक तो लेखकगण को प्रेरणा मिलेगी कि वे और शोध प्रपत्र प्रकाशित करें, दूसरे इसके माध्यम से यह ज्ञान नए विद्यार्थियों तक पहुंचेगा। मैं 'प्रज्ञा जर्नल' के सफल प्रकाशन की कामना करती हूँ।

नववर्ष की मंगलकामनाओं सहित,

(सुमित्रा महाजन)

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मार्च ०५, २०१५

सन्देश

मुझे यह जानकर अत्यंत हर्ष का अनुभव हो रहा है कि विश्वविश्रुत काशी हिन्दू विश्वविद्यालय की प्रसिद्ध शोध-पत्रिका **''प्रज्ञा''** के ''विज्ञान एवं प्रौद्योगिकी विशेषांक'' (अंक-६०, भाग-२, वर्ष २०१४-१५) का प्रकाशन किया जा रहा है। यह पत्रिका सन् १९५८ ई० से लेकर आज तक महामना के विचारों एवं आदर्शों तथा काशी हिन्दू विश्वविद्यालय की वैदुष्य परम्परा का सफल निर्वहन करती चली आ रही है। इस विश्वविद्यालय में छात्र एवं छात्राओं के मानसिक विकास एवं बौद्धिक क्षमता की वृद्धि के साथ ही उनमें उत्तम संस्कारों एवं उज्ज्वल चरित्र-बल के विकास पर भी ध्यान दिया जाता है। 'प्रज्ञा' जर्नल ने समय-समय पर वर्तमान परिवेश की ज्वलन्त समस्याओं एवं युगीन चेतनाओं से सम्बन्धित अनेक विशेषांक प्रकाशित किये हैं। इसी क्रम में वैज्ञानिक एवं प्रौद्योगिकी की विविध शाखाओं से सम्बन्धित अनेक शोध प्रपत्र एवं लेख प्रस्तुत अंक में प्रकाशित किये गये हैं। इस अंक में अन्तरराष्ट्रीय एवं राष्ट्रीय ख्याति प्राप्त वैज्ञानिकों एवं चिन्तकों के अनेक लेख संकलित हैं, जिनके द्वारा विज्ञान एवं प्रौद्योगिकी के विभिन्न क्षेत्रों की विशिष्ट उपलब्धियों का ज्ञान पाठक वर्ग को हो सकेगा।

मैं आशा करता हूँ कि यह विशिष्ट अंक विज्ञान एवं प्रौद्योगिकी के क्षेत्र के जिज्ञासुओं एवं सभी प्रबुद्ध पाठकों की ज्ञान-जिज्ञासाओं को संतुष्ट करेगा। 'प्रज्ञा' जर्नल के विज्ञान एवं प्रौद्योगिकी विशेषांक के सफल एवं स्तरीय प्रकाशन हेतु मैं इसके सम्पादक प्रो. श्रीनिवास पाण्डेय एवं उनके समस्त सहयोगियों को हार्दिक बधाई देता हूँ और साथ ही पत्रिका की अपार सफलता की कामना करता हूँ।

(गिरीश चन्द्र त्रिपाठी)

सम्पादकीय

प्राची-प्रतीचि के सुन्दर मेल से बनी अतीव सुन्दर इस सर्वविद्या की राजधानी में पूरब और पश्चिम की सभी विद्याओं एवं प्राचीन तथा अर्वाचीन ज्ञान की विविध शाखाओं के अध्ययन, अध्यापन एवं अनुसंधान की व्यवस्था है। इस महान विश्वविद्यालय के संस्थापक राष्ट्ररत्न पूज्य महामना पं. मदन मोहन मालवीय जी की दूरदृष्टि एवं उनकी उदात्त कल्पना का मूर्तमान स्वरूप यह काशी हिन्दू विश्वविद्यालय है। यही कारण है कि महामना ने आरम्भ से ही सांस्कृतिक एवं मानविकी विषयों के साथ-साथ आधुनिक विज्ञान एवं अद्यतन तकनीकों के अध्ययन/अध्यापन की व्यवस्था की थी। उन्होंने सन् 1905 के विश्वविद्यालय के प्रास्पेक्ट्स में भारत की क्षीण होती गौरवपूर्ण परम्परा पर चिन्ता व्यक्त करते हुए लिखा था— ''जो भारतवर्ष कभी अपनी धार्मिक/आध्यात्मिक शिक्षाओं द्वारा ही नहीं, अपितु विज्ञान, कला-कौशल, उद्योग-धन्धे आदि समस्त विद्याओं द्वारा संसार को उपकृत करता था .... आज दिनों दिन सूखता जा रहा है।'' उन्होंने इस चिन्ता से मुक्ति का रचनात्मक उपाय सुझाया और आधुनिक दृष्टि से व्यावहारिक कदम उठाने का संकल्प लिया— ''भारत अपने प्राचीन गौरव को प्राप्त करने में तब तक सर्वथा असमर्थ है जब तक वह वर्तमान वैज्ञानिक अन्वेषणों का अध्ययन नियमित तथा अनिवार्य नहीं बनाता।''

महामना की वैज्ञानिक सोच एवं दूरदर्शी दृष्टि का परिणाम है कि उन्होंने 1919 में ही बनारस इंजीनियरिंग कालेज (बैंको) की स्थापना की, जिसके प्रथम प्राचार्य चार्ल्स एलबर्ट किंग थे। यही कालेज कालान्तर में चलकर 1968 ई. में आई.टी. बना और जून 2012 में आई.आई.टी. बना। सन् 1924 ई. में सरसुन्दर लाल आयुर्वेद चिकित्सालय की स्थापना हुयी और वही सन् 1960 में मेडिकल कालेज (संस्थान) बना। इसके अतिरिक्त कृषि विज्ञान संस्थान एवं विज्ञान संकाय में अनेक आधुनिक विषयों के अध्ययन अध्यापन की आरम्भ से ही व्यवस्था की गयी। विज्ञान एवं तकनीकी क्षेत्रों में महामना के युगान्तकारी योगदान को चिर स्मरणीय बनाने हेतु 'प्रज्ञा' परिवार ने ''विज्ञान एवं प्रौद्योगिकी विशेषांक'' (अंक-60, भाग-2, वर्ष 2014-15) का प्रकाशन किया है। इस विशिष्ट अंक में आधुनिक विज्ञान एवं तकनीक के विविध क्षेत्रों से जुड़े हुए अनेक शोध प्रपत्र/लेख संकलित हैं। प्रस्तुत अंक में अन्तरराष्ट्रीय एवं राष्ट्रीय ख्याति प्राप्त अनेक वैज्ञानिकों एवं तकनीकी विशेषज्ञों के स्तरीय लेख संग्रहीत हैं। इस अंक में अंग्रेजी, हिन्दी एवं संस्कृत भाषा में लिखे गये शोध प्रपत्र/लेख प्रकाशित हैं। आशा है कि इससे पाठक वर्ग को विज्ञान एवं तकनीक के विविध क्षेत्रों से जुड़ी हुयी अनेक महत्वपूर्ण जानकारियाँ प्राप्त होगीं और यह अंक प्रबुद्ध पाठक वर्ग में पर्याप्त समादरणीय एवं संग्रहणीय बनेगा।

'प्रज्ञा' के ''विज्ञान एवं प्रौद्योगिकी विशेषांक'' (अंक-60, भाग-2, वर्ष 2014-15) के प्रकाशन के अवसर पर मैं सर्वप्रथम भारत के राष्ट्रपति एवं इस विश्वविद्यालय के विजिटर महामहिम श्री प्रणव मुखर्जी जी, लोक सभा अध्यक्ष श्री सुमित्रा महाजन जी के प्रति हार्दिक कृतज्ञता ज्ञापित करता हूँ जिनके शुभ संदेश एवं आशीर्वाद से हममें पर्याप्त उत्साह का संचार हुआ है। इस महान विश्वविद्यालय के कुलपति प्रो. गिरीश चन्द्र त्रिपाठी जी के प्रति हार्दिक आभार व्यक्त करता हूँ जिनकी प्रेरणा एवं प्रोत्साहन से यह विशिष्ट अंक प्रकाशित हुआ है। कुलसचिव डॉ. के.पी. उपाध्याय, वित्त अधिकारी श्री अभय ठाकुर तथा विश्वविद्यालय के अन्य पदाधिकारियों को भी धन्यवाद देता हूँ जिन्होंने अनेक प्रकार से हमारी सहायता की। 'प्रज्ञा' के संरक्षक मण्डल तथा सम्पादक मण्डल के आदरणीय सदस्यों एवं इस अंक के अतिथि सम्पादकों को उनके शैक्षणिक परामर्श हेतु कृतज्ञता ज्ञापित करता हूँ। इस अंक के विद्वान लेखकों का मैं हृदय से आभारी हूँ जिनके शोध प्रपत्रों/लेखों से यह विशिष्ट अंक समृद्ध हुआ है। बी.एच.यू. प्रेस के आचार्य प्रो. राकेश रमन एवं प्रेस के अन्य कर्मचारियों को प्रकाशन सम्बन्धी सहायता के लिए धन्यवाद देता हूँ। अन्त में मैं 'प्रज्ञा' कार्यालय के श्री राजेश कुमार, श्री जयप्रकाश एवं श्री अशोक कुमार को शुक्रिया अदा करता हूँ, जिन्होंने कदम-कदम पर मेरा सहयोग किया।

(प्रो. श्रीनिवास पाण्डेय)
सम्पादक, 'प्रज्ञा' जर्नल

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INDUSTRIAL APPLICATIONS OF NOVEL ALPHA AMYLASE

PROF. OM PRAKASH* AND SAUMYA KHARE**

New frontiers in biotechnology have given renewed impetus into industrial applications of α-amylase. Amylase represents one of the most important enzymes in biotechnology. Advancement in enzyme technologies endeavour cost effective and efficient production to meet the growing demand in industrial processes. The world market for industrial enzymes is estimated to be around 3 billion US dollar.[1] Amylase account for about 30% of world's enzyme production.[2] Consumption of enzyme is about 29% as food enzymes, 15% feed enzymes and 56% others.[3] In 1811 amylase was the first starch degrading enzyme discovered by Kirchhoff. As diastase, amylase was the first enzyme to be discovered and isolated by Anselme Payen.[4] The first three-dimensional structure of α-amylase was isolated from *Aspergillus oryzae* known as Taka-amylase A.[5] In 1930, Ohlsson suggested the classification of starch digestive enzymes in malt as α- and β-amylases.[6]

Amylases are ubiquitous enzymes which are produced from various sources including plants, animals and microorganisms. Despite of wide distribution, the microbial sources have attracted greater attention for industrial production of amylase due to several advantages, such as cost effectiveness, consistency, less time and space required for production, ease of process modification and optimization etc.[7] Amylases from microbial sources have dominant applications. In starch processing industries, the process of chemical hydrolysis of starch have been completely replaced by microbial amylases. Broad spectrum of α-amylase applications in industrial processes has widened its use in different sectors such as textile industries, starch processing, bread, bakery, biofuel, detergents, paper, brewing and distilling industries as well as in other fields like biotechnological treatment of wastes, molecular biology, pharmaceuticals, including medicinal, clinical and analytic chemistry etc.

Alpha amylase

α-amylase (E.C. 3.2.1.1) is an endoenzyme that catalyzes the hydrolysis of starch molecule in random fashion, which leads to the formation of á-limit dextrin, linear oligosaccharides, maltose and glucose unit by cleavaing α-D-(1-4)-glycosidic linkages. These are metalloenzymes which require calcium ions (Ca^{2+}) for their optimal activity, structural integrity and stability. Starch hydrolyzing enzymes are glycoside hydrolases which belongs to glycoside hydrolase family (GH-13) including α-amylase which have wide applications in industrial sectors. The α-amylase family of glycoside hydrolyses, is the largest family of glycoside hydrolases, transferases and isomerases comprising nearly 30 different enzymes. According to the classification of Henrissat[8] of α-amylase family, based on amino acid sequence homology, comprises of those enzymes which have following characteristic features:

1. They act on α-glycosidic bonds and hydrolyze them to produce α-anomeric mono- or oligosaccharides, form α,1-4 or 1-6 glycosidic linkages, or a combination of both (hydrolysis and transglycosylation) activities;
2. They possess a (β/α)8 or TIM barrel structure containing the catalytic site residues;
3. They have four highly conserved regions in their primary sequence which contain amino acids that form the catalytic site, as well as some amino acids that are essential for the stability of the conserved TIM barrel topology.[9]

Application of α-amylase

Application of α-amylase have world's major market share of enzyme in food and starch based industries. In 1894, Jhokichi Takamine industrially produced α-amylase from a fungal source (*Aspergillus*

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oryzae), known as Taka diastase. This was commercially used in 1984 as pharmaceutical aids for the treatment of digestive disorders.[10] A significant increase in amylase production and its utilization occurred in 1960 when α-amylase from *Bacillus subtilis* and glucoamylase from *Aspergillus niger* were used to replace acid catalysis in the production of dextrose from starch. In 1970, the development in genetic engineering tools successfully paved the way for the production of cloned amylases (*Bacillus stearothermophillus*) in 1980 and 1990 for its industrial applications.[11,12] In the present scenario, the amylase plays a key role in various industries such as textile, detergents, food and paper industries. Despite of these, amylases also have potential to be used in other fields such as biotechnological treatment of wastes, in molecular biology, pharmaceuticals, including medicinal and clinical chemistry. A comprehensive study on commercial applications of α-amylases is described by Godfrey and West.[13]

Starch liquefaction and saccharification

α-amylase have imperative applications in starch based industries. α-amylases have replaced the process of chemical hydrolysis of starch. These are used for thinning of starch in liquefaction process that converts starch into fructose and glucose syrup. Starch is converted into high fructose corn syrups (HFCS) which are used as sweeteners for soft drinks in the beverage industries. The enzymatic conversion of all starch includes: (1) gelatinization which involves the dissolution of starch granules thereby forming a viscous suspension; (2) liquefaction involving partial hydrolysis and loss in viscosity; and (3) saccharification which involves further hydrolysis to produce glucose and maltose. Gelatinisation is achieved by heating starch with water at high temperatures. Thus, the process requires use of highly thermostable α-amylase which remains active at high temperature of gelatinization and liquefaction. Initially, the α-amylase of *Bacillus amyloliquefaciens* was used for the process but it has now been replaced by the enzyme from *Bacillus stearothermophilus* or *Bacillus licheniformis*.[2] Enzymes from the *Bacillus* species are of great interest for large-scale biotechnological processes due to high thermostability and available efficient expression systems.[14]

Bread and baking industry

Rapid development in the field of biotechnology has made changes in processed food industries. α-amylase find extensive applications in baking industries. α-amylase are generally added to dough of bread which results in degradation of starch in the flour into smaller dextrins and then further fermented by the yeast. Amylase also enhances the rate of fermentation, reducing the viscosity of dough, increasing the loaf volume and improving its texture. Moreover, additional sugar produced in dough improves its taste, crust colour and toasting qualities of the bread.[15] α-amylases also have efficient antistaling property in bread baking, which improves the softness retention of the baked goods.[16-18]

Beverage alcohol and Fuel ethanol production

The production of fermentable sugar in beer industries occurs by the application of microbial amylases to aid cereal amylase. The α-amylase is also used for clarification of haze formed in beer or fruit juices. Over the last few decades there has been increasing demand for production of fuel ethanol as a result of higher prices of crude oil and increasing environmental concern. Ethanol is an interesting liquid biofuel to be utilized as it is efficient and cost effective. Starch can be converted to ethanol which involves the process of liquefaction and saccharification. Enzyme α-amylase is used for conversion of starch into sugar. Currently microbial amylase is generally used in the large scale industries. This is further followed by the process of fermentation where yeast is used for conversion of sugar into ethanol.[19] Fuel ethanol can be produced from renewable sources such as agricultural crops and its byproducts. The α-amylase including other enzymes such as glucoamylase and cellulases also play important roles in the production of fermentable sugar to produce ethanol.[20]

Textile industries

A potential interesting industrial application of α-amylase is in textile industries as desizing agent.

Modern production processes in textiles introduce a considerable strain on the warp during weaving. In textile, starch is used for sizing of warp yarn which is essential to reduce breakage of the yarn and cope up with the strain imposed during weaving.[21] Starch is of special interest as sizing agent because it is cheap, easily available and has an excellent film forming capacity. The desizing of starch is achieved by the application of amylases before dyeing of fabric. Before the discovery of α-amylase enzyme, the chemical treatment was being used for removing the starch. Boidin and Effront produced α-amylase from *Bacillus subtilis*, which is being used as desizing agent.[22] Thus, amylase is preferred as desizing agent due to its specific action and high efficiency, making the fabric softer and suitable for further dyeing process.

Paper industry

The demand of α-amylases for the production of low-viscosity, high-molecular weight starch to use in paper and pulp industry is the modification of starch for coated paper.[2] Likewise textile, starch is used for sizing of paper to protect the paper against mechanical damage during processing. Starch besides being a good coating material for the paper, are also an efficient sizing agent which improves the quality, reusability, erasability and finishing of paper. As for sizing the paper viscosity of natural starch is too high, so α-amylase is employed for partial degradation of polymer in batch or in continuous processes.[23]

Detergents

The application of α-amylase has been in laundry detergents since 1975. The α-amylases are the second largest group of enzymes used in enzymatic detergent. The application of enzymes in detergents is of great interest due to much milder conditions and lowering of washing temperature. 90% of all liquid detergents contain α-amylase.[24] Nowadays, the demand of α-amylase in laundry and automatic dishwashing is growing rapidly. The α-amylase enhances the detergents stability in order to remove tough stains of starch and making detergents ecofriendly.

Medicinal and clinical chemistry

The spectrum of α-amylases finds its application in other fields also such as medicinal and clinical chemistry. Amylases are of great concern in medicines, which are used to diagnose several illnesses. A higher than normal concentration of amylases can predict perforated peptic ulcer, acute inflammation of the pancreas, torsion of an ovarian cyst, strangulation ileus, macroamylasemia, and mumps. Amylase can also be measured in other body fluid including urine and peritoneal fluid. The level of α-amylase activity is of clinical importance in various human body fluid including diabetes, pancreatitis, and cancer research.[25] The application of α-amylase based liquid stable reagent, for the Ciba Corning Express clinical chemistry system has been reported.[26] Amylase can also be employed for the detection of higher oligosaccharides.[27] This claimed to be more efficient process as compared to silver nitrate test. Biosensors with an electrolyte isolator semiconductor capacitor (EIS-CAP) transducer for the process monitoring have also been reported.[28]

Pharmaceuticals

In the light of modern biotechnology, α-amylase attains much attention in the field of pharmaceuticals. Interestingly, α-amylase is the first enzyme to be potentially used for the treatment of digestive disorder in pharmaceuticals. Synthetic and natural biodegradable polymers are of special interests in pharmaceutical researches. These biodegradable polymers are used to control the drug release rates from parenteral controlled delivery systems.[29] Acceleration of drug release is required for drugs with limited solubility and drugs for which solubility varies with pH of gastro-intestine. A polysaccharide biodegradable matrix are of interest due to degradation of a natural product such as starch that occurs naturally in the human body.[30] Alpha-starch and cross-linked starch has been used as hydrogels. It has been described that by increasing the degree of cross-linking of starch, the rate of drug release is decreased. The α-amylase activity contained in the dissolution media is also responsible for release rate. The addition of α-amylase to cross-linked amylose (CLA) tablets can modulate the release kinetics of drugs.[29]

Elimination of starch based waste

Starch is the major storage product of plants and occurs extensively in the waste material produced from food processing industries. These starch based waste products cause pollution problems. Biotechnological treatment of the starch based wastes by microorganisms producing amylolytic enzyme produces valuable products including microbial biomass protein and also purifies the effluent.[31,32]

Molecular applications

In the field of molecular biology, α-amylase can serve as reporter gene system in addition to antibiotic resistance. The successful integration of foreign DNA into these gene results in disruption of α-amylase gene in order to prevent the starch degradation, which can be easily detectible through iodine staining procedures.[33] Thus, allows the change in gene expression to be assayed quickly and easily. As the enzyme is extremely stable over a wide range of conditions, measurements of α-amylase activity is simple, quantitative, sensitive, safe and less expensive.

Conclusion

With the advent in new advances in modern biotechnology, currently enzymes are extensively used in different industrial processes and new areas of applications are being recognized. The α-amylases are one of the enzymes that find its applications in several industrial processes. These have replaced many chemical processes offering environment friendly and promising alternatives. A new frontier in the enzyme technology offers a great potential for its applications in several industrial processes and helps to meet the challenges in near future.

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'CARBON FOOTPRINTS' AND ITS ROLE IN RAISING CLIMATE CONSCIOUSNESS

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The world is warming at an unprecedented rate and unless effective steps are taken urgently, the entire planet may witness burns. The warnings made in the scientific projections have already being signaled in the form of increased incidences of floods and droughts, increased frequency and strengths of tornadoes and hurricanes, sea level rise, loss of biodiversity and agriculture. We have therefore a little time left to take effective action so as to keep our planet comfortably livable for future generations. This fact has been well recognized and hence, controlling the emissions of greenhouse gases (GHGs) should be a priority. As a quantitative indicator of GHG emission from an activity or a body, carbon footprint (CF) is prevailing in climate related studies and actions, but voluntary individual carbon footprinting is its most popular application. Its popularization among the general public, most notably in developed countries is diverting appreciable amount of money to GHG management. It has therefore, emerged as a potential tool in promoting more GHG efficient lifestyles. However, in order to draw the maximum advantage from climate consciousness of the public, current methods of carbon footprinting facilities need critical evaluation and modification. Emergence of standard guidelines for carbon footprint calculations has helped reducing ambiguities during calculations. Moreover, the number of scientific case studies on carbon footprinting is also growing.

Understanding Global Warming

The earth receives the biggest share of energy from the sun. From the 1,370 W incident on the upper atmosphere, only 240 W m^{-2} is absorbed by the earth's surface. For mantaining the energy balance, the earth radiates back this energy in the form of infra-red radiations. Physical laws suggest that to reradiate this much of energy, the temperature of earth's surface should be around –19°C, much below our observed temperature (i.e 14°C). This would also be too low to sustain life. However, the presence of certain gases in the atmosphere trap some of the longwave radiation escaping the atmosphere, thus keeping it relatively warmer. These gases (most importantly CO_2 and water vapour) are termed as "greenhouse gases" and the effect that they produce to maintain earth's natural temperature is called "the natural greenhouse effect". Owing to spherical shape, the energy distribution on the earth is uneven and this energy gradient drives the atmospheric and oceanic convections like a huge engine thus operating the climate, well tuned to our natural environment yet highly sensitive to even slightest changes in the system.

In due course of civilization, particularly since industrial revolution, we have exploited natural resources without paying attention to probable consequences, and have released numerous anthropogenic constituents into the environment. Among these, certain GHGs are continually being emitted into the atmosphere, which add to the natural greenhouse effect, thus raising the earth's temperature beyond natural range, leading to global warming. Gases identified as culprits of global warming are: (i) CO_2, (ii) CH_4, (iii) N_2O, (iv) class of hydrofluorocarbons, (v) class of perfluorocarbons, (vi) sulphur hexafluoride and (vii) tropospheric ozone (IPCC, 2013). Among these, CO_2 holds the biggest share in raising the global temperature due to the huge quantity in which it is released annually, besides the fact that in the GHG group, CO_2 creates the minimum warming effect on mass basis. It is a gas that is inevitably released during all kinds of combustion and hence is very difficult to control. Since all gases have different

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warming effects and residence times in the environment, comparisons and evaluation of mitigation measures becomes difficult. This problem has been overcome by expressing the warming effect a GHG can cause relative to that of CO_2, on mass basis referred as the 'global warming potential' (GWP) of that GHG, the unit being CO_2-equivalents (CO_2-e). It is therefore CO_2-e that best represents the GHG quantity and hence is under focus among all global warming oriented discussions.

Management of greenhouse gases and the concept of carbon footprint

Following the rule, 'measurable is manageable' all GHG management efforts begin with GHG accounting. Initially employed in big industries in response to legal requirements in some of the countries, GHG accounting is a bit complex life cycle analysis procedure based on numerous assumptions and mathematical calculations. Today however, it has permeated to households, but with a new name, 'the carbon footprint' (CF). In light of popularization of the issue of global warming, climate change and heated international negotiations to control GHG emissions, general public has responded in a big way and they want to know about their environment and tend to contribute to GHG management in feasible manner. Carbon footprint fulfilled this desideratum as a quantitative expression of GHG emissions for which an entity is responsible. The term has therefore attained huge publicity and in a very short time has become a buzzword. (Kenny and Gray, 2008). Although most of the people may not exactly know, what it actually means, it is intuitively conveyed by the term itself that it has something to deal with global warming and lower CF means greater environmental friendliness. The definition of CF is also not uniform among the scientific and governmental studies, however there is an apparent nexus that it refers to the amount of GHGs emitted into or removed from the atmosphere in terms of CO_2-e, over a specified time period from a well defined set of activities for which the entity is responsible. For this relatively new concept, calculation methodologies are still evolving but it has proven assistive in taking mensuration of greenhouse gas emissions to households in an easily conceivable manner.

Carbon footprinting

Carbon footprint calculation must include all relevant GHG emissions during the entire process. For an example, for calculating CF of a pen, all the steps through which the pen passed must be looked at clearly. The entire life can be divided into three main stages:

1. Manufacture of the pen
2. Transport to the retail stores.
3. Use of the pen
4. Disposal

The first stage of manufacturing again comprises of internal stages involving, preparation of pen's body and refill from raw materials, assembling of pens which requires machines and human resources, that includes direct (directly measurable) as well as indirect (not directly measurable but is associated the activity) emissions. For example, CO_2 released from a diesel powered casting machine is a direct emission, while electricity purchased for running packaging units is responsible for indirect emissions if that electricity had been produced in a thermal power plant. Similarly, transportation of the pens to the shops, use as well as the mode of disposal (recycling, dumped to landfill or burnt) has certain emissions associated which are identified and properly quantified. All the GHG emissions are then expressed as CO_2-e and the quantity is called CF of the pen.

To maintain uniformity in the calculation and reporting of CF calculations, guidelines have been prepared internationally and some countries follow their own standards. Some important guidance are: GHG protocol of World Resource Institute and World business council for sustainable Development, Guidelines to National GHG inventories 1996 and 2006 of IPCC and ISO 14064 (part 1 and 2). Besides these, methods have been developed by government and non government organizations, as well as by those involved in carbon footprinting business. UK DEFRA, USEPA, The Climate Registry, and Carbon Trust are few to name but 'The Greenhouse Gas Protocol' of WRI/WBCSD (2006) is the most followed standard. These protocols

divide GHG emissions to be accounted in CF calculations in following three tiers:

1. All direct emissions, i.e., onsite emissions.
2. Embodied emissions in purchased energy.
3. All indirect emissions, such as those associated with transport of purchased goods, sold products, business travels, energy activities, disposal of products etc., not included in tiers 1 and 2

In lieu of the complex calculation process and uncertainties involved, most of the guidelines make calculations of tier 3 optional, however it has been evidenced that except for few industrial set ups (including thermal power plants and cement manufacturing), most of the industries have the major share of their CF in tier 3. Therefore, scientific studies suggest covering entire life cycle including tier 3, so as to yield the representative CF and to devise and evaluate effective GHG mitigation measures.

Carbon footprinting: popularity and ambiguities

Global warming is one of the most burning issues in political and scientific communities as well as a popular topic in public domain. While international talks over GHG control have been more like piecemeal, public at large has become interested in reducing personal emissions, especially in developed world. This behavioral change has compelled businesses to get the CF of their products and services calculated as people prefer the products providing information on its CF and can willingly pay extra for the products with lesser CF. A rush to calculate and cut emissions has thus begun among businesses and many of the well known companies have either declared themselves carbon neutral or have prepared action plans to reduce emissions so as to take competitive advantage and to get prepared in a projected carbon constraint economy. Besides this, online facilities, which offer individuals to calculate their CF free of cost have surged the internet. These calculators are available for calculating CF relating to lifestyle, travel, food etc, but only few of them reveal the mode of calculation. A comparison of some popular online calculators showed that no two calculators, yield similar CF for same person and hence it makes people confused over what CF is he/she is actually responsible for (Padgett et al., 2008; Kenny and Gray, 2008). Such calculators are often offered by carbon offsetting organizations, which compel the client to offset the CF through aforestation or supporting renewable energies. Celebrities have started declaring themselves carbon neutral thereby inspiring public too to go carbon neutral. The credibility of such offsetting claims however, has been questioned. Besides voluntary offsets, carbon credits can also help in reducing one's footprint. Carbon credits are in a way permission to emit by offsetting equivalent amount of emissions somewhere else, and can be freely sold and purchased in ever growing carbon market. Millions of dollars are exchanged with GHG emissions over the counter annually in these markets which are trustworthy because projects creating credits are critically analysed by the experts (usually UNFCCC), but the longer time requirement over decision of a project is the drawback. Therefore, private firms tend to offer offsets on their own. Certain certificates are being issued by the credible organizations in many countries so that the clients can ensure that investment will be effective in reducing their footprints. Carbon markets are highly assistive in circulating money towards cleaner technologies like renewable energy sources, and aforestation, avoided deforestation, sustainable agriculture etc. particularly in developing countries.

The prices of carbon credits have always been a matter of discussion as higher process are supposed to trigger emission reductions among polluters. Another point raised regarding carbon market is that it should not give emitters a chance to release controllable emissions, by purchasing credits.

Besides these ambiguities, carbon footprinting has helped hugely in expanding awareness and behavioral change in a favourable direction for GHG control worldwide. Its applicability is thus increasing exponentially and there remains no activity for which carbon footprinting has not been attempted. United Nations Development Program analysed CF for nations, and found that high income countries leave the biggest footprints while some of the countries in Africa leave

negligible. Similarly CF of many cities (Table 1) have been estimated so as to identify the areas of emission reductions. Universities including University of British Colombia and University of Pennsylvania revealed and tend to reduce their CF so as to display that they are as equally concerned about the environment as much they are for education. Conferences, sports events, Government bodies, services, transportation, food habits, all have been candidates to carbon footprinting. This idea, earlier applied to manmade systems has been extended to natural events and CF of Hurricane and wildfires has been calculated. It reflects that CF is no longer an indicative pressure term, but only a number figure to express climate friendliness.

Carbon footprint has been accepted among the public and getting it estimated and offset is an easy mode of feeling environment and climate friendly. Governments, businesses and other organizations have therefore been making use of this term for intended benefits. But to ensure effective benefits, it is essential to impose strict vigilance on whether CF calculated by a facility has been in accordance with acceptable guidelines as well as whether the offsets to footprints offered is actually occurring (Murray and Day, 2009). Though, United Nations Framework Convention on Climate Change recommends only those offsets that couldn't have occurred unless supported financially, very few of the offset providers bear UNFCCC's consent, due to very long decision procedure followed by UNFCCC. It therefore becomes responsibility of people before investment to judge whether it will be realized.

Doubtlessly, CF has appeared as an important tool in GHG accounting, representation and management scenario, which if employed intelligently and strongly has potential to modulate businesses and create a flow of money from developed to developing countries, thus helping in GHG emissions management. It is recognizable that only a collective action can pave the way to sustainable future as we are running short of time which shouldn't be overlooked.

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Table 1: Carbon footprints of some activities

Entity	Activities/Tiers	Carbon footprint	Reference
Per capita of a nation in 2001	Construction activities, shelter, food, clothing, mobility, manufactured products, services, and trade		Edgar and Peters (2009)
Uganda		1.1 tCO_2-e	
Luxembourg		3.3 tCO_2-e	
India		1.8 tCO_2-e	
Academia			
University of Pennsylvania	Tiers: 1, 2, 3	2.5×10^5 tCO_2-e.	TC Chan Center for Building Simulation & Energy Studies/Penn Praxis (2007)
University of British Columbia	Tiers: 1, 2, 3	8.3×10^4 tCO_2-e.	Ferris et al. 2007
Kresege Engineering Library at University of California, Berkeley	Tiers: 1, 2, 3	1.2×10^4 tCO_2-e.	Garg and Dornfeld 2008
Agriculture			
Potato	Tiers: 1, 2, 3	0.12 kg CO_2-e ha^{-1}	Roos et al., 2010
rice	Tiers: 1, 2, 3	7.28 X 10^3 kg CO_2-e ha^{-1}	Pandey et al., 2014
wheat	Tiers: 1, 2, 3	-5.49 X 10^3	Pandey et al., 2013

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HOW CYANOBACTERIA PROTECT THEMSELVES FROM UV-B RADIATION?

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The substantial loss in the stratospheric ozone layer due to anthropogenically released chemicals such as chlorofluorocarbons (CFCs), chlorocarbons (CCBs) and organobromides (OBMs) has resulted in an increase in the solar ultraviolet-B (UV-B; 280-315 nm) radiation on the Earth's surface [1]. Although very small proportions of solar ultraviolet radiation (UVR) contribute to the total irradiance on the Earth's surface (UV-C; 0 %, UV-B; <1 % and UV-A; <7 %), this part of the solar spectrum is energetically highly active and has become an important issue in the last few decades. UV-B radiation is detrimental for all living organisms ranging from prokaryotes to eukaryotes, including humans.

Cyanobacteria, the primitive O_2-evolving photosynthetic, ubiqutous prokaryotes are solely dependent upon the solar radiation for their energy requirement and thereby have to always face the UV-B stress. They are major biomass producers both in aquatic as well as terrestrial ecosystems and represent more than 50 % of the total biomass in many aquatic ecosystems. These prokaryotes are also an important source of several novel bioactive metabolites of industrial and medicinal value. In addition, their inherent capacity to fix atmospheric nitrogen makes them ecologically important for rice-growing countries where they add to fertility of the rice fields as natural biofertilizers. UV photons, mainly, UV-B can be absorbed by a range of biomolecules and are responsible for causing chronic and physiological stress in cyanobacteria either by direct or indirect effects. It has been shown that morphology, cell differentiation, growth, survival, pigmentation, motility and orientation, N_2 metabolism, phycobiliprotein composition, protein profile, DNA and $^{14}CO_2$ uptake are severely affected by UV-B radiation [2-4]. These changes could result from a number of primary UV-B mediated events such as direct photosynthetic damage, loss of permeability/ membrane changes, pigment destruction, protein/ enzyme inactivation, reduced DNA and protein synthesis, reduced uptake of nutrients, hormone inactivation and signal transduction *via* a specific UV-B photoreceptor.

During the course of evolution, cyanobacteria have evolved a number of mitigation strategies (Fig. 1) to minimise the lethal effects of UV-B radiation [5,6].

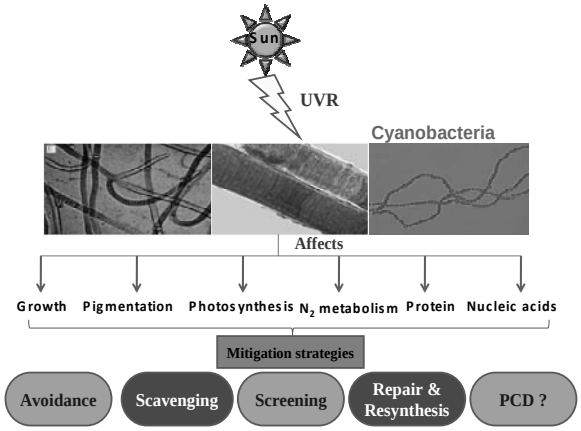

Fig. 1. Mechanisms employed by cyanobacteria to overcome the deleterious effects of UV-B radiation.

These defensive mechanisms include avoidance, scavenging of reactive oxygen species (ROS) by antioxidants, accumulation of carotenoids, synthesis of UV-absorbing/screening compounds such as mycosporine-like amino acids (MAAs) [7,8] and scytonemin [9], repair of UV-induced DNA damage by photoreactivation and excision repair and resynthesis of proteins. These defense mechanisms are briefly discussed below:

(i) Avoidance: Avoidance as a first line of defense mechanisms against high solar UVR includes migration from high to low UVR levels in the water column, formation of mats containing different cyanobacterial species or filaments enclosed in amorphous silica matrices, changes in morphology to

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increase self-shading, photokinetic and photophobic reactions and synthesis of extracellular polysaccharides. This mechanism depends on the motility and mat forming ability of cyanobacteria as well as on the turbidity and depth of the water column. It has been reported that *Oscillatoria cf Laetevirens, Spirulina cf. Subsalsa* and *Microcoleus chthonoplastes* [10] showed migration in response to UV-B radiation. *Nostoc commune* stimulated the synthesis of extracellular glycan following UV-B exposure, which provides UV-protection by increasing the path length for the absorption of radiation. *Arthrospira platensis* protect themselves against photo-damage by self-shading.

(ii) Antioxidants

Cyanobacteria has evolved an antioxidant system consisting of enzymatic and non-enzymatic antioxidants as second line of defense to overcome the oxidative stress induced by the generation of free radicals/ROS such as superoxide (O_2^-), hydroxyl radical (OH^-) or hydrogen peroxide (H_2O_2) *via* the interaction of UVR with oxygen and other organic compounds within the cell [11]. Non-enzymatic antioxidants comprise ascorbate (vitamin C), α-tocopherol (vitamin E), carotenoids and reduced glutathione. The enzymatic antioxidants include superoxide dismutase (SOD), catalase, glutathione peroxidase (GSH-Px) and the enzymes involved in the ascorbate-glutathione cycle to detoxify ROS, such as ascorbate peroxidase (APX), monodehydroascorbate reductase (MDHAR), dehydroascorbate reductase (DHAR) and glutathione reductase (GR). Carotenoids absorbs triplet state energy from chlorophyll and quenches singlet state oxygen while α-tocopherol prevents lipid peroxidation by scavenging ROS and provide protection to the cells. Ascorbate performs direct quenching of ROS, regenerating α-tocopherol. SOD scavenges superoxide radicals and converts them to hydrogen peroxide which is further converted to water and O_2. Three types of catalase-orthologues i.e., monofunctional haem-containing catalases, bifunctional haem-containing catalase-peroxidases and nonhaem-manganese catalases has been reported in many cyanobacterial genera [12]. Among them, NiSOD is the only SOD found in primitive cyanobacteria, Fe and Mn occupy the higher orders of cyanobacteria and Cu/ZnSOD is rare in cyanobacteria. UV-B irradiation was reported to induce the carotenoid content in *N. Commune*. An accretion of active iron superoxide dismutase (FeSOD) in desiccated field cyanobacterium *N. commune* has been reported to reverse the adverse effects of oxidative stress imposed by multiple cycles of desiccation and rehydration during the UV-B irradiation *in situ*. The mRNA profiling revealed an increase in the protective molecules such as carotenoids, glutathione peroxidase and superoxide dismutase in *Synechocystis* sp. PCC 6803 following UV-B exposure. An induction in the level of SOD and APX and non-enzymatic compounds such as ASA, carotenoids and α-TOC was found to protect *Anabaena doliolum* from UV-B induced oxidative stress. Two NADPH-dependent glutathione peroxidase- like proteins have been found in *Synechocystis* PCC 6803 and were found essential for the protection of membranes against lipid peroxidation. Rrubrerythrin-homologue (RbrA) a different type of peroxidase was found to protect the nitrogenase enzyme from oxidative stress in *Anabaena* PCC 7120.

(iii) Screening

Cyanobacteria have the ability to synthesize certain UV-absorbing compounds to screen the damaging effects of UVR as third line of defense. Mycosporine-like amino acids **(**MAAs) and scytonemin are well known UV-absorbing/screening compounds that provide photoprotection against UV-B and/or UV-A.

(a) MAAs

MAAs are small (<400 Da), colorless, water-soluble compounds composed of a cyclohexenone or cyclohexenimine chromophore conjugated with the nitrogen substituent of an amino acid or its imino alcohol. Generally, the ring system contains a glycine subunit at the third carbon atom [6,13]. Some MAAs also contain sulfate esters or glycosidic linkages through the imine substituent. Absorption spectra (Fig. 2) of MAAs ranges from 310-362 nm due to variations in the attached side groups and nitrogen substituents. Their stability against various abiotic stressors such as temperature, strong UVR, various solvents as well as pH makes them successful photoprotectants in various habitats and organisms. The biosynthesis of MAAs and mycosporines has been suggested to occur *via* the first part of the shikimate pathway. MAAs protect the cells by absorbing highly energetic UVR and then dissipating this energy in the form of harmless heat radiation to their surroundings. These compounds prevent 3 out of 10 photon from hitting cytoplasmic targets in cyanobacteria. The biosynthesis of MAA in cyanobacteria is dependent on photosynthesis for the carbon source and also on

available nitrogen. Presently, about 21 MAAs have been reported from terrestrial, freshwater and marine organisms. Several strains of *Anabaena* have been reported to produce only shinorine in response to UVR. However, recently, three MAAs (mycosporine-glycine, porphyra-334 and shinorine) has been reported in the rice-field cyanobacterium *A. doliolum*.

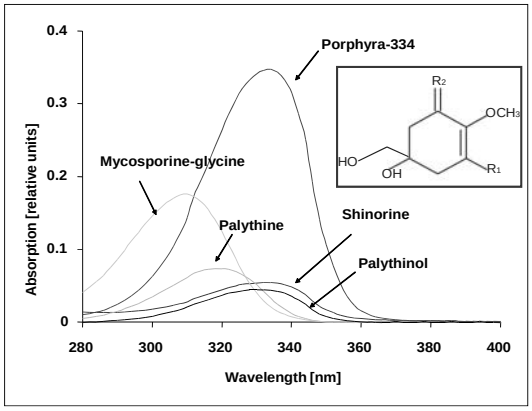

Fig. 2. Absorption spectra of various mycosporine-like amino acids (MAAs). Inset: basic structure of MAAs. In almost all MAAs R1 is the amino acid glycine, R_2 is an imino-or keto group or an organic moiety.

By using HPLC, Rastogi et al. [14] characterized the highly polar MAAs, shinorine, porphyra-334 and mycosporine-glycine and several other unknown MAAs, in the four cyanobacterial strains isolated from hot-springs in Rajgir, India. The efficacy of protection provided by MAAs depends on their location within the cell. The MAAs located in the cytoplasm provides limited protection but in the case of *Nostoc commune*, where they are actively excreted and accumulated extracellularly acts as true screening compounds. MAAs can also act as antioxidants preventing the cellular damage resulting from UV-induced ROS. They can efficiently block the formation of thymine dimers *in vitro*.

(b) Scytonemin

Scytonemin is a yellow-brown lipid soluble pigment located in the extracellular polysaccharide sheath of some terrestrial cyanobacterial species. Scytonemin is a dimer composed of indolic and phenolic subunits having a molecular mass of 544 Da and has an *in vivo* absorption maximum at 370 nm in the UV-A region but shows considerable absorption in the UV-B region also. Purified scytonemin shows absorption maximum at 386 nm although there being substantial absorbance at 252, 278 and 300 nm [9].

Scytonemin synthesis is mainly induced by UV-A radiation whereas blue, green or red light at the same fluence rates does not have a significant influence. UV-A in combination with increased temperature and oxidative stress have a synergistic effect on scytonemin synthesis. They are able to reduce the penetration of UV-A radiation in the cells to around 90 %. Scytonemin is highly stable and performs its screening activity without any further metabolic investment even under prolonged physiological inactivity (e.g. desiccation).They are supposed to be synthesized from metabolites of aromatic amino acid biosynthesis by condensation of tryptophan and phenylpropanoid-derived subunits. Besides having a role as UV protectant, scytonemin may have additional roles such as protection against pathogenic attack, bacterial decomposition or herbivore grazing.

(iv) DNA repair and resynthesis of proteins

Cyanobacteria have developed certain repair mechanisms and resynthesis of sensitive targets as fourth line of defence. These mechanisms include photoreactivation by photolyase (Fig. 3) which converts UV-induced dimers into monomers, the dark or excision repair and the recombinational repair [15]. Certain strains of *Anabaena* sp. such as *Anabaena* sp. PCC 7120, *A. variabilis* PCC 7937, *Anabaena* sp. M-131 and *A. variabilis* sp. PCC 7118 has been shown to possess photoreactivation system.

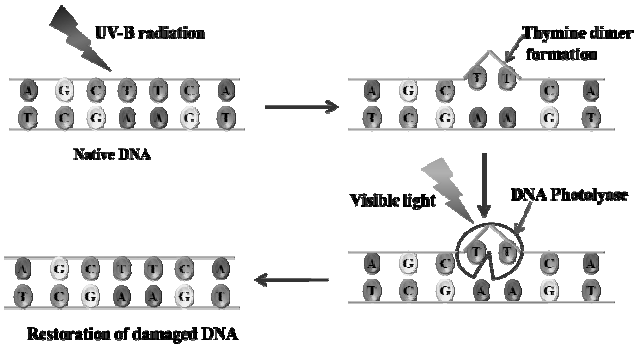

Fig. 3. UV-B-induced DNA damage and mechanism of photoreactivation in cyanobacteria.

Homologous gene for photolyase has been identified and functionally characterized in *Synechocystis* sp. PCC 6803. The gene for the DNA repair enzyme Fpg (formamydopyrimidine-DNA glycosylase) has been reported from *Synechococcus elongatus* and was suggested to be involved in photoprotection against oxidative damage. In addition to DNA repair by photoreactivation and excision

repair, cyanobacteria are also capable of synthesizing new proteins to replace the damaged one. The UV-B shock and acclimation response of *N. commune* under UV-B stress was found to be a completely different and complex phenomenon influencing a total of 493 proteins. D1 and D2 proteins of the photosystem II reaction center were found to provide protection and acclimatization against UV-B in *Synechocystis* sp. Recently, an autocatalytic programmed cell death (PCD) has been shown to operate in the nitrogen-fixing cyanobacterium *Trichodesmium* sp. and was found to be induced by high irradiance, iron starvation and oxidative stress.

Conclusion

Intense UV-B radiation reaching onto the Earth's surface has detrimental effect on a number of vital physiological and biochemical processes of cyanobacteria leading to reduction in growth and survival. In contrast, these organisms have developed several defense mechanisms that sustain their successful growth and survival in various habitats receiving high solar UVR. The balance between the damage and defense mechanisms also has the ecological importance as it maintains the productivity and nitrogen economy of an ecosystem. There are several families of SODs and catalases found in cyanobacteria but characterization of specific SOD and catalase expressed under UVR stress should be the aim of future research. Information related to the biosynthesis, ecological significance and distribution of sun-screening substances such as MAAs and scytonemin is still in their infancy stage and much work has to be done in this field. The molecular structure and reaction mechanism of DNA repair enzymes (photolyase and glycosylase) from cyanobacteria is also not well known.

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GILOY AND ITS MEDICINAL VALUE

*DR. ANITA RAI**

Giloy or Amrita is an anti-inflammatory (that reduces inflammation) and antipyretic (that reduces fever) herb. It is also known as Guduchi, Madhuparni, Amrita, Chinnaruha, Vatsadaani, Tantrika, Kundalini and Chakralakshanika. Giloy is found abundantly in North India.

This herb, which has been used in Ayurvedic Rasayanas since centuries, is very helpful in building up the immune system and the body's defense against infecting organisms. In a scientific study conducted using human WBC (white blood corpuscles), the Ayurvedic herb helps in enhancing the killing ability of macrophages (the resistant cells which are responsible for fighting foreign bodies as well as microorganisms). There are many uses of Tinospora Cordifolia, commonly called Giloy or Amrita. The stem is used in conditions like general weakness, dyspepsia, fevers of unknown origin, swine flu and many urinary tract infections. The bitter properties present in the drug show anti-periodic (Preventing regular recurrence of the symptoms of a disease, as in malaria) and antispasmodic properties which is again helpful in preventing infectious diseases like dengue, swine flu, malaria etc. This herb is highly recommended by Yoga Guru Swami Ramdev in preventing swine flu. Juice extracted from Giloy increases platelet count. Swami Ramdev has successfully used this to treat Dengue.

This wonderful Ayurvedic herb helps in raising the efficiency of protective WBC (white blood cells) and builds up the body's own protection mechanism known as immune system. It is used as an immunity booster in certain ailments like jaundice, hepatic fibrosis and seasonal fevers. Giloy or Amrita has proved very effective in preventing fibrous changes and promoting regeneration of the liver. It is a very good and helpful diuretic agent that helps removing renal stones and reducing urea from the blood. Giloy has antibacterial, anti-inflammatory, anti-rheumatic, and anti-allergic actions.

Some of the health experts and Ayurvedic doctors also prescribe Giloy for some sexually transmitted diseases such as gonorrhea. The herb is useful in treating various skin diseases and in some cases, hyperacidity too.

For maximum benefits, Giloy has been systematically formalized by plenty of clinical studies. Its formula has been subjected to the contemporary

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examination of clinical testing to prove its benefits in addressing the health concerns and its quality is controlled by the most advanced chromatographic techniques.

Pure extract derived from the dried herb is called the 'Guduchi Ghana Satva' or Giloy Satva. It is a very fine powder that carries great abilities of the herb Guduchi. The positive thing about Guduchi Satva is that even in minor dosit works miraculously.

It is useful in

1. Dengue
2. Swine flu
3. Bird flu
4. Fever of unknown origin
5. Throat infection
6. Sneezing
7. Coughing
8. Body aches

It is

1. Tridosha hara (Balances vitiated Tridoshas)
2. Kushtaghna, Vedanastaapana (Cures skin diseases and relieves pain)
3. Jwaraghna (reduces fever)
4. Vrishya (aphrodesiac)
5. Rejuvenator (Rejuvenates body systems)

Treatment and Prevention of Malaria, Yellow Fever, Encephalitis, Dengue Fever

The best remedy is to take white inner bark of Neem (Neem antarchaal), Rasont (Daruhaldi) and Satva Giloy, all in equal quantity, ½ tsp with warm water. This protects from all types of infectious fevers.

First of all take Giloy branches and cut it into small pieces. Take 2 glass of water and add the Giloy pieces into it and boil till the water reduces to half. Wait for till it comes at a normal temperature. Give this liquid to the patients. It is found that after 45 minutes patient's platelet increases in fast manner. This Remedies is very easy to prepare and inexpensive. Giloy leaves may be also used with Tulsi leaves and papaya leaves for treating hepatitis. Juice of 1ft. long branch of Giloy, three leaves of papaya and seven leaves of Tulsi; boiled and taken as a herbal drink enhances body's resistance level up to three times. It also increases platelets count, and decreases considerably Dengue fever.

Giloy increases the killing ability of the macrophages

The herb is very useful in strengthening the immune system of the body and builds up the body's defense against the organisms responsible for infections. In a study conducted on the herb in context of the human white blood corpuscles it has been found that the herb increases the killing ability of the macrophages in the body. The macrophages are the cells in the body which are responsible for fighting with the microorganisms and foreign bodies.

It is anti periodic and anti spasmodic

Giloy is a bitter herb. Its bitterness is associated with the anti periodic and anti- spasmodic properties. The anti periodic properties of the herb prevents regular occurrence of the symptoms of a disease as is in case of malaria. Due to this anti- periodic property of the herb it is widely used in the treatment of diseases like malaria, swine flu and dengue. Indian Yoga Guru Swami Ramdev has successfully used the juice of this herb in the treatment of swine flu and dengue. The studies conducted by him at his Patanjali Ashram have shown that the juice extracted from the fresh giloy plant increases the platelet count in the body.

It increases the efficiency of the WBCs

Dengue is sometimes associated with the problems of degeneration of liver. This wonderful herb fights this degeneration due to infection by raising the efficiency of the WBCs in the body and strengthening the protection mechanism of the body. Therefore this herb is not only effective in preventing fibrous changes and regeneration of the liver but also in some other ailments lie hepatic fibrosis, seasonal fevers and jaundice. Not only this, it also reduces urea in the blood.

Many clinical studies have been made on the herb

For maximum medicinal advantage, this herb has been formalized by many clinical studies. Its chemical composition and formula has been tested with the contemporary scientific methods including the advanced chromatographic techniques. Almost all the tests have proved that the herb is capable of addressing many health concerns including dengue and malaria. It has been found that the pure extract from the dried herb which is called Giloy Satva or Guduchi Ghan Satva carries great medicinal abilities. The Satva is a fine powder and acts wonderfully even in small doses.

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SEASONAL VARIATIONS IN THE AMBIENT AIR CONCENTRATIONS OF GASEOUS AND PARTICULATE POLLUTANTS IN VARANASI

ASHUTOSH KUMAR PANDEY AND PROF. B. D. TRIPATHI***

Varanasi is one of the most sacred places according to Hindu religious beliefs. This is one of the oldest continuously inhabited cities of the world and oldest in India. Mark Twain, the English author, who was enthralled by the legend and sanctity of Benares, once wrote "Benares is older than history, older than tradition, older even than legend, and looks twice as old as all of them put together." Cities are by nature, concentrations of humans, materials and activities. They therefore exhibit both the highest levels of pollution and the largest targets of impact[1]. As a direct result of urbanization, great threat to health and safety in cities comes from water and air pollution[2]. The worldwide epidemiological study on the effect of air pollution had revealed that particulate matter and gaseous pollutants have great potential to cause severe health effects[3,4]. The compact built fabric of the Varanasi city and its narrow lanes lead to limited air circulations, thereby, acting as a hindrance to the dispersal of pollution load[5]. The most common and toxic air pollutants are Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Ozone (O_3), Suspended particulate matter (SPM) and Respirable suspended particulate matter (RSPM). Sulphur dioxide (SO_2) is generally formed when fossil fuels such as coal, gas and oil are burnt for power generation. Industrial sources, thermal power plants and transport sector are major identified contributors of anthropogenic SO_2. Sulphur content in Indian coal is around 0.35 %[6]. Suspended particulate matter (SPM) is solid and liquid particles with aerodynamic diameter greater than 10 μm and is emitted from numerous anthropogenic and natural sources such as industrial dust, volcano and diesel-powered vehicles. RSPM or PM_{10} are particles having an aerodynamic diameter of less than 10 micrometers[7]. Nitrogen dioxide (NO_2) is generally released from natural sources such as lightning, fires and anthropogenic sources like internal combustion engines[8].

The effect of breathing in raised concentrations of nitrogen dioxide eventually increases the chances of respiratory problems such as inflammation in the lining of the lungs, reduction in the immunity to lung infections etc.[9,10]. Earlier studies have reported the presence of Polycyclic aromatic hydrocarbons (PAHs) in urban atmosphere of Varanasi[11]. Vehicle-derived particulates were monitored using magnetic properties of leaf dust and it was established that they are particularly dangerous to human health[5]. Study of air pollution content in the street canyon of Varanasi city was also studies[12]. However, thorough monitoring and analysis of selected criteria pollutants and their spatial and temporal variation are not studied in recent past. Thus the present study deals with the spatial and temporal (seasonal) variations of air pollutants (SO_2, NO_2, O3, SPM and RSPM) in the city of Varanasi, India for a period of three years.

Methodology

Monitoring sites

The city of Varanasi (82º15′E to 83º30′E and 24º35′N to 25º30′N,area 79.79 Sq. Kms. India) is one of the oldest living cities in the world, due to high population density of 2,399 km^{-2} [13] a substantial volume of traffic exists. Varanasi is regarded as the religious and cultural capital of India and tourists from around the world visit here throughout the year. Varanasi city has various residential colonies, commercial areas and traffic intersections. But mostly these areas are not so well defined and they overlap with each other i.e. at some places residential area also has commercial activities and traffic is common in some of the residential colonies. In the present study we have randomly selected six sites from the city (including one rural site) which are fairly away from each other and have different types of land use. Details of each site are given in Table 1.

Location of sampling sites is given in map (Fig.1). The rural site (site-6) is shown in inset.

Varanasi region has a tropical moist sub-humid climate, characterized by strong seasonal variations with respect to temperature and precipitation. The year

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Table 1. Description of Study sites

S.No.	Site	Site	Latitude (N)	Longitude (E)	Classification
1	Chandpur	Site-1	25° 17' 58.24"	82° 57' 16.80"	Predominantly Industrial area
2	Sigra	Site-2	25° 18' 59.3"	82° 59' 24.07"	Co-dominantly commercial and traffic zone
3	Lanka	Site-3	25° 16' 42.79"	83° 0' 7.89"	Mosaic of commercial, residential, traffic zone
4	Pandeypur	Site-4	25° 20' 57.51"	82° 59' 37.93"	Predominantly Traffic zone
5	DLW	Site-5	25° 17' 6.24"	82° 57' 35.80"	Residential and industrial zone
6	Jakkhini	Site-6	25° 11' 5.24"	82° 47' 7.14"	Rural area

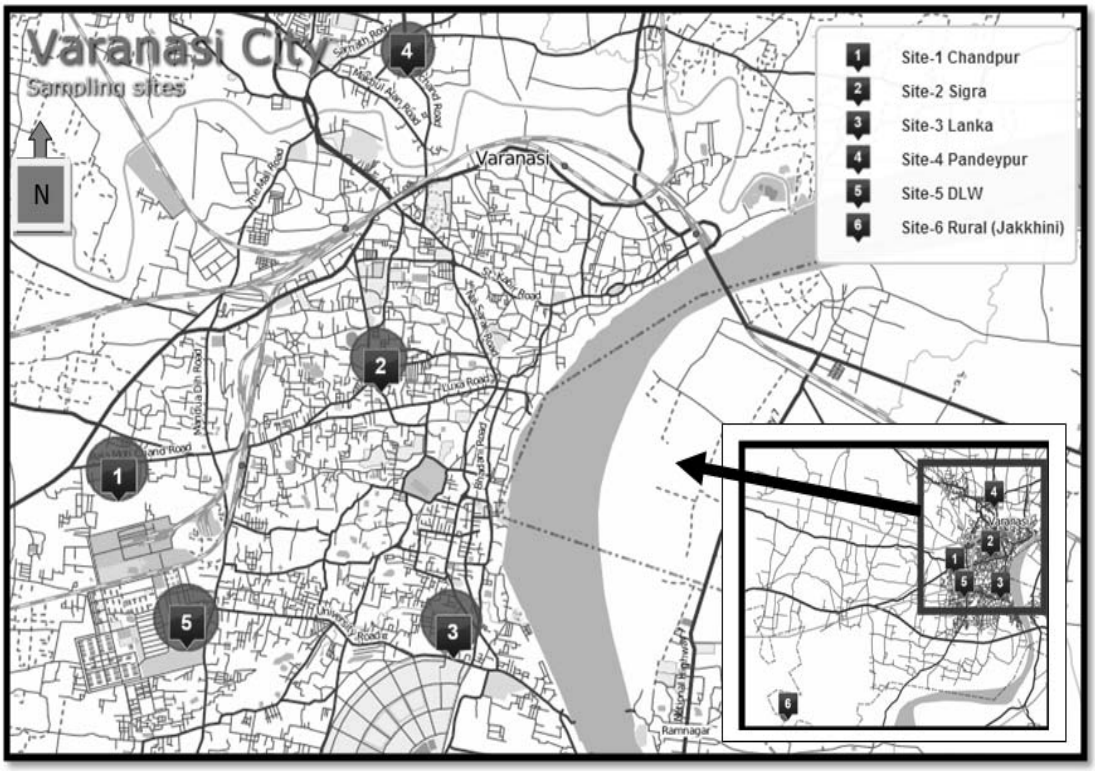

Fig. 1 Map of the study area showing sampling sites.

is divisible into a warm monsoon season (July–August), Post monsoon (September-October) a cool winter (November–February), and a hot summer (March–June). The summer is dry and hot with temperatures ranging between 35 to 45 ^{o}C during the day. Rainy Season is characterized by warm conditions (25-35^{o}C) and high relative humidity (70-91%). In the winter season, temperature falls between 10- 25°C. The total annual rainfall during the study period was 1251 mm, out of which about 85% occurred in the rainy season (Indian Meteorological Data Station BHU). The wind rose diagram is given in Fig.2.

Wind speed determines the travel time of a pollutant from its source to a receptor and accounts for pollutant diffusion in the windward direction. Therefore, the concentration of any pollutant at any receptor is inversely proportional to the wind speed.

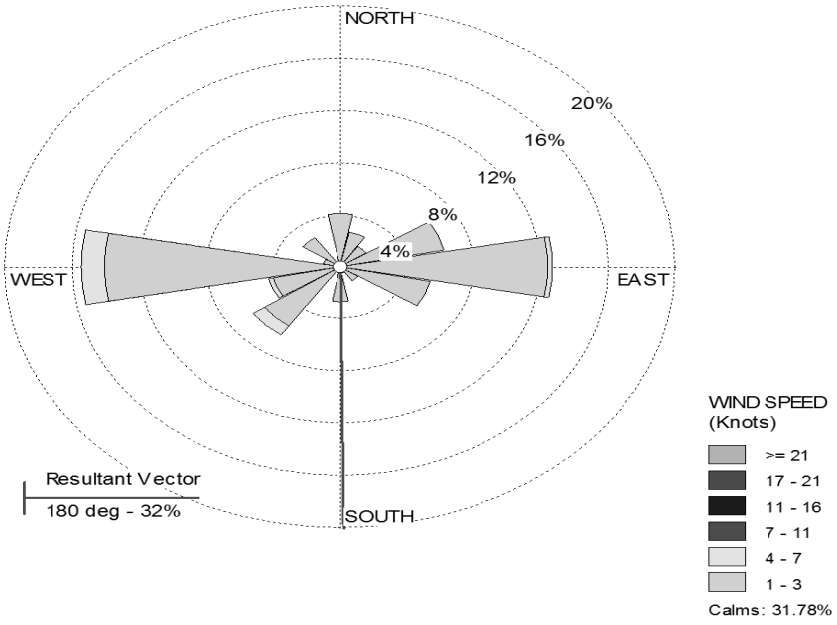

Fig. 2 Annual wind rose diagram of Varanasi City (2012-2013) (Based on data from Meteorological unit BHU)

Sampling and Analysis

Regular monitoring of all the parameters was done at all the six sampling sites for three years (September 2010 to August 2013). 24 hour monitoring at 4 hourly interval for Sulfur dioxide (SO_2), Nitrogen dioxide (NO_2), one hourly sampling for Ozone (O_3) and 8 hourly sampling for Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM or PM_{10}) was done twice a week (on weekdays) throughout the study period. Respirable Dust Sampler (Envirotech APM 460 NL) was used for monitoring of gaseous and particulate pollutants. The concentration of NO_2 was determined using the modified Jacob and Hochheiser method while that of SO_2 by improved West and Gaeke Method. Ozone was analyzed by chemical method as described in standard monitoring and analysis procedures[14]. All quality assurance and quality control measures were strictly followed. Meteorological parameters during the study period like rainfall and temperature were collected from the Indian Meteorological Department, Banaras Hindu University Varanasi.

Results and discussion

Regular monitoring of all the parameters (SO_2, NO_2,O_3, SPM and RSPM) was done at six selected sites (site-1to site-6) for a period of three year. The Box and whisker plot for all the parameters at different sites is given in Fig.3.

It is clear from the Figure that highest concentration SO_2 was recorded at site-1 which is predominantly an industrial area while lowest at site-6 which is rural area. The higher concentration of SO_2 in industrial area can be due to industrial emissions. Rural area has low concentrations of all the pollutants except that of PM_{10} and SPM, which may be due to presence of pollen, dust and other agricultural residues. Relatively low but still higher concentrations of most of the pollutants in the selected rural site (site-6) may be attributed to frequent use of diesel operated pumping sets, tractors and other vehicles.

Ozone concentration was found moderate at all the sites. At site-2 the annual mean value was observed to be 42.53±12.85 μgm^{-3} while minimum value of 37.86±9.66 μgm^{-3} was recorded at site-1. Ozone is a secondary pollutant and is formed by photochemical reaction of nitrogen oxides and hydrocarbons emitted from fuel combustion. Sunlight and hot weather conditions promote the formation of ground level ozone. Ozone concentration in Varanasi is found within permissible limits of CPCB. Previous workers have shown similar trend of ground level ozone in this region[15]. Annual mean value of NO_2 concentration was found highest (59.22±14.27 μgm^{-3}) at site-3 and lowest at site-6 (22.87±8.63 μgm^{-3}). Higher NO_2 concentrations in urban area may be due to high vehicular population and traffic congestion due to encroachment and intermixing of slow and fast moving vehicles in the city, also most of streets of

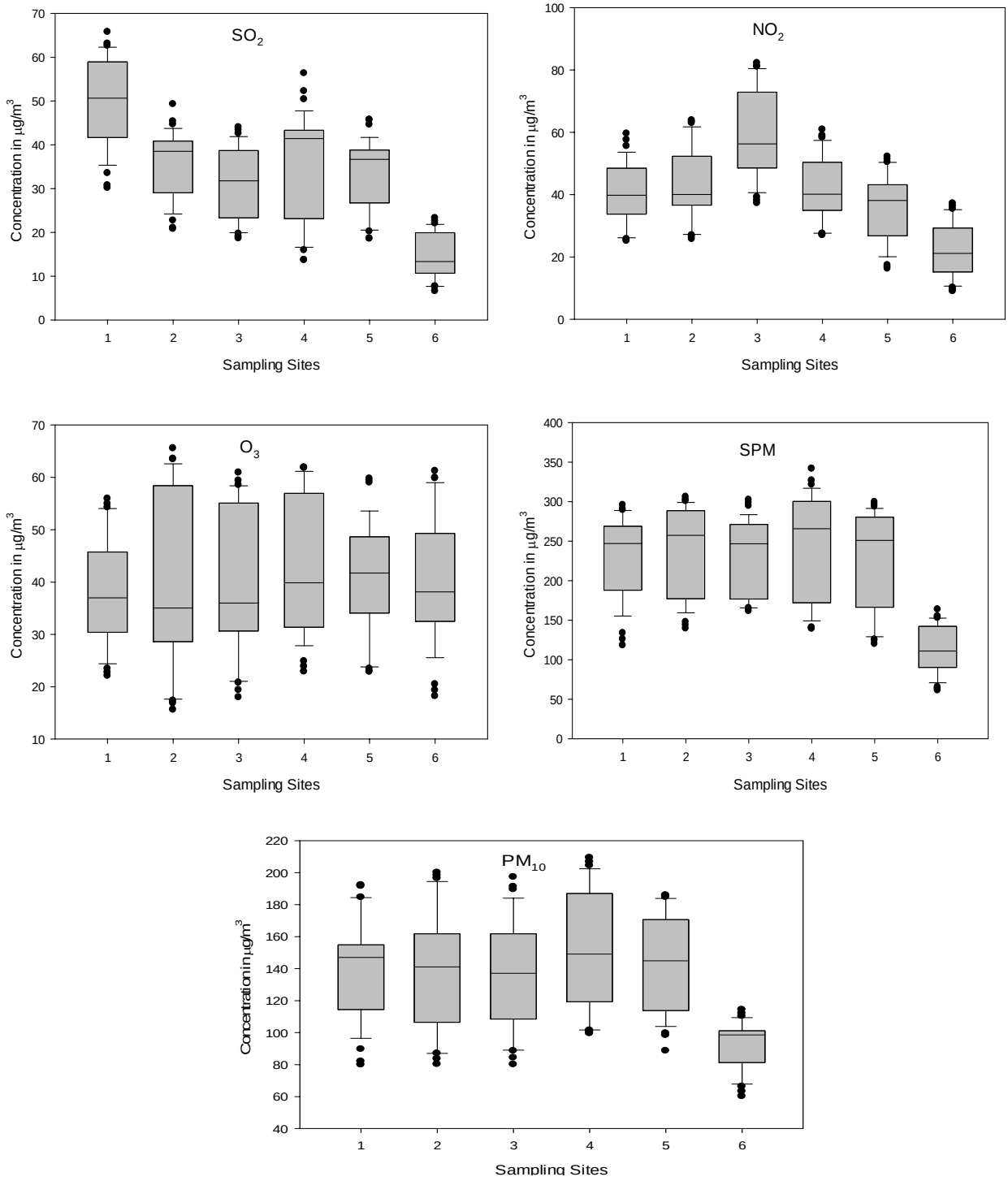

Fig.3. Box-Plot showing concentration of different pollutants at different sites

Varanasi are of street canyon type[16]. Now there is no SPM standard after November 2009 in India and is replaced with PM_{10} and $PM_{2.5}$ as par NAAQS[17] but we have monitored it to see its presence in the city. Annual mean value of SPM was found to be highest at site-4 (246.06±64.57 μgm^{-3}) which may be due to road and building construction work during the study period and very frequent and long lasting traffic jams. Minimum SPM concentration was found to be 113.89±29.8 μgm^{-3} in rural area (site-6) which is still

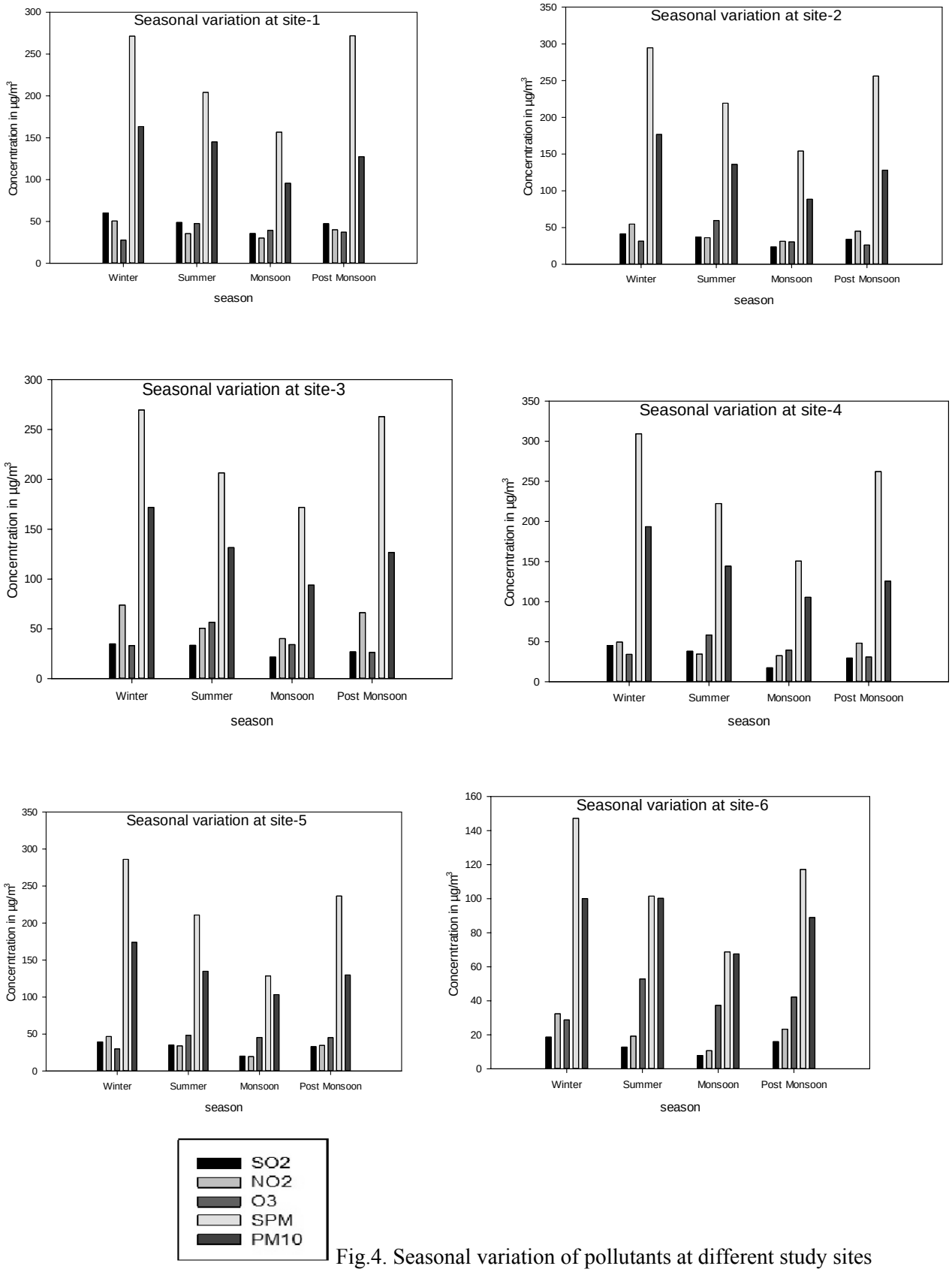

Fig.4. Seasonal variation of pollutants at different study sites

very high. Similar trend was observed for PM_{10} also. Annual mean values of PM_{10} concentration were found more than the NAAQS values at all the sites being highest at site-4 (151.07±35.84 μgm^{-3}) and lowest at site-6 (92.87±14.28 μgm^{-3}). The higher values of Particulate matter in Varanasi city is a matter of great concern and is resulting in various respiratory diseases. It is reported that in many cities of developing nations, the average annual levels of PM_{10} exceed 70μgm^{-3}. The WHO Air Quality Guidelines (AQGs) say that, in order to prevent ill health, these levels should be lower than 20 μgm^{-3} [18]. Among all the air pollutants in ambient air, PM affects more people than any other pollutant[19]. The SO_2/NO_2 ratios were found to be 1.24 at site-1, 0.83 at site-2, 0.52 at site-3, 0.86 at site-4, 0.93 at site-5 and 0.63 at site-6. The low SO_2/NO_2 ratio is indicative of mobile sources as major emission sources at most of the sites; this ratio is high at site-1 which means major pollution sources are stationary sources. All the pollutants show very clear seasonal variations. Fig.4 shows the seasonal trend of studied parameters at each site.

A significant seasonal trend was seen in PM_{10} concentrations at all the study sites. Higher concentrations were observed in winter followed by post monsoon and summer, while lowest concentration was observed in monsoon season. Similar trend was observed for SPM, SO_2 and NO_2. Higher concentration in winter may be due to low wind speed and lower mixing heights resulting in higher residence time, while lower concentrations during monsoon could be due to the washout of the particulates by rain. However, Ozone concentrations were found highest in the months of summer and lowest in winter and monsoon. Low concentration in winter may be attributed to absence of solar radiation which is key factor of ozone formation, while in monsoon season lower concentration may be attributed to washout of primary pollutants which are key ingredients of ozone formation.

Conclusion

This study provides comprehensive data with quality assurance and quality control of the ambient air quality in the study area for a period from October 2010-September 2013. The annual arithmetic mean values of SO_2 were found to be within the permissible limit at all the sites except site-1 (50.21±10.16 μgm^{-3}) which is an industrial area. The annual arithmetic mean values of NO_2 exceeded the permissible limit at all the sites except site-5 and site-6. It was highest at site-3 (59.22±14.65 μgm^{-3}) and lowest at site-6 (22.87±8.83 μgm^{-3}). PM_{10} concentration was highest at site-4 (151.07±36.78 μgm^{-3}) and lowest at site-6 (92.87±13.54 μgm^{-3}). It exceeds the permissible limit of CPCB at each site except site-6. SPM values are also very high at each site. Ozone concentrations were found within the permissible limit (8 Hour) at each site but found in higher concentration in summer and lower concentration in winter and monsoon. Each pollutant showed significant seasonal trend at each site, with highest concentrations in winter and lowest in monsoon. However ozone showed a different trend with its higher concentrations in summer and lower in winter and monsoon.

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REMOTE SENSING PERSPECTIVE FOR LARGE RIVER VALLEY PROJECTS IN INDIAN CONTEXT

DR. PRAVEEN KUMAR RAI* AND DR. KSHITIJ MOHAN**

In most of the countries, civilization has developed along the banks of rivers. With the advancement of science and technology a concept emerged to bring river water over long distances through Irrigation systems by constructing huge dams and multi-purpose hydel projects. These projects which are constructed with huge investments are getting silted at a faster rate resulting in reduced command area.

The land resource conservation and development is crucial for sustainable agricultural production. Land and water constitute the important resource base for meeting the essential requirements of society such as food, fodder, fibre, fuel, timber etc. For sustainable use of water recourses in any area we plan for river valley projects. River valley projects are projects in which we include:

a) Construction of a huge dams & reservoir built on river

b) Check dams

c) Construction of tunnels

d) Construction of roads

Dam structures block the flow of a river, stream, or other waterway. Some dams divert the flow of river water into a pipeline, canal, or channel. Others raise the level of inland waterways to make them navigable by ships and barges (Creager, 1968). Today there are more than 500,000 dams worldwide. The vast majority of these are small structures less than 3 m (10 ft) tall. Engineers regard dams that measure more than 15 m (50 ft) high as large dams. About 40,000 large dams exist in the world today. In a country like India where rainfall is erratic and depends considerably on the vagaries of seasonal winds- the monsoons, importance of dams can hardly be overemphasized.

Hundreds thousands kilometer long irrigational canals being fed by reservoirs created by around four thousand minor and major dams spread throughout the country have been responsible, to great extent, for making India self-dependent in food production.

The main objectives of any river valley projects are:

a. To Improve the hydro-electricity production

A dam generates electricity by releasing a controlled flow of high-pressure water from a reservoir through a channel called the penstock, where it spins the turbines that turn the generators, producing an electric current. The current then passes through 'step up' transformers that change it from a large current at a low voltage to a small current at a high voltage (Vishwanath, 2000). This current then goes over transmission lines to a substation, where the voltage is reduced for customers. Hydroelectric dams generate electricity. Hydroelectric dams harness the energy of water released from the reservoir to turn hydraulic turbines. The hydraulic turbines convert the energy of the falling water into mechanical energy, which is used to power electric generators.

b. Irrigation & drinking water

People have built dams to capture water to irrigate crops in areas where rainfall does not provide enough ground moisture for plant growth. Large storage dams support sophisticated modern irrigation systems that have dramatically altered the landscape of arid regions throughout the world (Vishwanath, 2000). For example, large storage Bhakhra dam in the India have transformed thousands of acres of arid Rajasthan desert into productive cropland. Dams also replenish the water supply of cities and towns**.**

c. Avoids floods & famines

Dams also protect low-lying areas from floods. Flood occurs when there is more rain falls than the soil and vegetation can absorb. The excess water runs off the land in greater quantities than rivers, streams, ponds, and wetlands can accommodate. Such heavy rains, and also snowmelt, periodically cause rivers to overflow their banks, spilling onto the surrounding floodplain. Ensuing floods can damage property and endanger the lives of people and animals.

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d. To improve inland navigation & development of fisheries

When a dam obstruct a navigable river, engineers build a canal adjacent to the dam to permit ships and barges to by pass the dam. Canal locks are a series of gates designed to allow a boat or ship to pass from one level of water to another**.**

e. Prevention of land degradation & soil erosion from the catchments area

f. To Maintain the ecological balance in the catchments area

g. Increasing tourism

1. Choices of dam types

International congress on large dams defines a large as one which has a height' of more than 15m from the lowest portion of the general foundation area to the crust.

Dams with height s falling between 10-15m which satisfy the following conditions are also classed among the large dams:

(a) Length of the crest of the dam greater than 500m.
(b) Capacity of the reservoir not more than 1 million cubic meters.
(c) Maximum flood discharge not to be less than 2000 cubic meters/second

2. Role of remote sensing and GIS for dam site location - An example in Indian context (Man river in the states of Gujarat and Maharashtra)

During dam construction engineer's concern on the topography, slopes and land use condition in dam sites –

GIS and Remote Sensing play an important role in generating automated spatial datasets and in establishing spatial relationships. The Environmental Impact Assessment, for the dam construction is easily performed using remote sensing satellite data and GIS techniques.

SELECTION OF SITES

(a) Topographically, a place which is most suitable for the purpose is selected. Ideally, it would be a narrow gorge (Fig. 1) or a small valley with enough catchments area available behind so that when a dam is placed there it would easily store a calculated volume of water in the reservoir created upstream (Mukerjee, 1990).

(b) Technically, the site should be as sound as possible: strong, impermeable and stable. Strong rocks at the site make job of the designer much easy, engineer can evolve best design. Impermeable sites ensure better storage inventories and stability with reference to shocks & slope failure around the dam.

(c) Constructionally, the sites should not be far off from deposits of materials which would be required for its construction because all dams require million of cubic meters of natural materials

2.2 Remote sensing & GIS in dam sites

Remote sensing & GIS are very helpful in dam sites selection. The aerial photographs, satellite data in remote sensing and DEM/DTM in GIS gives accurate information of dam site location and its slope or relief aspects.

2.2.1 Remote sensing satellite data in geological & geomorphological investigation for dam sites

Geology and Geomorphology of the sites:

For obtaining the geologic information, conventional and latest techniques of geological and geological survey needs to conducted. Geological information includes lithological & structural information of the dam sites areas (Mukerjee, 1990).

(i) Lithology

Here the geologist considers which types of rocks that makes the area. Surface & surface studies using different techniques of geological and geophysical investigation are carried out, which gives ideas about the type, the composition, and texture of the rocks exposed along the valley floor, in the wall etc. We study that the area are exposed under what class of rocks i.e. igneous, sedimentary or metamorphic us the exposed area and which of type is more prevalent, whether it is one class of the rocks existing there or more types of the same or different class rocks are found. Complex lithology creates problems in design and strong rocks like igneous (granite, gneiss etc) at the site make the job of the designer much easy, he can evolve best design (Singh P., 2004). By using satellite data lineaments map, geological maps etc. which gives ideas about geology of the dam site area can be easily prepared. Lineament maps give information about ground water potentiality and seismic activities of the area. If any area having high lineament density or any shear zones are identified, then that area is not favorable for dam site.

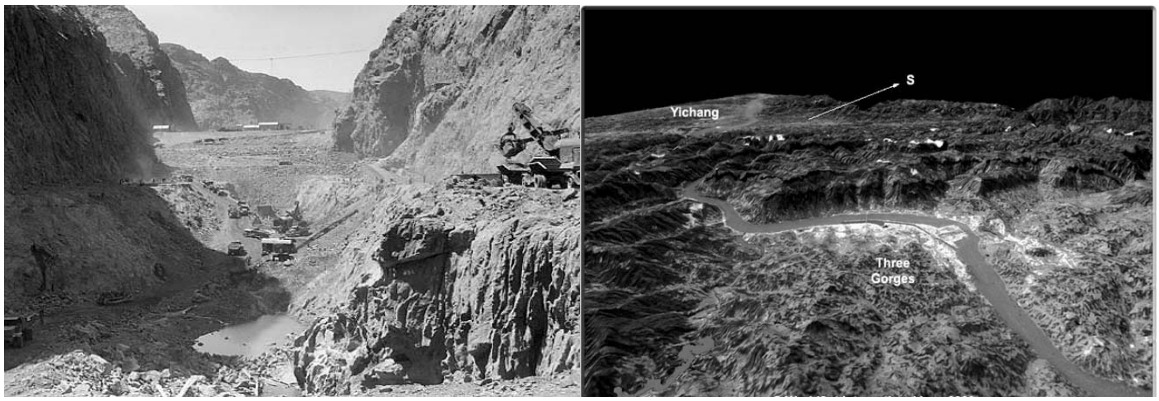

Fig.1: Topographical conditions near Dam site

(ii) Structures

Structure also plays an important role in designing and construction of dams. So, structural features of the rocks of the sites need to be investigated. This involves detailed mapping of plane of weakness like, bedding plane, foliation, shear zones, faults, folds, joints, cleavage and associated features. Fault structures, folds, joints etc can be source of danger in a number of ways. If dam site area having fault, fault zone or sheer zones lineaments etc. chances of earthquake becomes more and stability of dam gets endangered (Fig. 2 & 3).

(iii) Geomorphology

Geomorphological investigation in which engineers investigation about flood plain, alluvial plain, valley fills, hill & plateau rivers etc. of the dam site are very necessary during the construction of dam. Flatlands and plain can not be the convenient place for reservoirs. In alluvial plain, the reservoir area has to be an extensive, low-lying stretch bordered by high-land on flanks. Also the trend and rate of weathering and erosion in the catchments area or dam site also should be interpreted properly during geomorphological survey of dam site (Singh P., 2002). Likewise we can also prepare geomorphological map of the dam site by which we can easily predict that in dam site how much area comes under food plain, alluvium plain, during construction how much these areas are effected. Also we can analyze rivers in the piedmont slope area near dam site shows which type of pattern, how it is controlled by lineament or other geological features. These information easily find by preparing geomorphological map of dam site area.

The fig.4 gives idea about lineament & physiographic condition of Man River in the states of Gujarat and Maharashtra. The joint patterns as recorded in the rocks show a WSW–ESE and WNW–ENE direction.

Using satellite data landslide information about erosional & weathering aspects in the catchments area can be easily prepared. If the catchments happens to be made up predominantly of landslide, weathered, barren slopes which are broken, falling, shattered and jointed profusely, the run off and slope wash contribute heavy load of sediments to the reservoir after every rain. This would obviously decrease the effective storage capacity of the reservoir.

2.2.2 Remote sensing satellite data in hydrologic information for dam sites

This include information of river flow in the selected watershed i.e. how much water from different sources are coming in dam site because continuous supply in the catchments area are very essential so that when a dam is placed there it would easily store a calculated volume of water in the reservoir created upstream. If watersheds are very large it can be good for any dam location. Also, information about ground water table is necessary. In view of such a close relationship between water table and storage capacity of the proposed reservoir, it is essential that water table all along the reservoir areas, especially along the flanks, must be established.

The hydrogeomorphological map can be prepared by overlaying geomorphology, lithostratigraphy, structure and land use. The hydrogeomorphologic conditions for each landform types are identified based on the different features. Also by using remote sensing techniques watershed map of the river on which dam are proposed, can easily prepare which gives information of the steam

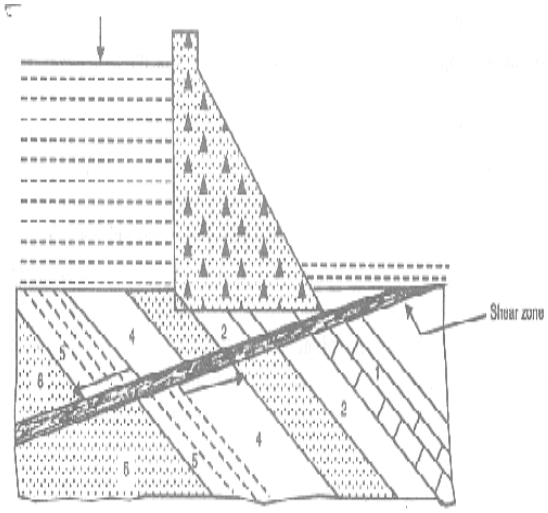

Fig.2: Shear zone under a Dam- unfavorable site

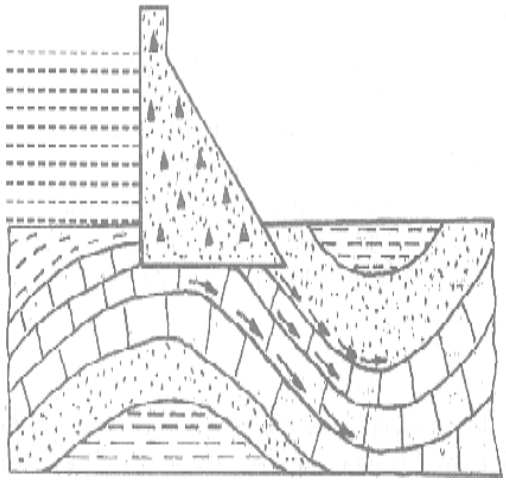

Fig.3: Effect of folding on Dam site.

order and amount of water coming in particular catchments area.

A studied has been carried out in the Man river valley, based on the characteristics of the 47 units of CEIU, each CEIU are assigned weightage and delivery ratio. The Sediment Yield Index is assigned to each CEIU. The sub-watersheds have been identified based on the area eroding more in time and space and have been prioritized based on the Sediment yield for future treatment (Fig.5).

2.2.3 Remote sensing satellite data in land use /land cover information

Before the construction of dam it is necessary to know about land use/land cover of the area. With the help of Remote Sensing & GIS techniques Land use/Land cover map of the proposed area where dam is constructed can be easily prepared. By land use/ land cover map we easily analyzed that how much agricultural land, forested area etc. will submerged, how much people or villages affected during the dam construction. GIS can help in the site selection for the rehabilitation and infrastructure location for the dispersed people.

2.2.4 Economic viability

Economically, the benefits arising out of a dam placed at a particular site should be realistic and justified in terms of land irrigated power generated or floods averted or water stored. Dams are invariably costly structures and can't be placed anywhere and everywhere without proper analysis of cost-benefit aspects.

3. Sonar surveys in dams and reservoirs construction

A dam had possible areas of seepage and an inspection was required. Visibility in the water was very poor and a scanning and profiling sonar survey was recommended. To produce finely detailed data it can be proposed that the profiling sonar head be lowered 150 to 20 above the bottom - this would keep the sound footprint small. Details of advantage to use Sonar data in Dam construction are given in fig. 6 & 7.

4. Environmental & social impacts on dam construction

According to Forest Research Institute (FRI), 1995, 3.5 % forested area has been destroyed and thousands of rare flora and fauna or other important species are destroyed due to river valley projects. Details impact on dams construction are shown in the fig. 8, 9 & 10. Impacts of river valley projects are showing below:

(a) Impacts at dam site

(b) Impacts on command areas

(c) Impacts in downstream area

5. GIS & remote sensing based study of the reservoir-induced land use/land cover changes in the catchment of Tehri dam in Garhwal Himalaya, Uttarachal (India): A case study

Tehri dam that is coming up in the catchment of Ganga River a little downstream of the confluence of Bhaghirathi and Bhilanganga rivers. Work on this dam started in 1978 and is envisaged to produce 2000 MW of electricity, besides irrigating 270,000 ha of land and

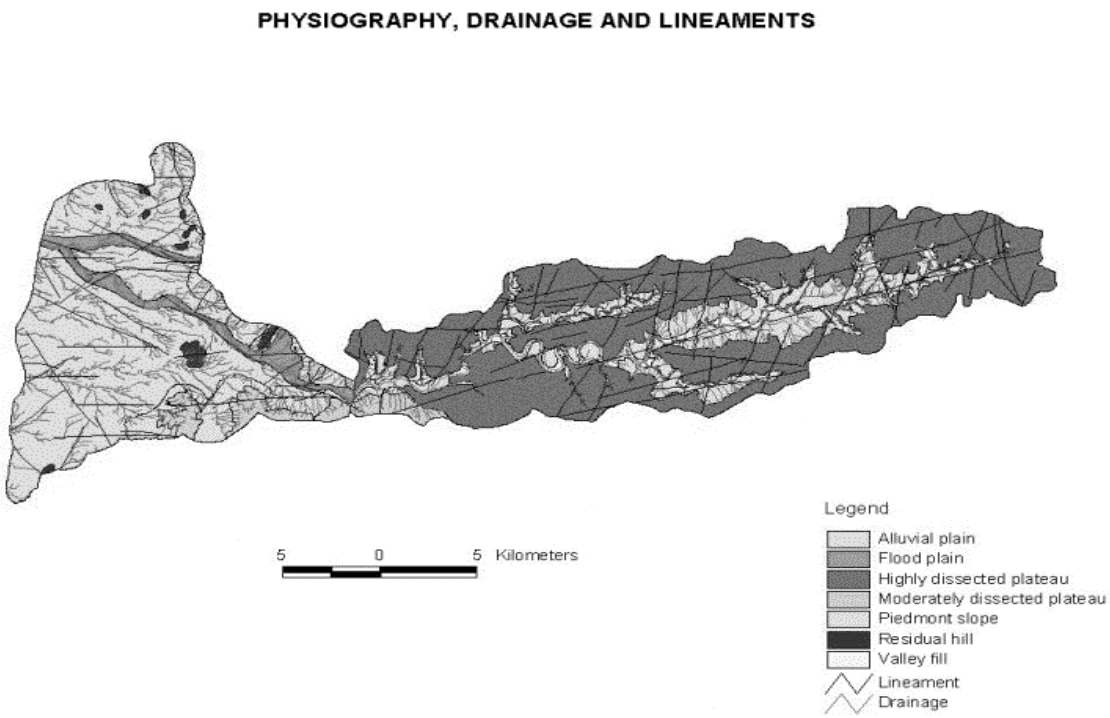

Fig. 4: Lineament & physiographic units in Man river valley.

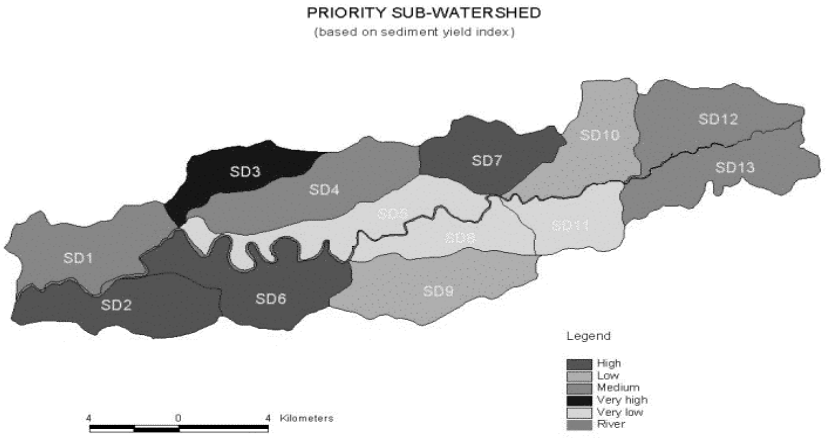

Fig. 5: Sediment Yield Index (SYI)

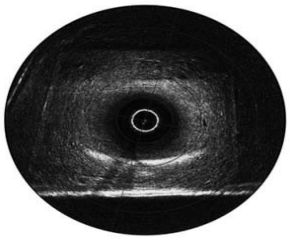

Fig. 6: Detail of the dam face showing construction joint & debris in Sonar data

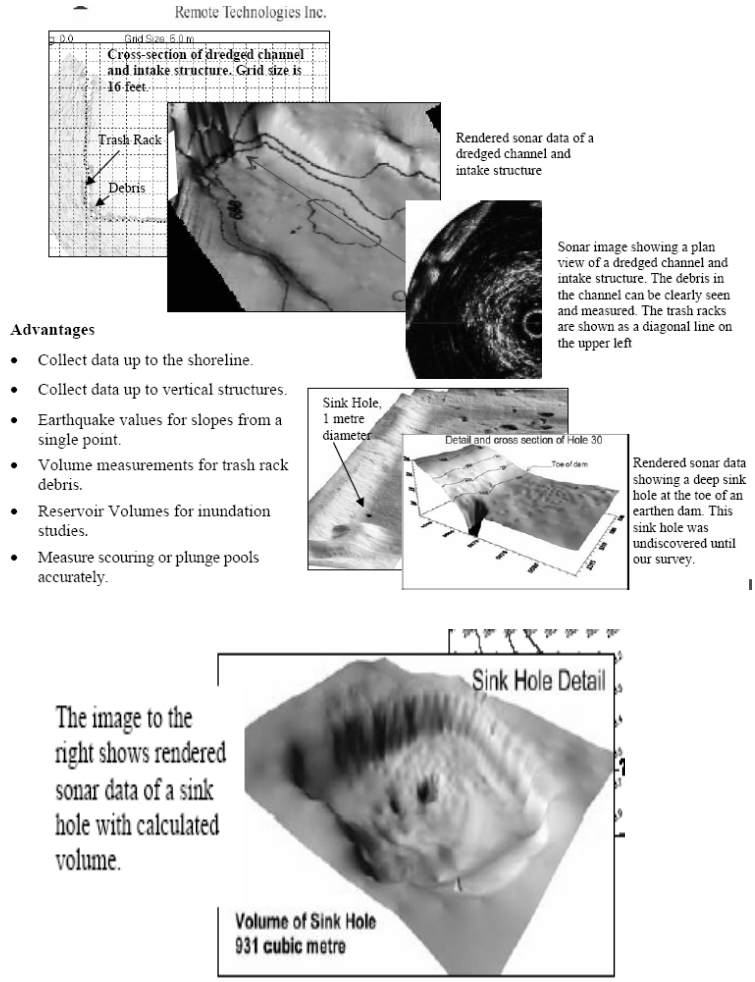

Fig.7: Advantages to use Sonar data in dam construction side

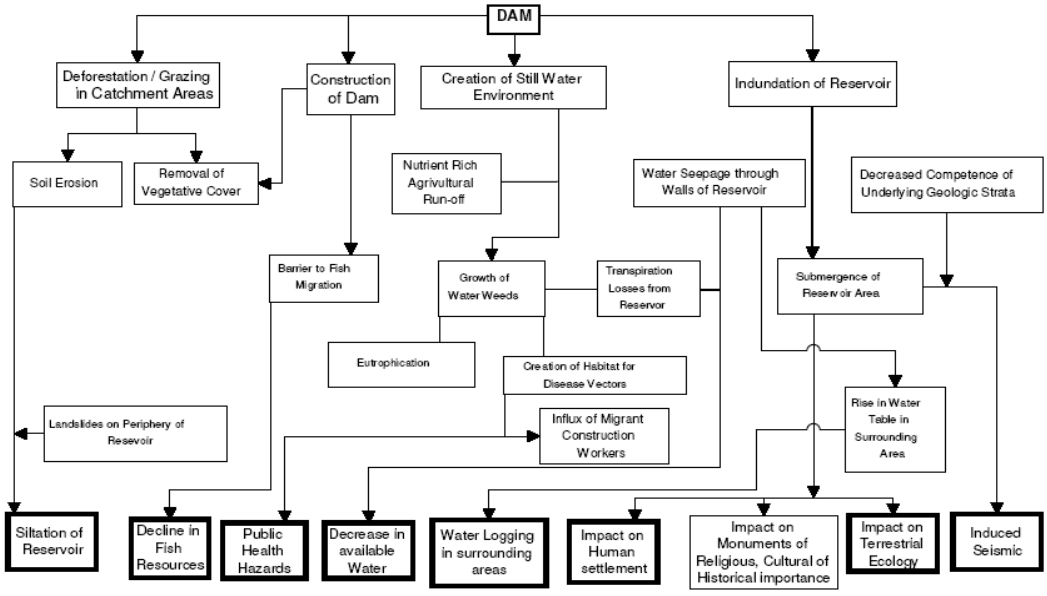

Fig.8: Impacts at Dam Site

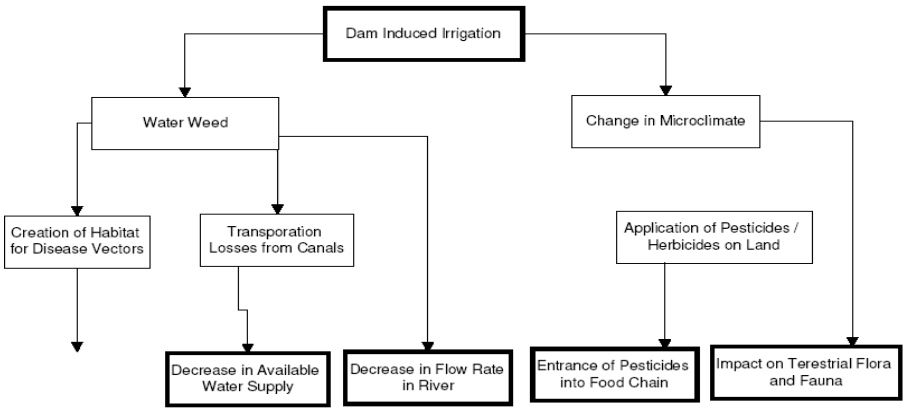

Fig. 9: Impacts on command areas

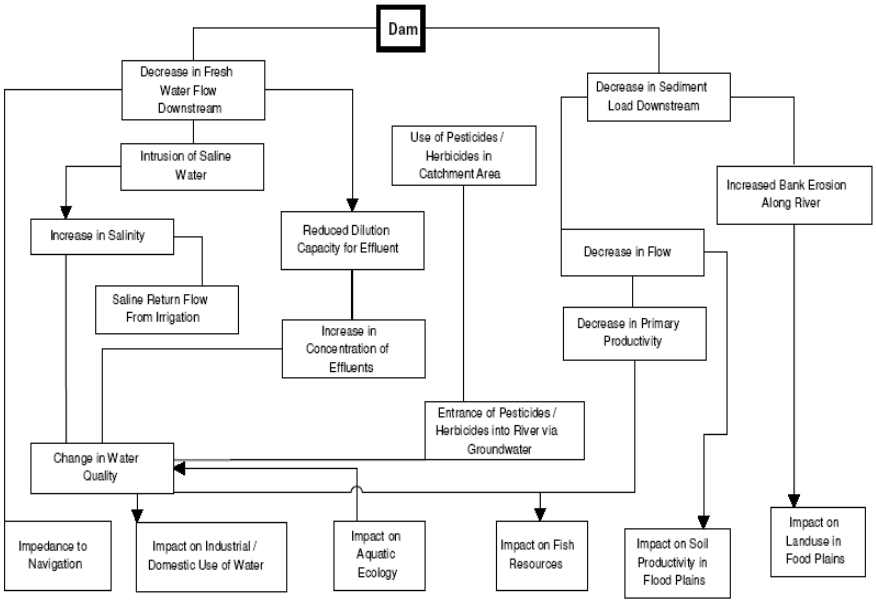

Fig.10: Impacts in downstream area

providing drinking water to the tone of 500 cusecs to the New Delhi.

Fig.11: Digital Terrain Model (DTM) of dam side area for perspective view

With the help of GIS based techniques and land-use/land-cover map prepared through satellite data, it is estimated that the Tehri reservoir in the upper catchment of Ganga river would directly affect 2688 ha of agricultural land and another 3348 ha around the reservoir rim would be rendered unfit for cultivation. The Himalayan terrain provides cost-effective conditions for dam construction–deep gorges with wide valleys on the upstream; but the inherent fragility and proneness of the terrain to seismic tremors is the bone of contention between environmentalists and policy implementers (Piyoosh et. al., 2002).

Remote sensing techniques are particularly suited for providing reliable, up-to-date and comprehensive data on land-use/land-cover. Apart from the field investigations, IRS LISS-III multi-

spectral and PAN (panchromatic) data are used for preparing the land use information of the area. Forest types identified along the slopes of the Bhaghirathi and the Bhilanganga valleys are classified into (i) dense mixed, (ii) open mixed, and (iii) scrub. The dense mixed forest accounts for 71.5% of the total forest covered area, while open forest accounts for another 26.4%. With the gentler slopes being cleared for cultivation, forests are mainly limited to the higher reaches; high (20–30°), very high (30–42°), and steep (> 42°) slope class accounting for 30 and 25, 15% of the forest cover respectively. The entire Bhaghirathi catchment area is mountainous and rugged, with poor infrastructure development. The area is therefore sparsely populated, with the population being concentrated in the river valleys where agriculture is being practiced in river terraces.

The Tehri dam is designed to be 260.5 m high and would submerge everything below the critical 840.5 m level on the upstream side. Digital terrain model (DTM) of the area together with the land-use/land-cover map prepared with the help of satellite data (Fig. 11). Under the GIS environment, a dam with 260.5 m height was simulated to assess the storage capacity of the showing impoundment of the area.

This submergence zone layer was then used for assessing the various land-use/land-covers types likely to be affected by the impoundment of water in the lake. These studies show that the Tehri reservoir would cover an area of 5170.21 ha and would have a storage capacity of 4345.44 million m^3. Agricultural land accounts for almost 53% (2690 ha) of the total area submerged by this dam. A number of habitations in the river valley, including the township and erstwhile district administration centre at Tehri submerged by the reservoir water. The reservoir affect, the land around the reservoir side. A buffer zone of 500 m is thus created around the reservoir and with the help of the land-use/land cover map, various-types of land-use, falling within this zone, have been marked out. It is observed that 3350 ha of prime agricultural land (around 47% of the total area within the buffer) on the upper terraces falls within this zone.

This land is be left barren even if not affected by salinity and the marginal farmers owning these lands would have to be rehabilitated. To add to it, around 42% of the area within the buffer zone falls in dense mixed forest and open forest covered area. Water sources of a large number of habitations on the reservoir are flooded by reservoir waters. This posed a threat of an epidemic or water born disease in the region.

Besides this, the regional or district level effects include: (a) Displacement of labor from agriculture; (b) Widening income disparities; (c) Declining sustainability of secondary and tertiary sectors; (d) Enhanced ecological pressure upon the catchment due to the migration of people; (e) Increased erosion due to engineering activities; (f) Scarcity of drinking water due to water sources getting inundated

At present agriculture has been the backbone of economy in Tehri region and the studies show that the reservoir have affected 6034 ha of prime agricultural area (mostly irrigated) of the river valleys. The dam would affect 3663 ha of mixed and open forests, with 2990 ha falling in the buffer zone of 500 m (Piyoosh et. al., 2002). With the increased humidity, biomass availability in the region have increased together with the increased incidences of water-borne diseases. There is an urgent need of promoting non land-based economic activities in the region apart from promoting the industrial infrastructure, so that the affected people could easily find suitable economic rehabilitation.

6. Conclusion

Satellite remote sensing data is an effective tool in any large river valley projects. It provides a synoptic view of the whole area in multi-spectral mode in different times of the year. GIS and Remote Sensing, play an important role in generating automated spatial datasets and in establishing spatial relationships. The Environmental Impact Assessment, for the dam construction can be performed very easily using GIS and Remote Sensing satellite data and software's. Efficient management of irrigation water can be suggested using recent information of the command area by processing satellite data through image processing ERDAS IMAGINE SOFTWARE. The impact of the dam in terms of submergence area and command area compute to assess the net benefit to the society. GIS can also help in site selection for the rehabilitation and infrastructure location. Hence, before starting any river valley projects all above aspects need to be studied thoroughly by civil engineers & designers.

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SCIENTIFIC AND TECHNOLOGICAL REVOLUTION (STR) AND SOCIAL CHANGE IN INDIAN CONTEXT

PROF. ANAND PRASAD MISHRA*

Science and technology as integral parts of human culture acts as instruments on space for evolving pattern of social transformation. The evolution of knowledge is the product of society to fulfill the needs of human requirement. It helps in maintaining their future path of development. The advancement of scientific knowledge and technological revolution are products of accumulated knowledge gained by society through achievements of historical development. Scientific and technological revolution (STR) reveals the status of social and cultural advancement in society, which ultimately creates new dimension in history of social progress. The interlinkages between STR, knowledge and society are quite visible in process of expanding space for democratization of social and economic production. STR created new intellectual horizon which enabled man to question the accepted belief, as well as established objective, purposes and goals of systems. The scientific and technological revolution (STR) impacted lot to social structure by changing means of production and relationship between man and man. Actually, "the philosophy created as a result of the twin development of science and technology on the one hand and the economic theories and philosophies on other reduced man to a number and a cog in the machinery of production and his creative capabilities could only be judged by the number of items produced in a given time and his effort value on that basis .The artisans reaction in Britain in the form of Luddite revolt was both natural and understandable" (Rahman, 1980). The status of STR is really a reflection of individual relation in their social life. It is a well known fact that the discoveries of steam engine and electricity created a background for ending of long practiced slavery in human civilization. Albert Einstein outlined the importance of electricity for ending slavery. This emerging pattern of STR also contributed in expanding dynamics of democracy in a science & technology based rich society. Democratization of society and increasing desire for democracy among people are significant elements, which promote scientific temper and technological revolution in society. Pandit Nehru, whose contributions to the progress of science & technology in India is well known that he was only prominent national leader who tried to initiate a debate in Congress for the needs of national policy on science. He also put forward some basic observations on national science policy, which are as follows;

a. Creating social consciousness amongst scientist, by posing social problems before them and asking them to try to find answers...
b. Involvement of scientist in decision making
c. Using scientific knowledge in reforms
d. Promoting scientific temper.

Nehru knew that science could not flourish merely by creating an infrastructure in a society which was steeped in superstitution; he, therefore, made considerable efforts himself, repeatedly pointed out to the scientists the need for the popularization of scientific outlook among the people. He wanted to make science & technology as a part of Indian culture. He thought this to be a critical factor in the development of science & technology in India.

Indian Social Structure and STR

The scientific & technological discoveries are the product of creativity of human being that itself representative of democratic social structure and individual freedom. To understand this, we may discuss about the invention of steam engine in Europe. The use of steam-power for driving engines first patented by James Watt in 1769, gave a tremendous boost to industrial production. After that in 1765, Lames Hargreaves, a weaver and carpenter of Blackburn, invented the 'spinning jenny' and patented it in 1770. It was a simple machine worked by hand which fitted into the domestic system of production and substantially increased the output of yarn. In 1794, Edmund Cartwright patented a power- loom. These inventions changed the pattern of production and overseas trade. These inventions may be examined in Indian context and evaluated through its social and historical reality. We may ask question why stem-engine was not invented in India. Why person like James Watts and others were not born in Indian society?

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The explanation of this question could be seen in Indian social structure. Indian social structure and its historicity may prove significant elements in study of STR and social change. “It is well known that the Indian sub-continent occupied a distinct place in the history of science in the ancient and the medieval period. A comparative study of Indian and European scientific thought shows that, while Europe was passing through dark ages from about 5th to the 11th centuries A.D., India reached the zenith of her cultural glory in the classical age and made remarkable progress in the field of mathematics, medicine, astronomy, chemistry and metallurgy. The scientific genius of the ancient Hindus, however, appears to have exhausted itself by the end of the 12th century. All original scientific works have written in India was before this time and more appeared once again before the end of the 19th century. The centre of intellectual gravity shifted to Europe. (Subbarayappa & Amit Das, 1980.).

These historical facts give us insights to understand the logic of scientific and technological revolution (STR) in India. The prevailing caste structure in Indian social organization played major role in shaping the evolutionary pattern of knowledge. The Brahmnical cultural value restricted the common people, especially working class, to participate in process of knowledge production. The parasitic approaches of ruling class people deprived large section of common masses from the ambit of science and technology. These deprived section, which lost their right to acquire knowledge, have only right to participated in labour oriented production, while the knowledgeable section of society detached themselves from labour and production. This ground reality in Indian context created dichotomy between knowledge, labour and production. Actually, the social hierarchy, untouchability, Brahminical mind set and its relation to production have played a negative role for manufacturing technology that enhanced labour productivity. The Indian dichotomy can be explained through the observation of great thinker Antonio Gramsci (1891-1937), when he said, “all men are intellectuals but not all men in the society have the function of intellectual “. He further observed that each social class, creates together with itself , organically , one or more strata of intellectual which give it homogeneity, and an awareness of the new function not only in economic but also in the social and political fields. These, intellectuals, as Gramsci said “actually the survivors of the past, since they were the part of the superstructure in which the base, in the particular mode of production is already substituted by a new one, hence far from reality, their ideology had to be idealist”. These ideological discourses substantially explain the Indian condition in which common people's intellectual capabilities were not fully utilized for the development of science and technology. Prior to that, we had a very balanced approach in our social order and scientific orientation, which ensured every man to participate in process of history.

Energy, science and society

The utilization pattern of energy is an important parameter for scaling the advancement of science and technology and social change. In primitive society the needs of developmental activities were fulfilled by human labour and later on shifted towards animal energy. The demand of human labour for development legitimized slavery in then society. The history of slavery shows that it in many ways has contributed for economic betterment and enhancement of productivity in a specific period of time. The evolution of science and technology opened new chapter in human civilization to fulfilled the needs from nature gifted energy resources and evolving technology of machine. The discovery of coal, petroleum, natural gas, uranium and other energy resources have major impact on individual, society, politics and cultural dimension in bigger way. The scientific invention, especially in context to our present day energy requirement, could be proved its utility to solve these problems in future through STR. This observation is quite visible in our scientific discourses and majority of scientist shown their optimistic attitudes towards this. Hari Narain (1970), Vice Chancellor of Banaras Hindu University, expressed his firm opinion on the potentiality of science & technology, in this context and he observed, “Over the very long run, man’s fate on the average is pre-destined by the Malthusian disequilibrium. Man pro-creates in a finite word. Man’s continued scramble for finite resources condemn him to eternal social instability, to violence and to brutishness. Science and technology have provided many solutions to save the mankind from eternal social instability”.

Actually, the STR is a powerful tool for any human society, which gives strength in hands of people of a concerned society that have knowledge about science and technology. It is fact of history that British conquered India not only because Indian economy was completely devastated at the time of its victory and the people of India were disunited, but the

British rulers brought in an advanced technology and trade, economic production system, education, science and culture. (George, basalla, 1967). The powerful nation always has better knowledge about science and technology, which gave them superior position among groups of nations. The British Empire adopted step-motherly design in developing the science and technology in India. Consequently, the status of R&D sponsored by western countries ignored the alternative sources of energy, like solar, wind, ocean current and thorium based nuclear energy and they never interested to open the natural routes of science and technology in most of the colonial tropical nations. The agenda of empire mostly confined towards the interest of colonial ruler, which constructed power plant, and other alternatives became insignificant and it never related with ground reality of tropical nations. The low level of skill in science and technology created the problems of stagnancy in social and cultural sphere of life that created obstacles in the process of social development.

STR and gender equality

The scientific and technological revolution (STR) impacted greatly on mode of production, process of social formation and its structure in bigger way. The transformation of mode of production from primitive to organized agricultural production and later on simple to complex productive processes have deprived women from productive assets. The evolution of STR is an important factor which considerably influenced the nature of production and ownership. Marx (1955) was aware that the process of production would reach a point where labour would become superfluous. This understanding gives us a point through which we can formulate a theory for historical routes of women deprivation. Engels (1884) described women position as varying according to the pattern of historical development and accessibility to modern knowledge and technology. Boserup (1970) observed, "in course of agricultural development men's labour productivity tends to increase, while women's remains more or less static ". Goody (1976) linked his work to the findings of Boserup by qualitative analysis of pre-industrial society; female farming was associated with hoe agriculture and simple polity, while male farming was associated with more advanced agriculture, more complex polities and with inheritance systems of diverging devolution under which property is transmitted to women either as dowry or inheritance. It clearly reveals that the subordination of women in specific historical periods was a consequential impact on women through her inability to command over the ongoing process of STR in historical development. It is a fact that most of STR has marginalized women to participate in every evolutionary developmental activities. Through these, most of our historical past was full of violence and conflict because soft and caring nature of women lost its legitimacy in decision making processes and it was masculine centuries. The contemporary soft skilled technology has many new things for women, which give her power to handle it and extend her command in every sphere of life. The 21stcentury STR provides women better opportunities in every sphere of life, and through this anyone can draw conclusion that 21st century will be a faminine century

STR in India

Being an ancient civilization and tradition of Vedic knowledge, Indian scholars contributed a lot for the development of science and technology. "About 1500 B.C Aryan migrated from the Iranian plateau to Indian sub- continent. They use to speak Sanskrit. They came with their own culture. In Vedic literature uses of plough and sieve were in vogue. The Rig Veda had no mention of rice but barley. In later Veda, rice was mentioned. Idea of rotation of crop was known. Large number of plants was known including the difference between trees, shrubs, and creepers. Internal structures of some of these plants were also known. About 260 animals were described. Mammals, birds, reptiles, fish and insects were separately mentioned. The Atharva Veda had reference of 16 types of Krimies (worms) in man and cattle causing diseases" (Sivatosh Mukherjee, 1980).

Sivatosh Mookerjee (1980) studied about the advancement of STR in Indian context. He found, "in a sweeping survey to ascertain the general pattern of growth of biology from the classic period to mediaeval period, one can deal with time span in two definite ranges. First, between 600 to 1200 A.D. and the second between 1200 A.D. to 1800 A.D. By far the most glorious period of scientific development in India fell between 4th to 8/9th century A.D. Science during this period blossomed into many technological innovations. .. Memorable names like Aryabhata I, Bhaskara I, Brahmagupta and others made some of the most fundamental discoveries in Mathematics and Astronomy….Buddhism's concern for the sick recreated some more interest in this (Ayurveda)

branch of science, Vagbhata and Nagarjuna being Buddhist monks took active interest in this area and contributed in research… During the 12 and 18th century the two trends of activity were evident. One trend concerned with the cultivation of the ancient tradition of science and the other had been the new influence of the Islamic and European science brought to India through new contact…Under the Islamic influence Unani like Ayurveda came to India during this period and flourished well. Unani was practiced by Hakim. Allauddin Khilji patronized many Hakims. Often Vaidyas and Hakims practiced together."During the Mughal period life science and agricultural sciences got importance and also contributed in many ways to discovery of science and upgradation of society.

During freedom movement Indian society confronted with many evolving question and its related ideology. Under these circumstances , a section of Indian intellectual who under the influence of national movement became aware of the need of science as most fruitful intellectual activity with its great potential to change economic and social life came forward to build the first Indian Research organization under the name , ' Indian Association for Cultivation of Science'. This national organization for the cultivation of science by the people of India was established by Dr. Mahendra Lal Sarkar in Calcutta in 1876. This has attracted the talented Indian youth, who later on contributed a lot for betterment of Indian science and raised it up to world class. Stalwarts like C. Bose, P.C. Ray, C.V. Raman and later on eminent physicist like K.S. Krishnan all worked in the Indian Association for Cultivation of Science .This proved the deep sense of understanding of our national leader about the importance of STR in nation building.

Indian National Movement added new chapter in furthering the advancement of science & technology during the period of 1930 to 1934. This was the period, when National Congress confronted with ideological debate. The progressive section of congress under the leadership of Pandit Jawaharlal Nehru tried to search out the routes for science and technology in India. They were firm in his opinion for expansion of science and technology in society and scientific temper among people. During these periods several efforts were made by our leaders to initiate their activities for expansion of institutions which can promote science and technology in India. In 1902, Board of Scientific Advice was established and later on in 1903 Imperial Agricultural Research Institute and Forest Research Institute (1906) started for scientific work. Major initiative was instrumented through national movement by constructing Board of Scientific and Industrial Research in 1942. In continuation to these efforts, our great national leader and congress president Mahamana Madan Mohan Malviya had demonstrated his vision for STR through his sacrifices for establishment and development of Banaras Hindu University. The vision of Banaras Hindu University laid by Mahamana is pertinent to mention here for understanding of dynamics of STR in India. Being a prominent congress leader Malviyaji proposed the concept of 'University' before the congress session which was held in Banaras in 1905. It was discussed by then prominent congress leader and all supported to this proposal. The proposed idea of university said, "Promotion of scientific, technical and artistic education combined with religious institution and classical culture as task for construction of seat learning. Through scientific & technological innovations, Banaras Hindu University contributed in many ways for STR and development in India. The premium institutions like ONGC, CSIR, ICAR, BARC, BHEL, etc., have been established and strengthen by trained people from BHU.

The previous discussions give us an account of scientific and technological development in India and the role of national movement in formulating design for advancement of science& technology. However, the evolutionary processes were very much painful and it still put obstacle from its social and cultural roots in furthering STR for common people. It needs new kinds of democratic alternative in our social structure. There is a need to move democratic towards a society and expand science & technology for a common man.

STR, democracy and development

The Scientific and technological revolution (STR) is itself a product of individual freedom and democratization of society. The experiences of STR in European society evolved through people aspiration in the forms of liberty, fraternity and equality that give opportunity to people to apply their creativity in a just way. The constituted law on Feb. 4, 1794 prepared ground for abolition of slavery in different parts of globe in general and Negro slavery in all the colonies in particular. This had also made background for STR and ultimately towards industrial development in western countries. It is well known fact that STR has opened entirely new chapter for democracy and development. It also requires quantitative and

qualitative re-arrangement, re-identification and re-definition in an evolving social reality. Moreover, the information and communication, as a product of STR, has started redefine of our thought and social activity, enhancing and penetrating into ground of our democratic life. Due to advancement in technology most of the manufacturing unit has gone through tremendous change and landscape of production now dominated by small, handy and computerized machine. This development dynamics and reality are becoming big concern for future agenda of social development. Anil Rajimwale, (2014) conclude this; "software, touch screen and virtual realities have great potentials for the future of society and the individual, including for democracy. One has to prepare for it by working out their implications. The borderline between software and hardware is getting blurred, and the hardware is losing the battle (contradiction) to software. This development is fraught with great possibilities for the future, as the machine, tools and other hard and tangible objects will be losing much of their present importance and role. This has a direct bearing on democracy" (Anil Rajimwale, 2014). These emerging discourses on STR give some insights about our future society.

Resolution on STR

The key to national prosperity always lies in hand of modernization, i.e. science and technology that itself a product of rational social set up. Modern technology is not a simple product of science. It emerged through as a process of cultural advancement and has its own logic and impact on socio-economic and political structure. Pandit Jawaharlal Nehru proposed Scientific Policy Resolution in Parliament in 1958 and it stated, "it (STR) is an inherent obligation of great country like India with its traditions of scholarship and original thinking and its great cultural heritage to participate fully in the march of science which is, probably, mankind's greatest enterprise today". This resolution prepared by our national leader explains the vision on importance of science, roots and policy orientation on issues of STR. The objective of scientific policy is still relevant to our nation and society. Some of the major aspects are as follow;

1. To faster all appropriate means for the cultivation of science and scientific research.
2. To ensure an adequate supply for research in science and technology.
3. To encourage and initiate programme for the training of scientific and technical personnel.
4. To ensure that the creative talent of men and women should be encouraged so that they could participate in every sphere of STR.
5. To ensure academic freedom to every individual that help enhancement of STR.
6. Transfer all benefits gained by STR to common people.

These objectives are very much significant for the development of science and society. Lastly, the Nehru vision on scientific temper is pertinent to be considered by ours in any scientific resolution. The "science could not flourish merely by creating an infrastructure in society which was steeped in superstition". Therefore, the level of science and technology always has its relation with rational social structure. This rational and scientific approach is quite significant and critical element in any resolution for development of STR.

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THE SENSE AND SCIENCE OF WATER IN ANCIENT INDIA CAN THE PAST BE THE KEY INTO FUTURE?

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The Past

Rivers and river-valleys had been centres of development of civilization. The importance of water as a precious resource had been realised by all civilizations to sustain life on earth. In *Srimad Bhagawadgita,* a spiritual classic in Sanskrit language (Chapter 3, Verses 14 & 15) containing lessons for humanity for ideal living, on water, it was said:

annādbhavanti bhūtāni parjanyādannasam bhavah

yajñādbhavati parjanyo yajñah karmasamudbhavah

karma brahmodbhavam viddhi brahmāksarasamundbhavam

tasmātsarvagatam brahma nityam yajñe pratishtitam

"where there is rain/water, there is food; where there is food, there is life, where there is life there is action; where there is action, there is knowledge; where there is knowledge there is sacrifice/offering; where there is sacrifice/offering there is rain/water" (slightly modified, Ramsukhdas, 1989: 133-134).

It is all pure science. It needs no elaboration; so much is in our hands, make it or mar it. At least, if the knowledgeable practise it, they can preach to spread the *'shruti'* the word, about water.

No more needs to be written about the importance of water. What was once a ubiquitous resource has become scarce and even in places where water is everywhere, it had become scarcer because of quality deterioration. The causes for the present state of affairs are--population increase, industrialisation, urbanisation, poor governance and management and peoples' apathy and ignorance. With the much expected changes in climate and environment coupled with increase in population, industrialisation and urbanisation, the situation can turn for the worse. Then, the question is, how to cope with the demand for water in future with further increase in the level of civilization when the requirement of water is expected to increase manifold.

The importance and value of water had been realised very well in ancient India. The ancient seers expressed on the importance and value of water thus (Rangacharya, 2000): "*praanavah aapah amritmavaapah* - water is life, water is ambrosia; *shantirvai bheshajam aapah* - water is peace, water is panacea; *rasovaa aapah annam aapah* - water is sap, water is food; *veeryamava aapah aapovaiyajnah* - water is strength, water is sacrifice; *aapo retah aapovai sarvadevata* - water is energy, water is all gods; *aapovai devanam priyamdham* - water is loved by gods". The last line (from Taittiriya Aranyak 6 Prashna) of this compiled hymn is connected with many stories of angels vis-a-vis water. The stories go thus: As water is not available in the Heavens, angels at the sight of water on earth used to get so much enamoured with it they used to forget to return to their heavenly abode enjoying in the lakes, ponds and rivers and used to attract the wrath of their 'bosses' for overstaying on earth. What angels don't have in Heaven, we have it on the Earth!? This is the reason why, water is offered as the most precious gift to gods in daily (*sandhyavandanam*) prayers: "*aachamanam* - sipping of water thrice; *aapo marjanam* - sprinkling of water on the body to immerse oneself in water to be one with the universe; *punar aachamanam* - sipping of water once again; *pratah prasanam* - drinking of water in the morning; *punar marjanam* - repetition of '*marjanam*'; *arghya pradaanam* - offering of water to the Sun god; *deva tarpanam* - offering of water to gods." In terms of health, the value of sipping and drinking of water in the mornings is well vindicated by modern research.

These are different steps in daily prayer—*sandhyavandanam*—morning, afternoon and evening prayer--which is intimately linked with water. At every step in this day to day prayer, water is used as the most precious gift that one can give to gods. There is nothing more valuable than water which can be given to gods as an offering. This was the type of relationship that ancient Indians developed with water and this relationship and veneration for water were responsible for keeping water sources full and pure.

This is what we have in *Rigveda, Mandala 10, Hymn 9* on waters which is recited during *sandhyavandanam* to perform *aapo marjanam* and

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punar marjanam.

āpohista mayobhuvas ta na ūrje dadhātana
mahe ranāya cakshase
yo vah śivatamo rasastasya bhājayateha nah ushatee riva mātarah
tasmā aram gamāma vo yasya kshayāya jinvatha
āpo janayathāca nah
śam no devīr abhishtaaya āpo bhavantu pītaye
śamyor abhi sravantu nah
īśānā vāryānām kshayantīś carshanīnām
apo yācāmi bheshajam
apsu me somo abravīd antar viśvāni bheshajā
agnim ca viśvaśambhuvam āpah pranīta bheshajam varūtham tanve mama
jyok ca sūryam driśe
idam āpah pra vahata yat kim ca duritam mayi
yad vāham abhidudroha yad vā śepa utānritam
āpo adyānv acārisham rasena sam agasmahi
payasvān agna ā gahi tam mā sam srija varcasā

"Benevolent waters give us energy. We look up on you with great delight. Give a portion of the most auspicious sap that you have like what mothers give their children. You sent us to this abode and give us strength to sustain life. You the goddesses of waters quench our thirst and flow to us to give us health and wealth. We beg you the water queens to flood and fertilise our fields. Oh! waters soothe our pain and heal our wounds and bless us with fire. Waters, be like panacea to cure our ills till we live to see the Sun. Waters, wash our sins, drive away the evil from within us. It is because of you waters from your moisture I am here on this abode this day, the fire within you rich like milk immerse me with your splendour" (slightly modified, http://hinduismfacts.org).

It is not the intention of the author to bat for the revival of rituals and to take recourse to religion in all matters. In India actually nothing is connected to religion as much as things are connected to religion in the other parts of the world for '*Hinduism'* in *sensu stricto* is not a religion but a philosophy and a way of leading scientific and systematic life. This digression, of course, not irrelevant to the subject, helps in understanding the scientific philosophy of *'hinduism'* especially in the context of water. In India, the so called 'religion' is basically based on five primordial elements—earth, fire, sky (ether), air and water—called '*panchbhutah'*--five elements. Of course, later these *'panchbhutas'*—five elements are replaced by Vishnu, Brahma, Mahesh, Indra and Yama (Singh, 2012). In fact, it is from these five elements the word '*bhagavan'*—God is made. *'bh'* stands for *bhoomi*--earth, '*a'* stands for *agni*--fire, *'ga'* means *gagan*--sky/ether, '*va'* means *vayu*--air,*'n'* stands for *neer*--water (Abhilash 2010). Several meanings are given for the word "*bhagavan*" and its etymology. In Sanskrit unlike in many other languages each and every letter in alphabet conveys a meaning or two. That explains the origin of the word '*bhagavan*'--God in India. And, this is the reason why, people living beyond the boundaries of the present day '*hindukush'* mountains are called *'idu'*, *('i'* is pronounced as 'i' in ice) the worshippers of 'five elements'—*panch bhoothas* or five Gods--*Vishnu, Brahma, Mahesh, Indra and Yama.* It is a different matter this word *'idu'* which means 'five' later on got corrupted to '*indu*' and '*hindu'* (Singh *op cit*). Subsequently, in an environment of complete creative freedom, several gods and goddesses in several forms and figures have been created by the creative minds basically out of these five elements—the *panchbhootas* or five Gods. So, the so called 'million Gods in *hinduism'* is a result of creative freedom enjoyed by the people of India. These million gods are in some way or the other are associated with these five elements and the energy inherent within them. Water is one of them.

Take a look at the names of a couple of important Indian rivers—the *Saraswati* and the *Ganga*. *Sarasvati* (holder of sweet water, the daughter of the seas), *Ganga* (from sky to earth), *Varuna* (daughter of *Varun*, the rain God) etc., etc., are generic names. This is exactly the reason why many small rivers and tributaries in many parts of present-day India are called by these names. The *Saraswati* and the *Ganga,* the personifications of water, one (*the Saraswati*), the holder of sweet water and the other (*the Ganga*) descending from the sky (*gagan*) to the earth *(gagar),* we know very well the former which nurtured a great civilization but choked up with unbridled silt coming down the Himalayas because of large scale afforestation and the latter is so polluted now, its waters are unfit to consume directly.

Alas, what did the Indians do to their lifeline—the Ganga. Just take a peek at Panditaraja Jagannath's poem *"Ganga Lahari"* on the Ganga.

samruddham soubhagyam sakalasudhayah kimapi ta
nmahaiswaryam leelajanitajagatah khandaparshoh
shruteenaam sarvasvam sukrutamatha moortam
sumanasam sudhasoundaryam te salilamashivam nah shamayatu

"You, Ganga who covered up the earth with greenery and wealth, the creator and sustainer of life

on earth, and the prized possession of Shiv, the essence of *Vedas*/knowledge and who is blessed by the gods as ambrosia, wash away all our sins, evils and inauspiciousness." (Marjanovic 2007: 23).

Now, the question is why and how so much of deterioration has come onto our waters in our great lifelines of rivers? In the same *'Ganga Lahari'* of Panditaraja Jagannath, he eulogised the *Ganga* further thus, Lord *Shiva* is considered as '*nirlobhi'* (non-miser); but as for '*Ganga*' He held it as his prized possession/wealth; meaning thereby that as mortals we (the Indians) should be great misers holding onto the *Ganga* in its pure pristine form for we owe our life, health and wealth to it. Are Indians doing it? The answer is an emphatic no. There are examples galore like this about the greatness of the *Ganga.* A line in Adi Sankara's Verse 20 in his '*bhajagovindam'* expresses thus the value of a drop of water of the *Ganga:*

bhagavadgeeta kinchdadheeta
gangaajalalavakanika peeta
sakrudapiyena muirarisamarcha
tkriyate tasya yamena na charcha

"A little study of the Bhagawad Gita, drinking of a drop of Ganga water, a casual worship of Murari—these will save you from debate and Death". (Rajagopalachari 1988: 33).

Myths have meanings. The *Ganga* is *'jatatavigalajjalapravah'*. Lord Shiva took Ganga into his locks, controlled it and released it for the sake of people. The forests of Himalayas are compared to the locks of Lord Shiva. The story *'Ganga Avatarana'* is well known to Indians. With no forests over the Himalayas, the Ganga can wreck havoc. There are examples plenty ascribed to uncontrolled rain causing havoc in the Himalayas because of forest felling.

It is because of the importance of water as life giving and life-saving and life sustaining element, it is venerated by Indians as the most precious liquid and hence have evolved a code of conduct near water sources especially near the river *Ganga*:

gangam punyajalaam praapya chaturdasha vivarjayet
souchamaachamaanam keshanimaalyamadhamarshanam
gaatrasamvaahanam kreedaa pratigrahamado ratim
anyateertharatinchaiva anyateertha prasamsanam
vastratyaagamathaaghaatsantaram cha visheshtah

"One should not perform fourteen acts in and around the holy waters of the river Ganga, i.e., excreting in the water, brushing and gargling, removing all clothes from the body, combing the hair, throwing hair or dry garlands in the water or throwing remains of a puja *(nirmalya)*, playing in the water, having sense of attachments to other holy places, praising other holy places, washing clothes, throwing in dirty clothes, thumping water and swimming" (*brahma purana prayaschittatatwa* 2.535 as quoted *in* Marjanovic 2007: 13).

All these fourteen don'ts have become do's of the present times! There is much more one can write and quote from the religious texts from ancient India on water. What quoted here are just a few.

The Present

Alas! Hindus have forgotten their *sastras* (texts) and wisdom, roots of our Gods and Goddesses, glorious culture and traditions. So the problems the present population is facing with water are connected with ignorance of people about their own *sastras* and wisdom, about the roots of their own gods and goddesses, value of water and callous attitude towards long established traditions and culture.

Situation now is pathetic. The less said the better about our waters. The streams, streamlets, the rivers and rivulets in Peninsular India though technically speaking ephemeral used to flow throughout the year though in lesser quantities in summer season about 40-50 years ago. Most of the streams and streamlets are dead now. They are carrying water only during rainfall. The reason, mountain and hill slopes are exposed barren of vegetation and thick regolith, two factors responsible for retention of water. Water used to be fit for direct consumption and cooking from open surface sources like rivers, streams, wells, tanks, ponds and irrigation canals. Now, the picture is entirely different. Most of the ponds and wells went into disuse and most of them are filled up for various reasons. And, irrigation canals are now looking like filthy drains. The reasons are quite obvious. As level of civilization has increased level of indiscrimination has gone up manifold. Reasons are many. One reason that can be seen and felt is utter apathy of people. If this apathy doesn't turn into empathy, there is doom looming large and nobody can do anything then.

In the words of Vivekananda, the fundamental character of India is 'religion'. But it seems we have forgotten our religion/philosophy and wisdom. If one takes this as an affront on our people and religion, what about what is said about water and especially the Ganga in our texts?! Do we have the same sense of understanding, veneration and relationship our

ancestors had and developed towards and with water!? No, is the simple answer. The ignorance is all-pervading equal with the commoners as well as with the educated people!

The Future

Very early in the history of human civilization, Indians have had the distinction of knowing the significance and value of water. Their knowledge was in Sanskrit and unfortunately they were made to forget it and thereby forgot all their knowledge. What is required is, at least Hindus must try to remember what was and is theirs. What is present is not definitely theirs. The question is, what is it that is called the present? It is extreme materialism and consumerism. Unfortunately, as the level of civilization has increased the level of indiscrimination has gone up manifold. Reasons are many. One reason that can be seen and felt is utter apathy of people towards their own *sastras/*texts. If this apathy doesn't turn into empathy, there is doom looming large and nobody can do anything then. Hindus must revive their real religion. Their religion of gods and goddesses is intact. It needs no revival. What is to be revived is, the religion of '*panchbhutah',* their real religion of science where we pray the primordial five elements—the earth, the sky (ether), the fire, the air and the water. Hindus of India have to moderate themselves on this front. What is written here is a systematic compilation of what is already spoken and written in words. The question is how many Hindus know about these things and how much do they think and introspect about their past glory, traditions and culture?!

India was once a super power. We're not a super power because of our might and military. No, we're a super power because of being a super knowledge society. That knowledge has not gone anywhere; it is there with us but we forgot its language. In ancient India, learning and teaching was based on three principles—*sravanam* (listen), *mananam* (repetitive recitation) *and nidhidhyasanam* (thinking and contemplation). This is exactly what is required to be done. Time and again it should be hammered on to them on the importance of water and to make them think and contemplate on it. Repetitively listening to and remembering a certain thing makes one to contemplate upon it. This way, one remains in ones consciousness thinking about water and continuous contemplation leads one to act. What is required is action. Nothing can save them from near doom other than their collective action/efforts towards keeping their waters pure and pristine.

What is required is some amount of sacrifice. Indians need to sacrifice something. What are to be sacrificed are their present day religious practices with water. Most of what they do as religious rituals in rivers are contrary to what should and should not be done as per their own *sastras*--the fourteen do's and don'ts listed in *Brahmapurana* near water sources especially near the *Ganga*. This is the key into a future of pure water.

It is not possible for everybody to come to know and learn the *sastras/*wisdom connected with water leave alone the rest of the vast knowledge available in ancient texts. In practical terms, if the powers that be and/or good intentioned people want some improvement to be made vis-a-vis water, it can be done like this. On one front, there must be wide publicity blitz through every possible media on what is said in the ancient *sastras*/wisdom and on the other, like traffic police controlling traffic, on-site scouts at religious places near water sources must be deployed to prevent 'god-forbidden' practices through which they are partly polluting their sacred rivers and waters. Of course, major sources of water pollution are garbage, sewage and industrial pollutants from many of India's towns and cities. Concerted efforts have to be made by the government with the active participation of the public to prevent these pollutants from entering into the sacred waters and rivers. Not that what is written here is something new and has not been said by anybody so far. It is just like reminding Indians once again to go back to their *sastras/*wisdom so that they can bring some improvement at least in the case of their sacred waters and rivers sans which life cannot sustain. If at all there is one *param dharma/*great duty Indians have to perform, is to make every attempt to see that life on the Mother Earth is sustained. If at all there is a key into the future, it is the past! Taking a cue from what has been quoted in the beginning, it can certainly be said, if we don't take care of our rivers and other surface water storages, our country would very soon lose the status of being "a *punyabhoomi*" / "the blessed land". Our rivers can be taken care of through logical and rational legislations

and strict implementation. Implementation is possible with only peoples' participation; participation means, sacrifice. If the rivers, the lifelines of India are lost, we are lost. So, arise, awake!!

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ULTRAVIOLET-B INDUCED PHYSIOLOGICAL AND GENETIC DAMAGE MANIFESTED INTO YIELD LOSS

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Owing to the immobile nature of plants they are constantly subjected to the harmful UV-B radiation reaching the biosphere; which is increasing due to reduction of the stratospheric ozone (O_3) layer. Although, the Montreal protocol has succeeded in controlling most of the ozone depleting substances (ODS), but ODS already in atmosphere are long-lived, recovery cannot be immediate and present projections estimate a return to pre1980 levels by 2050 to 2075 (UNEP, 2008). UV-B radiation (280-320 nm) has the potential to disproportionately affect metabolic processes including suppression of photosynthesis and protein synthesis, which in turn decreases growth and productivity (Bornman and Teramura, 1993). UV-B also induces photodamage in DNA. Even worse, plants lack a reserved germ line and mutations occurring in somatic cells could be transmitted to the progeny. The major UV-B induced lesions are cyclobutane pyrimidine dimmers (CPDs) and pyrimidine-pyrimidone (6-4) photoproducts, which are formed between adjacent pyrimidines on the same strand (Britt, 1996). CPDs constitute the majority of these lesions (approximately 75%), and the (6-4) photoproducts account for remainder. Such damage can be lethal or mutagenic to organisms and can also impede replication and transcription (Sancar *et al.*, 2004). Plants possess mechanisms to cope with UV-B induced DNA damage, including photoreactivation (photorepair) and nucleotide excision repair. In plants, photorepair is mediated by photolyase, which absorbs blue/UVA light as an energy source to monomerize dimers and is the major pathway for counteracting UV-B induced DNA damage (Britt, 1999). The plants in which CPD photolyase was over expressed had higher CPD photolyase activity and showed more resistance to UV-B induced growth damage than wild-type plants. These lesions result in mutations if photoproducts are bypassed by error-prone DNA polymerases (Britt, 1996). Thus, accumulation of such lesions must be prevented to maintain genome integrity, plant growth and seed viability.

While the high UV-B dose induces damage in plants, the low dose response mediated by receptor lead to various protective responses (Fig. 1). UV-B radiation has been amply demonstrated to induce specific changes in gene expression (Favory *et al.*, 2009), increased accumulation of UV-B screening pigments (Agati and Tattini, 2010) and altered phytochemical content (Schreiner *et al.*, 2012). Many of these responses have been linked to increased UV-B tolerance, which do not cause substantial damage (Ballaré *et al.*, 2011). These responses can therefore be defined as regulatory rather than damaging. However, productivity may not be directly affected by UV-B under such conditions, but regulatory changes in photosynthate allocation and morphology (Jansen *et al.*, 2012) may affect the productivity. UV-B induced changes in the carbon partitioning from growth pools to secondary metabolic pathways (Bassman, 2004) led to changes in crop morphology, crop reproductive organ abortion and yield reduction (Mohammed and Tarpley, 2010).

Detrimental effects of UV-B radiation on photosynthesis have been characterized in detail. These effects include inactivation of photosystem II (PSII), reduced activity of Rubisco, reduced levels of chlorophylls and carotenoids, down-regulation of transcription of photosynthetic genes and decreased thylakoid integrity and altered chloroplast ultrastructure (Vass *et al.*, 1996). PSII is a protein pigment complex, the reaction centre core of which is formed by D1 and D2 proteins (Mattoo *et al.*, 1999). The D1 and D2 reaction centre proteins are extremely UV-B sensitive and degradation is driven by as low as 1 μmol m^{-2} s^{-1} UV-B fluence rate (Jansen *et al.*, 1996). The UV-B driven degradation of the D1-D2 proteins may be, but is not necessarily, accompanied by a loss of PSII functionality. The damage to photosynthesis by UV-B radiation is caused by the generation of free radicals (Hideg and Vass, 1996). These radicals accumulate in the thylakoids and are responsible for peroxidation reactions that destroy various components of the photosynthesis apparatus (Malanga *et al.*, 1997), among which are D1 and D2 proteins,

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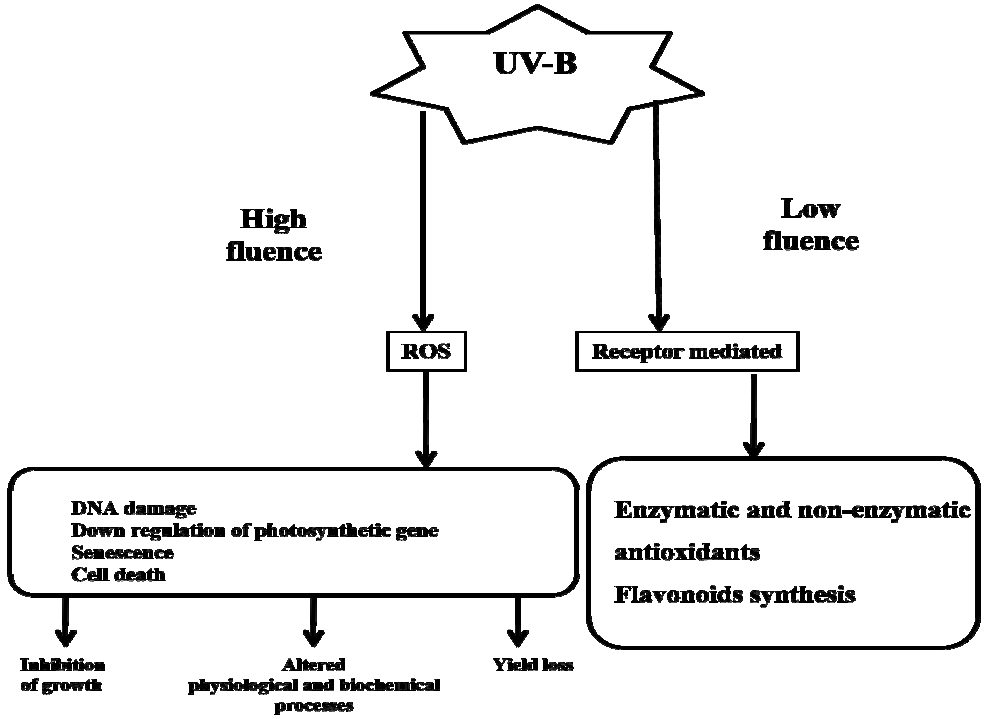

Fig. 1. Simplified model showing pathways in plant response to low and high UV-B

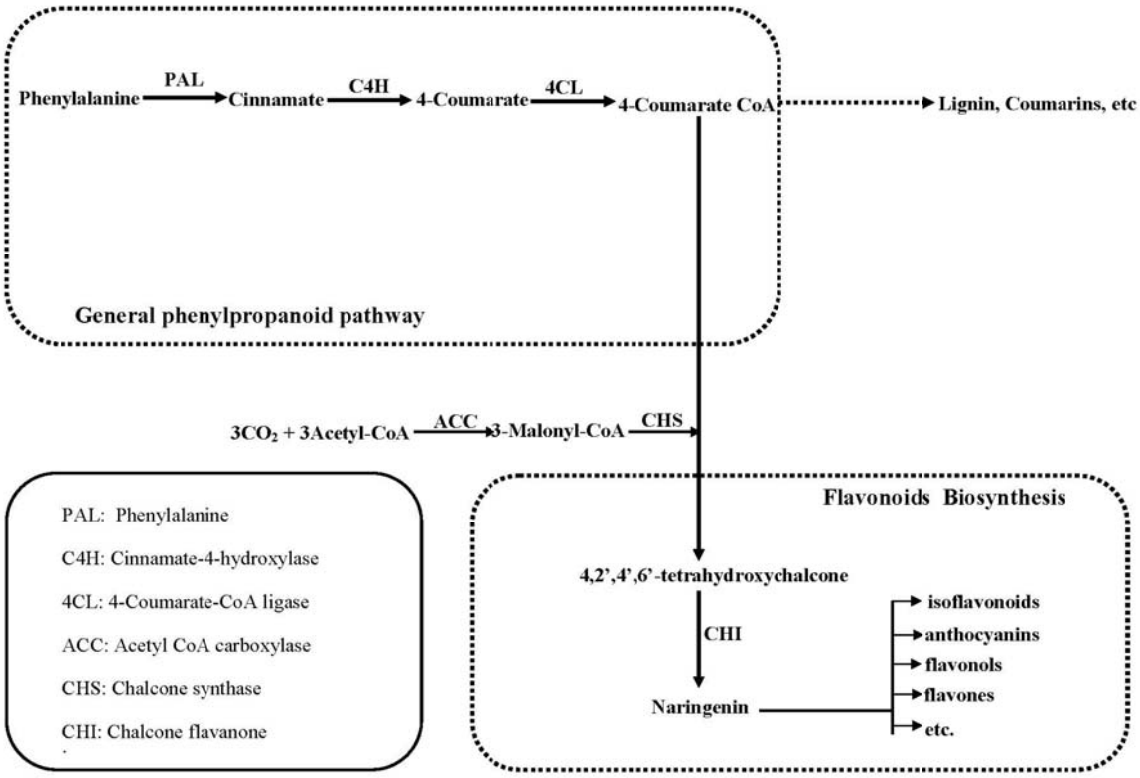

Fig. 2. Outline of general phenylpropanoid pathway and flavonoid biosynthesis. Reactants as well as products of each step with participating enzymes are indicated

Table 1. Effect of UV-B on yield of different crops.

Plant	UV-B dose	Yield loss	References
Triticum aestivum	10 kJ m^{-2} d^{-1}	'.' 74.1%	Yuan *et al.* (2000)
	11.4% above ambient	'.' 24.0%	Zheng *et al.* (2003)
	Corresponding to 15% O_3 depletion	'.' 20%	Lizana *et al.* (2009)
Oryza sativa	4.2 kJ $m^{-2}d^{-1}$	'.' 8.7%	Kumagai *et al.* (2001)
	14.7 kJ m^{-2} d^{-1}	'.' 27.8%	Hidema *et al.* (2005)
Zea mays	30% more than ambient	'.' 18.2%	Yin and Wang (2012)
Glycine max	10 kJ $m^{-2}d^{-1}$	'.' 92.8%	Yuan *et al.* (2002)

which are highly susceptible to peroxidative condition (Jansen *et al.*, 1996). Protection against UV-B can occur at different levels (Teramura and Ziska, 1996). Plants can accumulate UV-B screening compounds such as flavonoids (Middleton and Teramura, 1993), the antioxidant system can deactivate oxygen radicals, or the effective replacement of damaged constituents can resist UV-B stress. UV-B photoreceptors interact in signaling phenylpropanoid metabolism and flavonoid biosynthesis; these interaction occur at the level of gene expression and epidermal flavonoid accumulation (Wilson *et al.*, 2001) (Fig. 2). Cumulative damaging effects of UV-B lead to yield loss (Table 1).

Programmed cell death (PCD), is a genetically controlled self destruction mechanism in all eukaryotic multi-cellular organisms and can be induced either as part of normal development or in response to stress. The higher dose of UV-B can induce oligonucleosomal DNA fragmentation, as a physiological response, which shows nucleosomal fragments in multiplies of 180 bp like a typical apoptotic DNA ladder (Lytvyn *et al.*, 2010). DNA laddering is an integral part of programmed cell death (PCD) in plant systems (Houot *et al.*, 2001) confirming the role of UV-radiation in induction of PCD.

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USE AND ABUSE OF SOCIAL MEDIA IN PRESENT ERA

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Social media refers to the means of interactions among people in which they create, share and exchange information and ideas in virtual communities and networks. Andreas Kaplan and Michael Haenlein define social media, "as a group of internet based applications build on the ideological and technological foundations of Web 2.0 and that allow the creation and exchange of user generated content." Social media introduces substantial and persuasive changes to communication between organizations, communities and individuals.

Based on individual companies' statistics in July 2011, Face book passed 750 million users (2011); LinkedIn had over 100 million members (2011); Twitter hits over 177 million tweets per day (2011); YouTube reached three billion views every day (2011). Social media are technologies that facilitate social interactions, make possible collaboration and enable deliberation across stakeholders. These technologies include blogs, wikis, media (audio, photo, video, text) sharing tools, networking platforms (including Face book) and virtual words. Social media differentiates from traditional/ industrial media in many aspects such as quality, reach, frequency, usability, immediacy and permanence. According to Nielsen, internet users continue to spend more time with social media than other sites.

Social Networking sites have a significant regional influence. "Face book"(www.facebook.com) is popular in USA, while "Sina Weibo" (www.weibo.com) and "Ren Ren" (www.renren. com) are the dragon kings of China. "Orkut" (www.orkut.com) is the favourite of Brazilians while the Japanese are happy with "Mixi" (www.mixi.com). Indians too prefer "face book" and "Orkut" while Europeans cling to "Badoo" (www.badoo.com). Video sharing site "You tube" (www.youtube.com) and photo sharing site "Picasa" (picasaweb.com) offer a content sharing functionality to social media.

Much of the criticism of social media are about its exclusiveness as many sites do not allow the transfer of information from one site to another, disparity of information available with, issues with trustworthiness and reliability of information presented, concentration, ownership of media content and the meaning of interactions created by social media. Due to increase in social media websites, there seems to be a correlation between the usage of such media with cyber bullying, online sexual predators and decrease in face to face interactions. Likewise media seems to be influencing kids lives in terms of exposing them to alcohol, tobacco and inappropriate sexual behaviour. This issue is becoming even more prominent as kids are starting to engage with such media sites at a younger age. Instead of giving a kid toy at the dinner table to keep him quiet, parents are now resorting to I pads and other technological devices that are more advanced.

It is argued that social media has positive effects also. In the book, "Networked- the new social operating system" by Lee Rainie and Barry Wellman, the two authors reflect on mainly positive effects of social media and other internet based social networks. According to the others, social media is used to document memories, learn about and explore things, advertise oneself and form friendship. For instance, they claim that the communication through internet based services can be done privately than in real life.

Today, in the 21st century, we do not need a pen, paper and a grand old postman to convey our thoughts to a distant someone. With the speeds of Mbps blazing the social networking sites, we are on the screen of any computer worldwide.

It was Professor J.A. Barnes of Churchill College, Cambridge who first coined the term "Social Networking" in the 1950s. He defined it as "an association of people drawn together by family, work or hobby." This term now largely refers to the internet based networking websites that enable its users to share their thoughts,

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videos, etc. This fast evolving culture of Social Networking has permanently altered the progression of the internet in particular and society at large.

A report by Forbes magazine (http://www.forbes.com/sites/ilyapozin/2012/06/26/the-rise-of-social-enterprise/) claims that newer social networking are posing serious challenges to the older ones. It has ranked content sharing internet-based sites "Pinterest" above "Face book" and "Google+". While Face book happens to be nine years old, Google+ just celebrated its first birth anniversary and its parent site "Orkut" is into its eighth year.

The dynamism of social networking sites is being fuelled mainly by rapid growth in three sectors-

- First, software programming especially "user interface/ experience",
- Second, communication networks,
- Third, advanced microprocessors.

In 2002, a simple text based webpage would take almost 1-2 seconds to appear on the user's screen, while today a webpage loaded with tons of graphics would take a few milliseconds to mark its presence.

Social networking has opened doors to new forms of businesses and marketing companies. Social Media Optimization (SMO) is the new buzzword. It refers to the use of Social networks to create awareness about a product. According to Wikipedia, "Social Media Optimization is becoming increasingly important for search engine optimization, as search engines are increasingly utilizing the recommendations of users of social networks such as Face book, Twitter and Google+ to rank pages in the search result pages. The implication is that when a webpage is liked by a user on a social network, it counts as a vote for that webpage's quality. Thus search engines can use such votes accordingly to properly rank websites in search engine result pages.

Celebrities especially from film business, routinely employ Search Engine Optimization companies to increase their search ranking. These companies popularize events associated with the celebrities. Many consumer goods companies also sponsor online campaigns marketed through SEO engines on these sites. It has also led to the growth of a newer breed of customer relationship management (CRM) companies such as Lithium (www.lithium.com), Yammer (www. yammer.com) and Salesforce.com that work with corporate organizations to form a social bridge with employees using social networking.

In recent times we find human kind pioneering social networking sites that have made their presence felt like never before. Social networking sites are increasingly being used for political campaigns. These websites have become gateways for politicians to reach out to the youths. The sites are also being used by the activist groups. In many countries it has given voice to the unheard, constant political campaigns through sites such as Twitter and Face book has led to mass movements for instance the "Jasmine Revolution" in Tunisia. They have brought about revolutions, overthrowing governments. They have spawned spontaneous protests against corruption and crime and other issues that exercise the minds of common citizen. In India too, the government is slowly realizing the potential of this tool and waking up to use it for the benefit of citizens. The Delhi and Mumbai Traffic police have set up Face book pages where one can report traffic offenders, upload images and videos of violators. District administrations of many cities have their own FB page through which they connect with people, especially the youth. These websites are also assisting security agencies in extracting information on absconding criminals.

At a personal level, they have brought long last friends in touch, allowed close interactions with distant relatives, spawned professional networks and given a new dimension to marketing and business. Social networking sites have today ushered in a totally unique kind of social interaction.

Social networking media is also being used for maintaining professional connections. LinkedIn (www.linkedin.com) is a good example of a professional networking website. The site acts as a bridge between various professionals and is routinely used by recruiters for short listing candidates for a job profile. It also helps professionals to get recommendations and references.

Another form of social networking that is growing at a very fast rate concerns the dating and matrimonial websites; Jeevansathi (www.jeevansathi.com) and Bharat Matrimony (www.bharatmatrimony.com) are good examples of such sites. Here users create individual profiles that can be seen by other users and also shortlist prospective bride/ grooms for marriage.

One other use that is being discussed is the use of social networks in the science communities.

Julia Porter Liebeskind et al. have published a study on how new biotechnology firms are using social networking sites to share exchanges in scientific knowledge. It is stated in the study that by sharing information and knowledge with one another, they are able to "increase both their learning and their flexibility in ways that would not be possible within a self contained hierarchical organization."

Social networking is allowing scientific groups to expand their knowledge base and share ideas and without these new means of communicating their theories might become 'isolated and irrelevant'.

In fact, researchers use social networks frequently to maintain and develop professional relationships. They are in consolidating social ties and professional contact, keeping in touch with friends and colleagues and seeing what their own contacts are doing. This can be related to their need to keep updated on the activities and events of their friends and colleagues in order to establish collaborations on common fields of interests and knowledge sharing. Social networks are used also to communicate scientists research results and as a public communication tool and to connect people who share the same professional interests, their benefits can vary according to the discipline. The most interesting aspects of social networks for professional purposes are their potentialities in terms of dissemination of information and the ability to reach and multiply professional contacts exponentially.

Social networks like LinkedIn, Face Book, Researcher Gate give the possibility to join professional groups and pages, to share papers and results, publicise events, to discuss issues and create debates.

The use of online social networks by school libraries is also increasingly prevalent and they are being used to communicate with potential library users, as well as extending the services provided by individual school libraries.

But in doing so, these platforms have also bared their sinister side spreading unfounded rumours, helping criminals share innocent users and trap gullible users (youngsters). There have also been instances concerning wrongful penal censure of users as happened recently in the case of a Mumbai girl.

Hopefully, as the technology evolves we will find a more mature audience in the internet based social arena.

The Dark Side

In contrast to the ways and means by which social networking media is phenomenally expanding, there are some areas of concerns that have not been addressed adequately by companies and Governments.

Apart from the privacy concerns, social networking sites are also being held responsible for many crimes like cyber bullying and abuse, posting and distribution of offensive content, identify theft, cyber stalking, spreading rumours, internet scams and unfriendly murders.

Social networking sites have become a safe heaven for gender related offenders and pedophiles. Children are the most vulnerable to the dangers of social media considering their tender age. Social networking is also being held responsible for rise in relationship wreckage, many cases of breakups, divorces and suicides have been reported due to the depression and agony caused by unfaithfulness online.

Privacy concerns with social networking services have been raised growing concerns amongst users on the dangers of giving out too much personal information and the threat of sexual predators. Users of their services also need to be aware of data theft or viruses. However, large services such as MySpace often work with law enforcement to prevent such incidents.

In addition, their is a perceived privacy threat in relation to placing too much personal information in the hands of large corporations or governmental bodies, allowing a profile to be produced on an individual's behaviour on which decisions detrimental to an individual may be taken.

Furthermore, there is an issue over the control of data-information that was altered or removed by the user may in fact be retained and passed to third parties.

As social networking sites have risen in popularity over the past years, people have been spending an excessive amount of time on the internet in general and social networking sites in specific. This has led researchers to debate the establishment of internet addiction as an actual clinical disorder. Social networking can also affect the extent to which a person feels lonely. Social networking sites like Face book and MySpace may provide people with a false sense of connection that ultimately increases

loneliness in people who feel alone.

Ambiguity of internet related laws around the World is considered to be a major reason for the stealth of the cyber crimes. The IACP centre for social media (www.iacpsocialmedia.org) is a partnership program assisting law enforcement agencies, have dedicated sections to deal with cyber crimes; for instance the Mumbai police cyber cell (http://cybercellmumbai.gov.in/). Another website, (www.indiacyberlab.in) is very useful to learn about the cyber laws and cyber crimes.

The Bright Side

Nevertheless, social networking is expanding its horizon to engulf larger positions of online business. It is bringing people of varied nationalities together and creating innumerable opportunities with a level playing field in the globalized economy. The graph of social interaction on web is now tilting towards reputational interactions.

At the same time, it is rightfully compelling youths to adopt technology in internet deficient rural India, which in turn, is propelling the nation towards a faster path of industrial growth by induction of newer insights and fresh methodologies.

Social networking is also enabling the masses to raise issues that earlier used to be buried due to fear of administrative backlash. The world has now become a global society with social media acting as a bridge for sharing sentiments. Although issues such as privacy and cyber stalking seem to affect the largely positive reputation, the usefulness of social networking easily dwarfs the fears surrounding its worthiness.

As Mark Zuckerberg, CEO and founder of Face book says, "when you give everyone a voice and give people power, the system usually ends up in a really good place.

Few recommendations and suggestions could be used to inform people about how to use social media and what they get out of it. People must be aware about the use and abuse of social media.

- Awareness programs about social networking sites for example cases of offence.
- Programs for children such as (Content Safety Management) for example unauthorised websites, pornography, etc.
- Awareness about dangers of social media for example hacking.
- Information about laws related to IT (to decrease offences related to social networking sites.

Traditional media as well as new media could be used to educate people about the use and abuse of social media. It involves reasoning clearly about controversies that may involve the websites student's use, the mobile devices they carry, the TV shows they watch, the music they hear, the magazines they read and much more. The aim of traditional media should be to help students become critical consumers who seriously examine the social media's role in their lives and in the greater culture, without making them totally cynical and distrustful of all social media. The traditional media could help people to think in an educated manner about the forces that shape the media and their relationships with them so that they will become media literate citizens who are:

- Knowledgeable about the influences that guide media organizations.
- Up-to-date on political issues relating to the social media.
- Sensitive to the ethical dimensions of social media activities.
- Knowledgeable about social media effects.

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A SHORT GLIMPSE OVER THE SCIENTIFIC AND TECHNOLOGICAL EXCHANGE BETWEEN INDIA AND IRAN

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India is one of the most ancient countries of the world that is still having the oldest continuous culture and civilization. This country is having the great diversity in itself. The Indian Subcontinent including present day India and Pakistan with special geographical conditions has a deep root in producing the civilization which is settled in Deccan plateau, Punjab, Sind and Bengal. Everyone can see the traces of this civilization in the richness of the museums of Calcutta, Lahore, Peshawar, Mumbai Hyderabad and other cities of the world. It is said that the Dravidians created the Sind or Indus civilization that in the following period with the combination of the ancient civilization and cultural elements of the Aryan invaders from the North West, and cultural exchange with the neighboring civilizations like Iran, the cultural identity of India has been formed and evaluated. Despite the diversity of elements, it has tried to protect the unity and identity of Indian culture and civilization.[1]

Iran and Al-Hind wal Sindh (name given by muslim scholars to India) had adjoining boarders. More than any other factor geographical proximity brought them together. In the 8th and 9th centuries India contributed to the highly advanced civilization of Iran and in the following centuries, Iran gave to India elements that made this subcontinent the most desired piece of land in the world.

The presented article is an endeavour to highlight the transmission of science and technology from Iran to India, following the establishment of the Delhi Sultanate till the foundation of the Mughal Empire.

The transmission of Indian works on science found their way to Baghdad long before the foundation of the Delhi Sultanate. Indian numerals, mathematics, arithmetic, medicine, pharmacology, philosophy, toxicology, astronomy and veterinary science and many other disciplines were transmitted to the caliphate. The 9th century scholar Jahiz wrote, "we have found the Indians most advanced in astrology and mathematics. They have their own script. They are also far ahead in medicine. They have special secrets (asrar) in medicine. They have drugs for all the deadly diseases. Sculpture and painting are their special arts. Chess which is a game of great skill and intelligence is their invention. India is the fountainhead of thought and wisdom."[2]

With the establishment of the Delhi Sultanate the floodgates of information and technology were opened and transformed the Indian Society in several fields like textile production and use of items like paper, irrigation devices, horseshoe, gunpowder and stirrups etc. The spinning wheel known as Charkha came to India in the early period of the Delhi Sultanate from Iran. This Iranian gift is being used by the Indian weavers even now. Likewise, the wooden cotton gin, known in India as Charkhi, Belna or Resta used for the purpose of separating seeds from cotton, and to loosen and separate the cotton fibres is also an Iranian gift to India. The use of Charkha and Charkhi brought about massive increase in the quantity and quality of textile products.

In the field of agriculture the introduction of the Persian wheel which had an oval chain of buckets to pull water from deep well increased the production of food crops and other agricultural commodities. The Persian wheel with a gearing device came into general operation in the Arab world and was passed on to Europe through Spain and to India through Iran.[3] As a result of the application of this irrigational device we can witness a remarkable agricultural expansion in early Medieval India.

Paper which is considered to be one of the important milestones of human civilization was manufactured in China for the first time in the first century A.D. It reached Baghdad in the 8th century. But in India it came into regular use only in the 13th century. We can see the earliest surviving paper manuscript in Persia are dated 718 A.D., while in India it is dated only 1223-24 A.D. With the establishment of the Delhi Sultanate, Delhi became another Baghdad a seat of learning, and this finally resulted in the large, scale manufacturer of paper.[4] The Turks wrested victory due to their political tactics. The Turks defeated the Rajputs, protected their Indian territories from the invading Mongols, since they could meet the enemy on an equal footing, equal military technology, the use of the iron stirrup and iron horseshoe, technological innovations which came to India from Iran.

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The iron stirrup reached Iran from china towards the end of the 7th century. It came to India through the Turks. Because of the iron stirrup the Turks used the bow from the saddle while moving on a speeding horse. They could also use two weapons while holding the reins in the mouth and throw the lance in a reverse direction. Another technique of increasing the striking power as well as the stamina of the horses was the iron horse shoe, which though reached Iran later was in full use when the Turks established their empire in India. After some years the Rajputs also began the use of the above two devices.

Another important element of war technology was the use of gunpowder, which also came to India during the Sultanate period from western neighbours. Guns were fired on the western coast of India much before Babur's guns thundered at Panipat in 1526A.D. The implications of the use of gunpowder are obvious.[6]

In the field of physical sciences also there was a cross transmission between India and Iran. In the growth of science and learning, India and Greece contributed equally during the period of the Abbasids. Sanskrit and Greek traditions thus absorbed at Baghdad came back to India and Europe as a finished product.[7]

'Arrisalah fil Kimia' (1020A.D) was a short treatise alchemy by Bu Ali Sina famous as Avicenna in west. The manuscript is available in the Khuda Bakhsh Library, Patna. The book on chemistry was brought to India from Iran and helped in dyeing and bleaching in textiles, cutting and polishing of stones and manufacture of metallic stones.

In the field of physics and metaphysics seventeen of works of Avicenna are available in India. His treatise namely "Arrisalah Fil Bayan-e-Asbabur Ra'd wa'l - Barq" (on the causes of thunder and lightning) and "Ashshifa'ul - IIahiyat" (on motion contact force vacuum, infinity, light heat and specific gravity) are remarkable gift to Indian science.

In the field of mathematics also the works of Avicenna and other Arabic and Persian writers found their way to India. The work of Avicenna namely "Danesh Nameh Ala'I (on geometry) was well accessed in India. The book namely "Al-Fawaidul – Baha' iyyah" is a very useful work on arithmetic, geometry, determination of areas, volumes and inheritance, authored by the famous scholar ' Abdullah Al- Bag hadi Al- Khadami is also an Iranian contribution to India.

Although there existed intellectual communications existed between India and Iran, but it is a matter of surprise that works on agriculture, horticulture and botany did not find their way to India from Iran. The famous "Kitabush Shifa" dealing with logic, physics, mathematics, astronomy, plants, metaphysics and animals, authored by Ibn Sina is again a remarkable Iranian contribution to India.

The encyclopedic work namely "Danish Namhai Jahan" dealing with natural philosophy, mineralogy, botany, psychology, anatomy, vapours, rain, wind, thunder and meteors etc. written by Ghayasuddin Isfahani was made available to the Indians during the Sultanate period, accelerated the Indian minds in these fields.

In the field of medicine also number of Persian and Arabic works paved their way to India and they were used by Indian physicians or teachers and are still recommended books for the students of Tibbiya or Unani institutions in Indian subcontinent including today's India, Pakistan & Bangladesh. Among them the book of Abu Bakr Muhammad Bin Zakaria Razi named "Kitab Burus Sa'at" in Arabic, the Risalah Fi'l Tahaffuz Mina'n – Nazalah, a book on the treatment of colds, in Arabic, the Risalah Dar Khawas-i-Haywanan" in Persian on the curative properties of the flesh of different animals, the "Hadayatul Muta" in Arabic meant for initiating students in the study of medicine, the Risalah Fi't Tibb a treatise on medicine written in Arabic, the Al- Adwiyatu –Qalbiyah by lbn Sina on cardiology etc. are remarkable.

There is hardly any doubt in the fact that Iranian influence on Indian works especially on Unani medicine becomes very obvious during the Sultanate period. Besides, there were also a fairly large number of physicians who migrated to India where they had established themselves in the field of medicine.

From the above discussion it is evident that there exists deep and profound influence of Iran on India in the esoteric and allied fields of science and medicine. It can be concluded that the deep affinity between these two countries sharing the same social root upgraded enormously in the field of science & technology during the Sultanate period.

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INNOVATIVE TECHNOLOGIES TO BOOST UP PRODUCTIVITY IN AGRICULTURE

DR. RAM NARAYAN MEENA*

Agriculture is the mainstay of India which provides employment to nearly 52 per cent of the population. However, Agriculture contributes only 16 per cent to India's Gross Domestic Product. Increasing agricultural growth is the top priority of our government and will continue to remain, as around 70 per cent of the population lives in rural India.

Agriculture plays an important role in economic development, such as provision of food to the nation, enlarging exports, transfer of manpower to non-agricultural sectors, contribution to capital formation, and securing markets for industrialization,

India is the world's largest producer of milk, pulses and spices and has the largest area under wheat, rice and cotton. The effectiveness of Indian agriculture is the effectiveness of the Indian economy. In the geographical aspect India has the highest advantage of farm area under cultivation, but the yield is neither encouraging nor remunerative to the cultivators. In China net cropped area is only ten per cent while the world average is 10.7 per cent.

There is a limit to cultivable land, which is currently 11 per cent of the 13.2 billion ha of the total land area of the planet, the rest being taken up by forests, settlements and grass lands etc. So the solution lies in increasing productivity of agriculture.

In spite of the Green Revolution, our agricultural productivity continues to be low at 1.7 tonnes/ha as against the world's average of 2.6 tonnes/ha.

In India, Green Revolution in agriculture has made significant contribution on aggregate supply of food grains, ensuring food security to the growing population. However, the momentum gained during the period of Green Revolution has slowly declined. Now, the agricultural growth faces a serious challenge in terms of sustainability. Today, the main problem in agriculture pertains to sustainability of resources, use and indiscriminate use of chemical fertilizers and pesticides. These problems have led to increasing awareness and a felt need for moving away from the input intensive agriculture perused during the Green revolution phase, to sustainable farming in different parts of the world. Better agriculture practices are needed to bring sustainability in Indian Agriculture.

Agriculture has to match the pace of the population growth to counter hunger and poverty in the world particularly in the developing countries. Cereals are the dominant part of our food security and world cereal output in 2012 was 2.309 billion tonnes. It is estimated that the world population will be 9.1 billion persons by 2050, up from the current population of 7 billion. More importantly, income growth will increase the quantity and change the composition of agricultural commodity demand. Demand for energy will also compete with the food security as parts of our agricultural commodities are going for the production of bio-fuels which will also continue to grow. Thus, significant increases in production of all major crops, livestock and fisheries will be required. According to the estimates of the Food and Agricultural Organization (FAO), agricultural production would need to grow globally by 70 per cent by 2050 and more specifically by almost 100 per cent in developing countries, to feed the growing population alone. This excludes additional demand for crops as feedstock and the demand for bio-fuel sector.

Today, agriculture is in serious constraint due to the challenge of hunger, malnutrition, poverty and climate change. Some recent estimates suggest that total factor productivity (TFP), the most comprehensive measure of productivity reflecting the efficiency to turn all inputs into outputs, grew at an average rate of around 2 per cent per year since 2000 across major world regions. The most popular indicator of land productivity is crop yield. This is a worrying factor as the average global rates declining. Since the 1980s, growth in wheat and rice yields fell from 2.5-3 to around 1 per cent. Maize yields showed growth of slightly less than 2 per cent over the last decade. This is the major concern due to the lack of technology transfer. The gap between farmers' yields and technical potential yields reflects the largely suboptimal use of inputs and insufficient adoption of most productive technology. According to FAD, this

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yield gap was approximately 11 per cent in East Asia and with unequal access to resources and inputs could raise total agricultural output in developing countries by 2.5-4 per cent which can lead to a reduction of 12-17 per cent in the number of undernourished globally.

Indian Scenario

Sustainable agricultural growth is important to check the hunger and poverty in the vulnerable population of the country as for 1 per cent growth in agriculture sector there would be a 2-3 per cent reduction in poverty. India's population is expected to reach 1.5 billion by 2025, making food security most important social issue and food production will have to be increased considerably, to meet needs of growing population. The farm sector achieved 3.6 per cent growth during the 11th Five Year Plan (2007-12) which was much higher than growth of 2.5 and 2.4 per cent during 9th and 10th plans. Food grains production in India has shown remarkable improvement in recent years. The production of food grains in 2011-12 was at a record high of 259.32 million tonnes.

While focusing on increasing productivity in agriculture, innovative technologies should be infused to lower production costs, conserve biodiversity, more efficient use of external inputs for more sustainable agriculture and environment increase stability of production to lessen suffering during droughts due to abiotic and biotic stresses. Indian agriculture has all capabilities in the form of technology and management to accelerate the growth.

The Planning Commission has targeted an annual growth rate of 4 per cent for the agriculture sector in the Twelfth Five-year Plan. This is evident from the statistics as the production of food grains has increased by 4 times, horticultural crops by 6 times, fish by 9 times (marine 5 times and inland 17 times), milk 6 times and eggs 27 times since 1950-51. Green Revolution is our biggest success which resulted in an increase in food production from 800 million tonnes to more than 2.2 billion tonnes between 1961 and 2000. Indian Council of Agricultural Research (ICAR) with 99 Institutes, 78 AICRPs/AINPs, 08 Zonal Project Directorate, 68 Agricultural Universities and 637 *Krishi Vigyan Kendras* (KVKs) spread across the country constitutes one of the largest national agricultural research systems in the world. But now, there is need for another green revolution by tapping the unexplored potential of vast tract of the country with the augmentation of irrigation and technology.

Our agriculture is still technology less as far as world agriculture is concerned. Yields per hectare of foodgrains, fruits and vegetables in our country are far below global averages. Our rice yields are one-third of China and about half of Vietnam's and Indonesia's. Even India's most productive states lag global averages. For example, Punjab's yield of rice in 2010 was 3.8 tonnes per hectare against the global average of 4.3 tonnes. The average yield for apples in India (J&K) is about 11 tonnes per acre compared to the US, New Zealand, Israel or China, where yields range 30-70 tonnes per acre. The available data show that the productivity of *kharif* sorghum can be increased 3 to 4 times, *rabi* sorghum 1.4 to 2.3 times and bajra 1.8 to 2.3 times from their current level of productivity. Similarly, the productivity of pulses and oilseeds can be increased 2.3 to 2.5 times, through attention to seeds, soil health, pest management, crop life saving irrigation and post-harvest technology. Supplemental irrigation based on rain water harvesting will help to increase yields further. A second area needing immediate attention and action relates to improving the productivity of wheat, rice, pulses and oilseeds in the Indo-Gangetic plains and eastern India, particularly in Bihar, Jharkhand, Chhattisgarh, Odisha, eastern Uttar Pradesh, West Bengal and Assam. According to a report of Chambers of Indian Industries (CII) and Mc Kinsey, the country's agricultural output by 2030 could reach Rs 29.28 lakh crore level and food exports could jump to over Rs 7 lakh crore. Consequently, processing could grow from Rs. 1.1 lakh crore to Rs 5.65 lakh crore by 2030 while India's food exports could grow from Rs 1.4 lakh crore to Rs. 7.72 lakh crore by 2030. The new Food and Agriculture Integrated Development Action (FAIDA) report focuses on mango, banana, potato, soybean and poultry which represent categories that are likely to drive the next wave of growth.

Need for Climate Change Resilient Technology

Climate change is the biggest threat to sustainable agriculture in the world. Global agriculture will need to adapt to climate change. The number of people on Earth is expected to increase from the current 6.7 billion to 9 billion by 2050. To accommodate the increased demand for food, world agricultural production needs to rise by 50% by 2030[3]. Compounding the challenges facing agricultural production are the predicted effects of climate change[2]. There is growing evidence that climate change has had negative effects on agriculture and particularly in

developing countries. Agriculture (including deforestation) accounts for about one- third of greenhouse gas emissions; for this reason, it contributes significantly to climate change mitigation. Agriculture is the largest water user worldwide, representing about 70 per cent of total withdrawal. Agriculture is also a major source of water pollution from nutrients, pesticides, soils and other contaminants, leading to significant social, economic and environmental costs. It also damages the wider environment through the emission of greenhouse gasses. In some intensive farming systems, up to 50 per cent of available inorganic and organic nutrient inputs are not always utilized by crops or pastures, leading to significant pollution from nutrient run-off. The scenario is just opposite in the case of large parts of the developing world, where crop farming leads to a net extraction of nutrients from the soil.

While crops can be adapted to changing environments, the need to reduce emissions will increasingly challenge conventional, resource-intensive agricultural systems. Productivity growth needs to increase to keep up with demand growth, but also to supply shocks, whether due to climate change or due to resource limits more generally. Agriculture planning in future has to take into consideration the total scenarios of land, water and energy keeping in view the demand of food and other agricultural commodities. Indian Council of Agricultural Research has taken various initiatives to mitigate the impact of climate change such as National Initiative on Climate Resilient Agriculture (NICRA) and development of abiotic stress tolerant crops. During 2011-12, more than 15000 germplasm of wheat and 2000 germplasm lines of other crops like rice, maize, pulses were screened for drought, heat and submergence tolerance which are the major climatic stresses and more than 50 promising lines were identified in different crops which will be used for breeding purposes during next year. Drought and flood coping technologies were demonstrated on farmers' fields for adoption in large number of villages for up-scaling. For agriculture to respond to future challenges, innovation will not only need to improve the efficiency with which inputs are turned into outputs, but also conserve scarce natural resources and reduce waste.

Better Management of Water Resources

Availability of water is most critical for increasing the productivity in agriculture. In India, around 78 per cent water goes to the agriculture sector, while the remaining part shared out between drinking, industry and other usage. Therefore, it is required that water storage facilities to be increased in the country to 450 million cubic meter by 2050. Dry land agriculture should be the main focus area as more than 60 per cent of the cultivated area in the country is without irrigation. The Centre had earmarked 60 per cent of allocation to agriculture in dryland farming in the 12th Five Year Plan to provide major thrust to enhance agriculture production.

Fig.1: Resource Management Technology

Need to Infuse Innovative Technologies

Technology transfer in agriculture should focus on key interventions at different stages of the crop from sowing of the seed, crop protection, harvesting, post-harvest management and marketing. There is need to infuse innovation systems in agriculture that allow more sustainable use of resources, such as no-till farming, insect - resistant crops, more efficient irrigation,

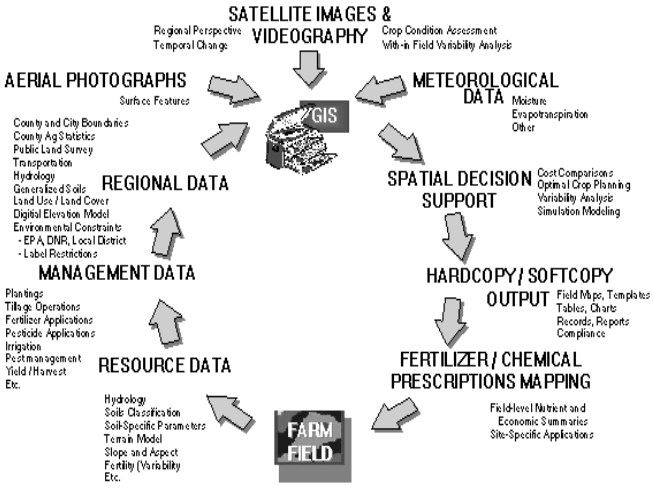

Fig. 2: GIS Networking

water management systems, sensors for nutrient status

in crops, remote sensing, Global Positioning Systems (GPS) and Geographic Information Systems (GIS) to improve and monitor land use and SMS messaging for enhancing advisory services to farmers.[1] ICAR has taken number of steps for technology dissemination and human resource up gradation. Presently, more than 300 KVKs are providing Kisan Mobile Advisories to farmers on their registered mobile phones. In the year 2011-12, about 1.10 lakh short text messages (SMSs) were delivered to 13.40 lakh farmers for timely actions. Student ready scheme is one such thrust area for 12th Five Year Plan. Village Knowledge Centres, and online databases in local language should be established. Fast technology dissemination will certainly reduce the knowledge deficit with the farmers and will help in accelerating the stagnant growth of agriculture, realizing higher potential of our land and hard work of our farmers. Under this, students of around 11 branches of agriculture will be given training in skills, knowledge, attitude, innovation and confidence. The thrust of

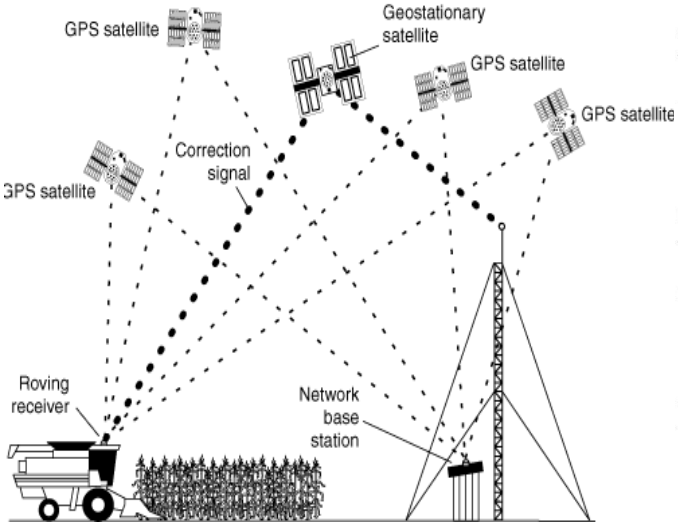

Fig. 3: GPS-Networking

this scheme is to give hands on experience on working in rural areas and ICAR has come up with more than 300 experiential learning models for agri-graduates. Our traditional knowledge is also one of our important time tested technologic asset. Agricultural universities across India will now be able to take on board progressive farmers as teaching faculty in their respective institutions. It is known that a traditional Indian farmer has nearly 40-50 skill sets with him and that is why they can be equally good teachers on par with teaching faculty in agricultural varsities.

Potential of Plant Biotechnology

Biotechnology is one of the important area which with the help of various technologies like Genetically Modified crops can lead our agriculture to a higher trajectory of growth. GM food crops along with other GM non-food crops were grown by farmers in 160

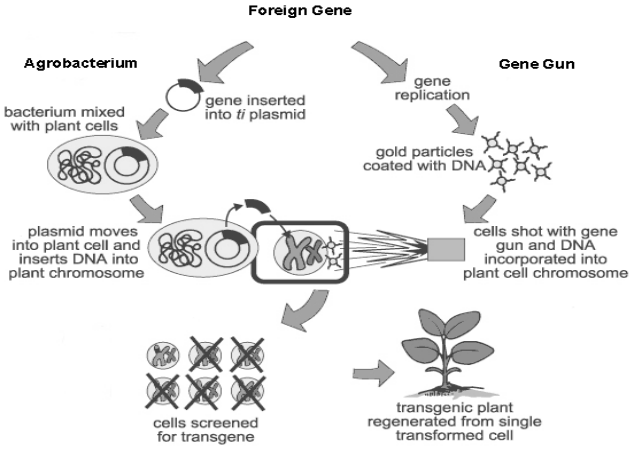

Fig. 4: Development of Bt. Cotton

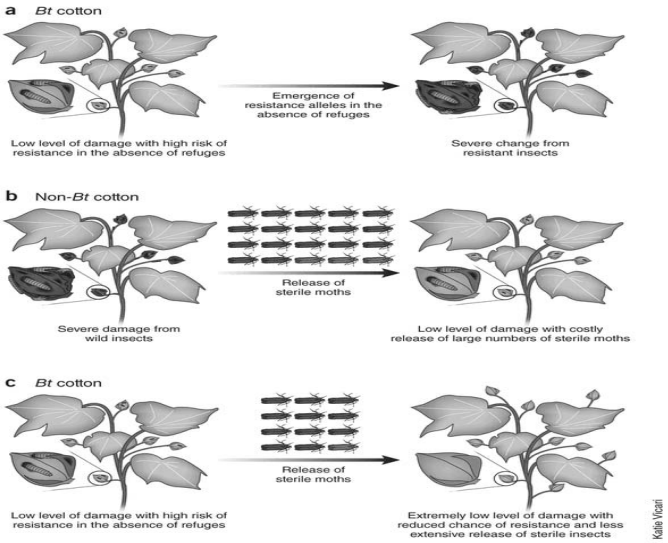

Fig. 5: Bt. Cotton and Non-Bt. Cotton

million hectares, in 2011 in more than 25 countries wherein the share of the developing countries is 46 per cent. India grows transgenic Bt. Cotton in 8.4 million hectares.

The government has approved 17 GM crops of 8 traits which are of virus- and bacteria-resistant as in 2012. The country has also developed golden rice which is rich in β-carotene. This is a great solution for India as nearly 5,000 children go blind every year because of β-carotene deficiency. According to the information from the National Research Centre on Plant Biotechnology,

two golden rice varieties with vitamin-A - Swarna and Jaya would be tested in open fields in 2013 and the Bt pigeonpea and chickpea would be released for field trials in 3-4 years.

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EXTENDED SURFACES (FINS)

PROF. K.N. RAI* AND SURJAN SINGH**

The word extended surface means surface is increased or area of the surface is increased by adding fins. Suppose we want to release the heat in environment from the hot body, which have small area or surface now we add a plate or rod with this small area so that area is increased, this plate or rod is called fin or extended surfaces or heat exchanger. In nature ears of rabbit act as fins to release heat from the blood. There are many type geometry of fins, the common profiles of fins are shown in Fig 1.

Fig. 1. Typical fin profiles (i) longitudinal fin of rectangular profile (ii) triangular profile (iii) concave parabolic profile; (iv) annular fin of rectangular profile; (v) redial fin with rectangular profile (vi) cylindrical spine;(vii) conical spine; (viii) Spine with convex parabolic profile.

Historical back ground of Fin

First time Harper and Brown studied extended surface in 1922. This is a report No 158 and title is "MATHEMATICAL EQUATIONS FOR HEAT CONDUCTION IN THE FINS OF AIR-COOLED ENGINES". They established mathematical Equation and obtained solution for extended surface, this is known as cooling fin and this name is given by Harper and Brown; later it becomes known as fin. These fins are used in air cooled aircraft engines. After this some fins came in existence longitudinal fins of rectangular profile and trapezoidal profile (Harper and Brown called wedge-shaped fins) and radial fins of rectangular profile (Harper and Brown called circumferential fins). Concept of fin efficiency was introduced by Harper and Brown, latter it was called fin effectiveness. Harper and Brown provided analytical solutions for the two dimensional model for both rectangular and wedge-longitudinal fins and the circumferential fin of uniform thickness. Schmidt (1926) studied three profiles, and concluded that the least material is required if the fin temperature gradient from base to tip is linear and fin thickness vary to produce this result. The pin fins of different profiles were considered by Bueche and Schau (1936). They studied conical fins and considered dissipation was a function of the Biot modulus. Murray (1938) studied the problem of the radial fin of uniform thickness (rectangular profile) presenting equations for the temperature gradient and effectiveness under conditions of a symmetrical temperature distribution around the base of the fin. A step by step procedure for calculating the efficiency and temperature gradient of fin whose thickness varies in any manner first was studied by Hausen (1940). Focke (1942) studied temperature gradient in conical and cylindrical spines and obtained optimum cylindrical and conical spine. i.e. minimum material required to a fin. In 1942 Avrami and Little derived equations for the temperature gradient in thick bar fins and studied that under what conditions fins act as insulators on the

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base. In 1944 Carrier and Anderson studied fins with constant thickness, radial fins with constant thickness and constant cross section area. They also determined efficiency of fin and presented in the form of an infinite series.

Extended Surface

In many engineering processes heat is generated in the machine, how to control this heat, is a big problem. Extended surface is required to release the heat in environment. Extended surface is high performance heat transfer component which have small weight, volume, cost and required shapes. Shape of these components are cylindrical, bars and plates, used to flow the heat between source and sink. Surface is extended by adding some metal plat, spines or tubes, this additional surface is called extended surface. The elements used to extend the prime surfaces are known as fins. Applications of these components are in air-land-space vehicles, chemical, cryogenic processes, refrigeration, in electrical and electronic equipments, refinery, turbine, furnace, gas turbines, boilers, nuclear-fuel system etc. Figure of fin is presented in Fig. 2. Flow of heat is presented in figure 3.

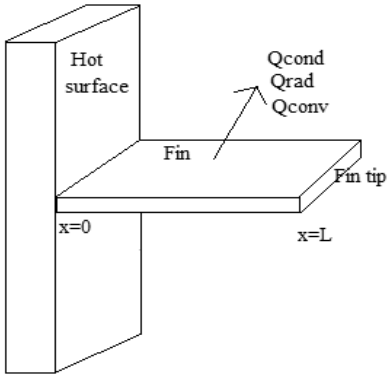

Fig.2. Fin attached with surface

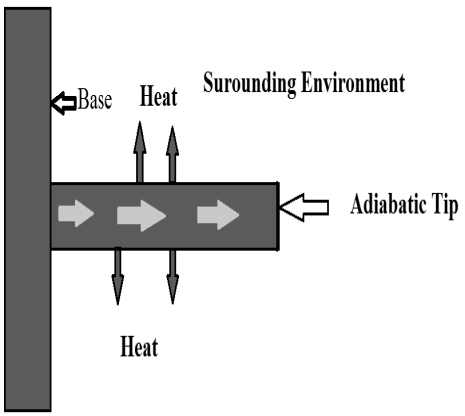

Fig. 3. Heat release in surrounding Medium from fin

Murry and Gardener (1945) proposed analysis of extended surface based on following assumptions:

1. The heat flow in the fin and temperature at any point on the fin remain constant with time.
2. The fin material is homogeneous and its thermal conductivity is the same in all directions and remains constant.
3. The convective heat transfer coefficient is constant over the entire surface of the fin.
4. The temperature of surrounding medium of the fin is uniform.
5. The fin thickness is small in comparison to height and length, so that temperature gradients across the fin thickness and heat transfer from the edges of the fin may be neglected.
6. The temperature at the base of the fin is uniform.
7. There is no contact resistance between fins and the prime surface.
8. There are no heat sources within the fin itself.
9. The heat transfer through the outermost edge of the fin (tip of fin) is negligible in comparison two surfaces of the fin.
10. Heat transfer from the fin is proportional to the temperature excess between the fin and the surrounding medium.

In 1945 Gardener proposed following profiles

For straight or longitudinal fins

$$y = y_b \left(\frac{x}{x_b}\right)^{(1-2n)/(1-n)}$$

For spines

$$y = y_b \left(\frac{x}{x_b}\right)^{(1-2n)/(2-n)}$$

For radial or circumferential fins

$$y = y_b \left(\frac{x}{x_b}\right)^{-2n/(1-n)}$$

These equations depends on assignment value of n, for example n=0, represents straight fin with rectangular profile. Gardener provide solutions, in terms of Bessel functions for n = 0 or integer and n is fractional. Gardener was demonstrate first time use of applied mathematics in the field of extended surfaces.

Height coordinate x in the direction from fin tip to fin base. DeLorenzo and Anderson (1945) provided a correlation for the heat transfer coefficient and friction factor for the longitudinal fin. Gunter and Shaw (1945) presented flow friction data for radial fins

Longitudinal Fin

Generalized Differential equation: Consider longitudinal fin of the arbitrary profile presented in Fig.4 and assume that the fin is releasing heat in its surrounding environment. In Fig.4 curve $y = f2(x)\ and\ y = -f2(x)$ symmetrical about axis. Fin thickness is $\delta(x) = 2f2(x)$. Let L is the length of fin. Area of the fin is $A(x) = 2Lf2(x)$. T_b represent temperature at fin base, and temperature at tip (x = a) is denoted by T_a. Let x be the height coordinate. In extended surface analysis we compute temperature excess. Let θ(x) be the temperature difference between point on the fin surface and surrounding medium. In Steady state condition Fin surface temperature is T(x), Heat entering through element x+ dx by conduction and heat leaving the element at x. Heat conduction in the small element is defined as:

$dq = k\frac{d}{dx}\left(f_1(x)\frac{dT}{dx}\right)$, where $f_1(x)$ is the profile curve, $\frac{dT}{dx}$ is temperature gradient, k is the thermal. Generalized differential equation of fin is

$$f_1(x)\frac{d^2\theta}{dx^2} + \frac{df_1(x)}{dx}\frac{d\theta}{dx} - \frac{2h}{k}\theta = 0.$$

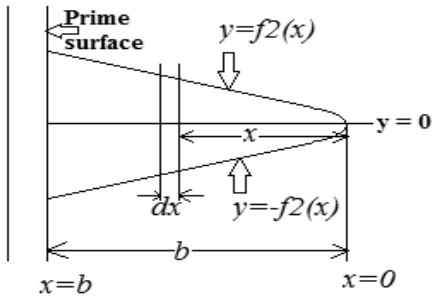

Fig. 4. Longitudinal fin with arbitrary profile

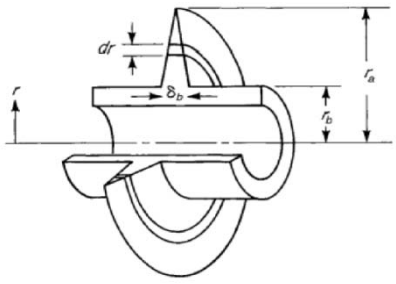

Fig. 5. Radial fin with triangular profile

Then temperature difference is defined as:

$$\theta(x) = T(x) - Ts.$$

Radial fin of triangular profile with exact solution was provided by Smith and Sucec (1969), shown in Fig 5.

Longitudinal Convecting Fins

There are five common profiles of longitudinal convecting fins as shown in Fig. 6

(i) Rectangular (ii) Trapezoidal (iii) triangular (iv) concave parabolic (v) convex parabolic. We obtain mathematical models based on the following assumptions:

1. Heat conduction in fin is steady state and one-dimensional.
2. The fin material is homogeneous and isotropic (identical property in all directions)
3. There is no energy generation in the fin.
4. Heat transfer coefficient is constant and temperature.
5. Thermal conductivity of fin is constant
6. Contact between the base of the fin and the primary surface is perfect.
7. Base temperature is constant.

Power law type variation in h was studied by Han and Lefkowitz (1960), which is given as$h(x) = (\gamma + 1)h_0\left(\frac{x}{b}\right)^{\gamma}$ where γ is a number, h_0 the mean value of h, and b is the height of the fin.

Effect of temperature dependent thermal conductivity on longitudinal fin with rectangular profile was studied by Aziz and Enamul – Huq (1975) and krane (1976). They consider temperature dependent thermal conductivity as $k = k_s[1 + \beta(T - T_s)]$, where T_s is the surrounding temperature. Nguyen and Aziz (1992) used Finite difference method in solution of longitudinal fins of rectangular, trapezoidal, triangular and concave parabolic profiles, when fins release heat by convection and radiation. They concluded that a convecting- radiating fin has a lower efficiency in comparison of purely convecting fin. In 1996 Aziz and Kraus studied radiating and convecting –radiation extended surfaces with examples. In 2001 Kraus et al summarized both the ideas mentioned above.

Fin Efficiency

The fin efficiency is defined as ratio of actual heat transfer to heat transfer from an ideal fin and denoted by Greek letter η, i.e.

$$\eta = \frac{q_{actual}}{q_{ideal}}$$

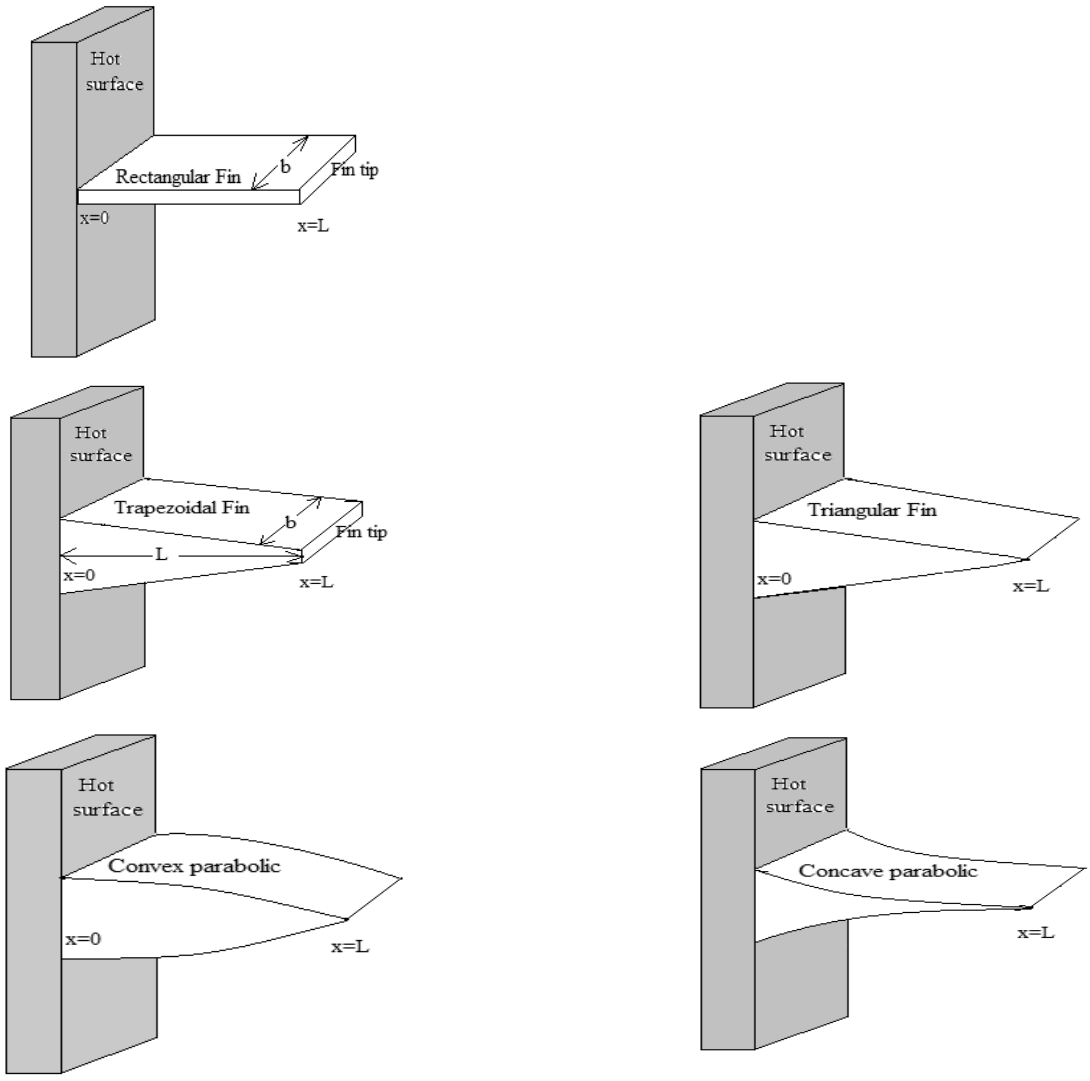

Fig. 6 different type fin profiles.

Efficiency of any fin is vary with its thermal conductivity and mode of heat transfer

Application of Heat exchanger

In any industry heat is required according to need, sometimes it is added, removed or transfer from one medium to another medium. Generally heat exchangers widely used in refrigeration, air conditioner, power plant, nuclear plants, chemical plants, thermal power plants, petroleum refineries, electronic equipments, radiator in car, sugar processing, aircraft engines. Generally fluids are used in heat transfer process. Fluids may be water, oil and moving air. In car radiator is used for heat transfer purpose. In radiator we use antifreeze liquid i.e. mixture of water and ethylene glycol, which transfer heat from engine to radiator, and then from radiator to surrounding air.

Material: different material used in heat exchangers such as aluminum, Copper, stainless steel, nickel alloys, titanium etc. Thermal conductivity of diamond is five times than copper, due to high cost and lake of availability, it is not used. In nature, aluminum and copper are easily available and fins are made by these materials. Due to high cost, silver and gold are not used in fins.

Mathematical Modelling: Heat Transfer real life Problem → Mathematical Formulation (Using Differential Equation and Boundary Conditions, Variable, Constants) → General Solution of Differential Equation → Using Boundary Conditions→

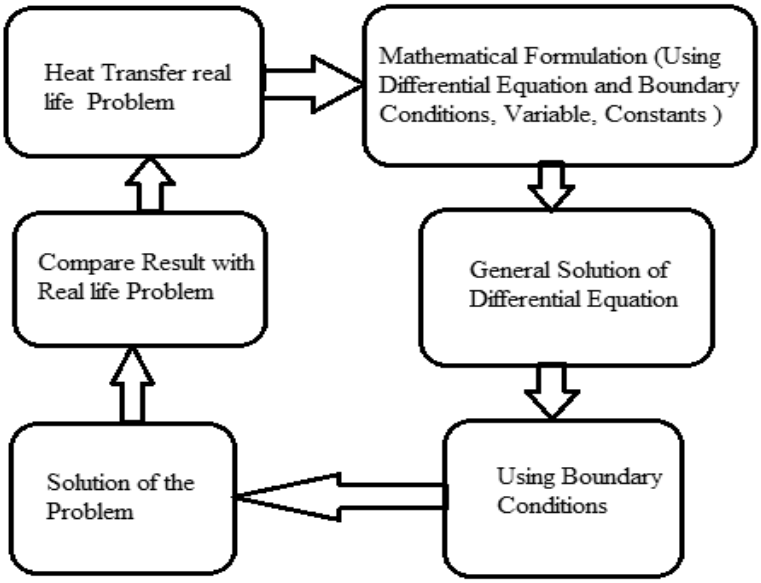

Fig. 7. Mathematical Modeling of Heat transfer Problem

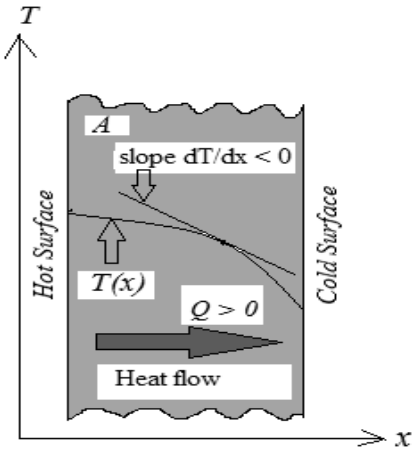

Fig. 8. Temperature gradient and heat flow

Solution of the Problem → Compare result with real life problem If results are match with real life problem then we say that our model is correct other wise modification is required in model.

Meaning of initial and boundary conditions: In mathematical study we consider three type boundary conditions i.e. first, second and third kind boundary conditions. The initial condition represents temperature in the body at initial time t = 0, In steady state temperature remains constant with time. Boundary condition of first kind represents constant surface temperature. Boundary condition of second kind represents constant surface heat flux. The relationship between surface heat flux and the surface temperature is represented by boundary condition of third kind.

For example we consider one dimensional transient (unsteady) heat conduction in plate,

$$\frac{\partial^2 \mathrm{T}}{\partial x^2} = \frac{1}{\alpha}\frac{\partial \mathrm{T}}{\partial t}$$

where $\alpha = \mathrm{k}/(\rho \mathrm{c})$, $\mathrm{k}((Wm^{-1}K^{-1}))$ is the thermal diffusivity of the medium, c is specific heat, and ρ is the density.

Initial temperature distribution

$$T(x,t)_{t=0} = T(x,0)$$

At x = 0, the boundary conditions are as follows:

Boundary condition of first kind: Constant surface temperature

$$\mathrm{T}(0,\mathrm{t}) = \mathrm{T_s}$$

Boundary condition of first kind: Constant surface heat flux

$$-k\frac{\partial \mathrm{T}(0,\mathrm{t})}{\partial x} = q_s''$$

Boundary condition of third kind: relationship between surface heat flux and the surface temperature (Surface Convection)

$$-k\frac{\partial \mathrm{T}(0,\mathrm{t})}{\partial x} = h[T_\infty - \mathrm{T}(0,\mathrm{t})]$$

Where h $(Wm^{-2}K^{-1})$ is convective heat transfer coefficient and T_∞ is the temperature of the hot fluid in contact with the surface at x = 0.

One dimensional heat conduction with heat genration

One dimensional transient heat conduction in plane wall with constant thermal conductivity and heat generation is given as follows

$$\frac{\partial^2 \mathrm{T}}{\partial x^2} + \frac{e_{gen}}{k} = \frac{1}{\alpha}\frac{\partial \mathrm{T}}{\partial t}$$

where T is the temperature, *x* is space coordinate, e_{gen} is the heat generation per unit volume, k is the thermal conductivity, t is the time.

Fourier's Law of heat conduction: The rate of heat conduction through a medium in a specified direction is defined as follows

$$Q_{cond} = -kA\frac{dT}{dx}$$

Heat is conducted in the direction of decreasing temperature, and thus the temperature gradient is negative when heat is conducted in positive x direction. In above expression k is the thermal conductivity of material, A is the area of fin and $\frac{dT}{dx} < 0$ is the slope of the temperature.

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NEUTRINOS : A HIGHLIGHT

DEEPIKA GROVER AND DR. VENKTESH SINGH***

The neutrino (ν) was first postulated in 1930 by Wolfgang Pauli to explain the continuous spectra of electrons emitted in the radioactive disintegration of neutron rich nuclides, called the beta decay. Rather than the expected discrete energy, named as the end point energy, the electrons emitted in the beta decay are observed to have energy in a continuous range.

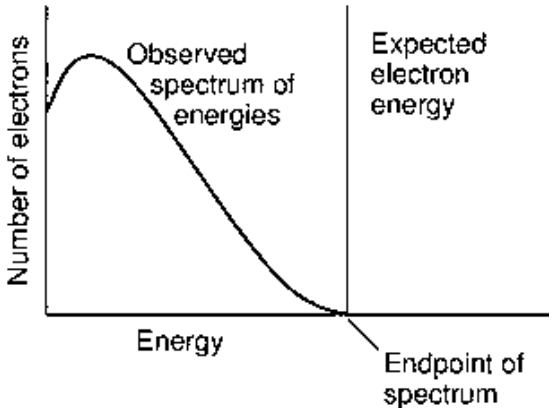

Fig. 1. Energy Spectrum of emitted electrons in the beta decay process (Unlike the expected discrete energy, the electrons are emitted out with continuous energy)

The corresponding conservation of energy, momentum and angular momentum was achieved by postulating another particle which Enrico Fermi called the neutrino and developed a theory of beta decay based on it [1]. Fig. 1 shows the electron energy spectrum in the beta decay process.

Detection of Neutrinos

The first detection of neutrinos was done in 1956 in an experiment for which Clyde L. Cowan and Fredrick Reines were awarded a Nobel Prize in Physics in 1995. In their experiment [2], Cowan and Reines used a nuclear reactor as a source of antineutrinos. They achieved a flux of the order of 10^{13} antineutrinos per second per square centimeter. The antineutrinos, produced as a by-product in the nuclear reactor, then interacted with protons (p) in a tank of water (200 litres), creating neutrons (n) and positrons (e^+). Each positron (e^+) annihilated with an electron (e) producing two gamma (γ) rays. The gamma rays were detected by placing a scintillation material in the water tank, which in response to gamma hits gave off light flashes. The flashes were detected by photomultiplier tubes.

For more precise results from their experiment, Cowan and Reines placed cadmium chloride ($CdCl_2$) in the tank (about 40 kg dissolved in 200 litres water). The neutron produced in the reaction was captured by highly effective neutron absorber, Cadmium (Cd) producing a gamma ray which was detected 5 microseconds after the gamma ray from the positron. The coincidence of both events – detection of two gamma rays by positron annihilation and detection of one gamma ray by neutron capture – gave a distinct signature of antineutrino interaction with protons.

Neutrino Flavors

Leon Lederman, Melvin Schwartz and Jack Steinberg in 1962 made a prize winning discovery at Alternating Gradient Synchrotron (AGS), Brookhaven National Laboratory proving the existence of muon neutrinos [3]. They were awarded 1988 Nobel Prize in physics for their discovery. Their experiment used a beam of energetic protons accelerated from the AGS to produce pi mesons (π), which traveled 21.34 meter toward a 5000-ton steel wall. During their flight, the pions decayed to muons and neutrinos. The muons were absorbed in the steel wall but the ghost like particles, neutrinos, passed through it into a neon filled spark chamber. The impact of neutrinos on aluminum plates in the chamber produced muon spark trails that were detected and hence lead to the discovery of muon neutrinos. Upon the discovery of third lepton, the tau, in 1975 at Stanford Linear Accelerator Center [4], it was expected to have an associated neutrino. The first detection of tau neutrinos was reported by the DONUT experiment at Fermi National Accelerator Laboratory in 2000 [5]. Thus, till now there are three neutrino flavors – electron neutrinos, muon neutrinos and tau neutrinos.

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Neutrino Properties

Neutrinos are electrically neutral fundamental particles having half integral spin i.e. obeying Fermi Dirac statistics. They interact via weak forces. Decades of neutrino experimentation have shown that neutrinos have mass although very small compared to the subatomic scale. The existence of neutrino masses implies them to have a tiny magnetic moment [6] and hence the possibility of their electromagnetic interaction. Also, mass existence ruled out the long accepted fact that neutrinos travel with the speed of light. While the neutrinos possess left handed helicity (spin antiparallel to momentum), the antineutrinos have right handed helicity (spin parallel to momentum). The physical size of neutrinos [7] is defined using their electroweak radius

$$< r^2 > = n \times 10^{-33}\ cm^2$$

where $n = 3.2$ for ν_e

$= 1.7$ for ν_μ

$= 1.0$ for ν_τ .

Neutrinos – Majorana or Dirac

Hypothesized by Ettore Majorana in 1937, a Majorana particle refers to the one that is its own antiparticle (Photon is an example of Majorana particle). This is in opposition to the Dirac particle that is different from its antiparticle. The experimental situation of neutrinos being Majorana or Dirac is still inconclusive. However, theoretically there exist reasons to think neutrinos as Majorana particles. If neutrinos are Majorana, the first signature would be the existence of neutrinoless double beta decay. Numerous experiments such as COBRA, DCBA, EXO, KamLAND-Zen, CUORE are searching for neutrinoless double beta decay.

Solar Neutrino Problem

The Sun is a natural nuclear reactor in which proton-proton fusion reaction takes place producing helium, neutrinos and photons via the reaction

$$4\ {}^1H + 2\ e \rightarrow {}^4He + 2 \text{ neutrinos} + 6 \text{ photons}.$$

The neutrinos, being feebly interacting, travel from the Sun's core to the Earth without much absorption by the Sun's outer layers. In late 1960's Raymond Davis Jr. and John. N. Bahcall, conducted an experiment [8] using chlorine based detector in the Homestake Gold Mine in Lead, South Dakota to measure the neutrino flux from the Sun. Bahcall did the theoretical calculations and Davis designed the experiment. The experiment reported the neutrino count on Earth to be one third of the number expected by Bahcall's calculations. Many subsequent experiments such as Kamiokande, SAGE, GALLEX confirmed this deficit. This discrepancy between the predicted and measured rates of neutrino detection created the solar neutrino problem. Raymond Davis Jr. was awarded 2002 Nobel Prize in Physics for his pioneering contribution. The solar neutrino problem lasted till about 2001 and was finally resolved with an improved understanding of the Standard Model of Particle Physics – Neutrino Oscillations.

Neutrino Oscillations

In 1957, Bruno Pontecorvo, proposed that neutrino-antineutrino transitions may occur in analogy with neutral kaon mixing. This idea initiated Maki, Nakagawa and Sakata in 1962 to develop a theory of neutrino flavor oscillations which was further elaborated by Pontecorvo in 1967. This theory [9] describes neutrino oscillations to be arising from a mixture between the flavor and mass eigenstates of neutrinos. The three neutrino flavors that interact via weak forces are each a different superposition of the three neutrino mass eigenstates. This mixing between neutrino flavor and mass eigenstates is represented by a 3×3 matrix called PMNS matrix.

$$\begin{bmatrix} \nu_e \\ \nu_\mu \\ \nu_\tau \end{bmatrix} = \begin{bmatrix} U_{e1} & U_{e2} & U_{e3} \\ U_{\mu 1} & U_{\mu 2} & U_{\mu 3} \\ U_{\tau 1} & U_{\tau 2} & U_{\tau 3} \end{bmatrix} \begin{bmatrix} \nu_1 \\ \nu_2 \\ \nu_3 \end{bmatrix}.$$

The PMNS matrix is a unitary matrix that describes the probability of a neutrino of given flavor α to be found in mass eigenstates *i.* The probability is proportional to $|U_{\alpha i}|^2$. The matrix is parameterized by three mixing angles (θ_{12}, θ_{23} and θ_{13}) and a CP-violating phase (δ). Thus there are six parameters that affect neutrino oscillations: the three mixing angles, a CP-violating phase and the two mass square differences. The angles θ_{12} and θ_{23} have been measured to be non zero by various experiments. In 2012, the last angle θ_{13} was measured to be nonzero at DayaBay / Reno to a statistical significance of 5.2σ [10]. No measurement of the CP-violating phase (δ) has been made. The best estimate of the difference in the square masses of the neutrino mass eigenstates 1 and 2 was made by KamLAND in 2005: $\Delta m^2_{21} = 0.000079\ eV^2$ [11]. In 2006, MINOS, using an intense

beam of muon neutrinos from the Fermilab's NuMI (Neutrinos at the Main Injector) beam, measured the difference in the square masses of the mass eigenstates 2 and 3: $|\Delta m^2_{32}| = 0.0027\ eV^2$ [12]. Whereas the absolute values of two mass square differences are known, the ordering of the masses has not been determined.

The first evidence for neutrino oscillations came in 1998 from the Super Kamiokande that confirmed oscillations from muon neutrinos to tau neutrinos. Many experiments such as MINOS+, NOνA, LBNE are working on neutrino oscillations.

Neutrino Oscillations – A Resolution to Solar Neutrino Problem

During their flight from the Sun to the Earth, the electron neutrinos produced in the p-p fusion reaction in the Sun, oscillate to other two flavors which were not detected by the detectors used in earlier times leading to the solar neutrino problem. This problem was convincingly solved in 2001 from Sudbury Neutrino Observatory, Canada which distinguishly detected the electron neutrinos and the other two flavors coming from the Sun by using heavy water as the detection medium [13]. They found that around 35% of the solar neutrinos arriving at the Earth are electron neutrinos and the rest are the other two flavors. The total number of neutrinos detected was in well agreement with the number predicted by models on the solar interior.

The MSW Effect

The presence of electrons in matter changes the energy levels of propagation eigenstates of neutrinos due to charged current coherent forward scattering of the electron neutrinos. The coherent forward scattering is analogous to the electromagnetic process leading to the refractive index of light in a medium. This means that neutrinos in matter have a different effective mass than neutrinos in vacuum. Since neutrino oscillations depend upon the squared mass difference of the neutrinos, they may be different in matter than they are in vacuum. This effect causing modification of neutrino oscillations in matter is called MSW effect or matter effect.

Sterile Neutrinos

Till now the Standard Model of Particle Physics includes three neutrino flavors known as the active neutrinos and their corresponding antineutrinos. But the results of various neutrino oscillation experiments (eg. LSND results interpreting antineutrino oscillation with $\Delta m^2 \sim 1\ eV^2$ [14]) cannot be explained in the framework of three neutrino flavors and need to go beyond the Standard Model. To explain these results, another neutrino flavor has been hypothesized. This fourth neutrino, unlike the active neutrinos, that are left handed and charged under weak interactions, is right handed and does not interact via any of the fundamental interactions except gravity. The first evidence in favor of the fourth neutrino came from the LSND results that searched for muon antineutrino to electron antineutrino oscillations and to measure νC cross sections. Other experiments such as MiniBooNE, KARMEN (jointly with LSND) also favored the hypothesis. Whereas many experiments support the fourth neutrino, a number of experiments searching oscillations have obtained null results. The Large Electron Positron collider at CERN experimenting on the invisible decay width of the Z boson supports only three neutrinos with mass below one half of the Z boson mass, which couple to the Z boson, and therefore, the fourth neutrino, if it exists, cannot couple to the Z boson and hence is a sterile neutrino [14].

In contrast to the number of active neutrino types, which is equal to the charged leptons and quark generations, the number of sterile neutrino types is unknown. In many models explaining neutrino masses, sterile neutrinos are held responsible for imparting mass to the active neutrinos via seesaw mechanism.

Sources of Neutrinos

Thermonuclear fusion inside the Sun or other stars is one of the natural sources of neutrinos. The main reaction producing neutrinos is

$$p + p \rightarrow {}^2H + e^+ + \nu_e.$$

Each second, about 65 billion solar neutrinos pass through every square centimeter on the part of the Earth facing the Sun. Cosmic ray interactions with the atmosphere is another natural source of neutrinos. When cosmic rays (protons) interact with atomic nuclei in the Earth's atmosphere, many unstable particles are produced which decay producing neutrinos. Collapse of massive stars, Supernovae, is also a natural neutrino source. When massive stars collapse, matter densities at the core become so high that the electrons and protons combine to form neutrons and electron neutrinos which are emitted out. The thermal energy of the newly formed neutron core, the Big Bang and radioactivity also constitute the natural neutrino sources.

Particle accelerators are one of the artificial sources of neutrinos. They use the technique of smashing energetic protons on a fixed target producing mesons, primarily, pions and kaons. These unstable particles are then magnetically focused into a long tunnel where they decay producing neutrinos as one the decay products. Nuclear reactors are the major source of electron antineutrinos which are produced in the beta decay of neutron-rich nuclei such as ^{235}U, ^{238}U, ^{239}Pu, ^{241}Pu. Nuclear bombs also produce very large quantities of neutrinos.

Acknowledgements

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JOSHI EFFECT

PROF. S.B. RAI*

I think most of readers of Pragya and the scientific community is aware with the name of Prof. Shudhanshu Shekhar Joshi (S.S. Joshi) however very few people know the scientific contribution made by Prof. Joshi. Prof. Joshi was head of the Department of Chemistry Banaras Hindu University for more than two decades. He along with his students developed a new innovative technique being here in Chemistry Department of Banaras Hindu University, without involvement of any sophisticated instruments or any foreign aid or Scientists. It is a highly sensitive analytical spectroscopic technique and can be used for the detection of trace presence of impurity in the sample, presence of new isotopes of the elements, in the study of structure of atoms and molecules, ionisation potential of atoms/molecules, quantum defect, electron affinity, electronegativity etc. It is counted as one of most sensitive technique even in recent years. It is possible to detect impurity $\leq 10^{-9}$ gram using this technique. The technique is: when one passes a monochromatic beam of light through a discharge (A discharge is a system in which the vapour of the sample under study is kept at low pressure in a closed glass/quartz/metal tube. A low current high voltage is applied across the tube. Due to this potential a glow of the gas takes place such as in tube rods in room a change in discharge current is seen if the wavelength of the incident light matches with the energy separation between two levels of the atom/molecule present in the discharge. This change in current gives the idea of transition from one level to the other of the species and can be monitored easily. This was detected by Prof. Joshi for the first time.

Actually when a voltage is applied to the gas in the discharge, the atoms or molecules of the gas are excited to higher energy levels by electron impact excitation and distributed in different energy levels. In normal conditions these atoms or molecules come to ground state and emit photons due to limited lifetime of the excited state of atoms or molecules. However if we pass the light of appropriate frequency through the discharge before it decays, the atoms/molecules from the excited state can further be promoted to another excited state depending upon wavelength of incident light and energy separation between the levels. This shows a change in discharge current/ voltage. This change in discharge voltage/current is very small (generally of the order of mA/mV, μA/μV, nA/nV). Though at present it is possible to measure a change in current or voltage up to femto ampere(10^{-15} amp) or femto volts (10^{-15} V),however during 1930's(When these experiments were conducted)it was simply an imagination. A more interesting thing is, Joshi and co-workers used ballistic galvanometer (lamp and scale arrangement) for these measurements whose sensitivity is in mA/mV range.

Almost at the same time Penning also made a similar report. Penning explained his observations in terms of Penning ionization. Penning ionisation is, if one provides energy to an atom or molecule (through electron- atom collisions or atom-atom or atom-molecule collisions) which is sufficient to ionise atoms or molecules a change in current in the discharge is seen. The electrons and ions thus formed after ionization causes a change in discharge current. However, Joshi effect is slightly different from Penning ionization. In this case it is not necessary that incident radiation must have energy which is sufficient to ionize the atom or molecule. However it can be observed with any wavelength provided the energy of the incident photon match with separation between any two excited levels so that incident light promotes atom/molecule from one level to the other. Now if in the new level the probability of ionization is large compared to earlier level the current of discharge will increase. An inverse will hold good in the other case. On the other hand if this incident energy is sufficient to ionize the atom/molecule it may ionize the atom/molecule directly giving a change in the current. Thus Penning ionization is a special case of Joshi effect.

Though some work were carried out during that period using conventional fixed wavelength light sources however the potential of this technique remained unexplored till the discovery of laser sources

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particularly the tunable laser sources. In 1976 Green and his group at National Bureau of Standard (now NIST) USA used dye laser and measured the signal in discharge of several atomic species[1]. They named this technique as Optogalvanic Spectroscopy. During 1998 Prof G.W. Series from Reading University UK was visiting our laboratory[2]. We showed voluminous work done by Prof. Joshi and his students and convinced him that Optogalvanic Effect is nothing but basically the Joshi effect. Later on in a review article in Contemporary physics, Prof. Series has mentioned that Optogalvanic effect is basically Joshi effect reported first by Prof. S.S. Joshi from Chemistry Department of Banaras Hindu University, India.

Thus Joshi effect is basically an excitation of atoms/molecules from one state to other leading ionization and thereby a change in current. The promotion of atoms/molecules from ground state to other states takes place through collisions in between electrons/ions in the discharge with atoms/molecules or in between atom-atom or molecule-molecule or between atom-molecules. Further these atoms/molecules may be in ground state or in excited state moving or in rest. The possible processes of excitation may be

(1) Electron impact excitation/ionization.
(2) Associative excitation/ionization.
(3) Chemiionization/excitation.
(4) Collision between pair of excited atoms/molecules.

Electron impact excitation is one of the important process involved in exciting the atoms/molecules from one state to other or in ionizing them. In associative process an atom/molecule in highly excited state may collide with same kind of atom /molecule in ground state and promote it to the excited state and thereby causing a change in impedance of the discharge. If the two atoms are of different kinds the process is termed as chemi ionization-excitation. It may happen that both the atoms/molecules are in excited states, their collision may result a change in state and thereby an ionization probability or change in impedance of discharge. This process is important when the two colliding atoms/molecules are in metastable states (long lived states). These collision processes depend on two factors

(1) Pressure of the gas in discharge column
(2) Lifetime of the levels

The collision probability in the discharge will be large if the pressure of the gas in discharge column is large. However it is difficult to get stable discharge if the pressure of the gas in discharge column is very large. So the discharge and thereby the signal in this condition will fluctuate .This will not permit to get real signal .Thus it is essential to have a very stable discharge .The lifetime of the level in real sense plays an important role. If the atom/molecule is in the metastable (long lived) state, the probability of collision will be large. A reverse will hold good in the case of normal state (stable). Thus in a discharge (where atoms or molecules are distributed in different levels) when the atomic/molecular species are promoted from a stable to a metastable state, the probability of collision (ionization) is increased. This results in increase in impedance of the discharge or a positive signal. However if the atomic/molecular species is promoted from a metastable to a stable state the probability of collision is reduced. This results in a decrease in the impedance of discharge or a negative signal. Thus in this case there is probability of getting positive as well as negative both the signals. As mentioned earlier that Joshi and his students did all these measurements using ballistic galvanometer and lamp and scale arrangements which is not very sensitive particularly in the case of negative signal which appeared just as noise and they could not interpret it. However in recent years the detection sensitivity has increased up to femto ampere/volts and therefore very weak signal can also be detected using this technique. The discharge itself populates the level and change in current/voltage of the discharge due to the absorption of light gives the signal. The other advantage with this technique is that absorption can be monitored even from very high lying excited states (close to ionization limit) using Visible/NIR/IR light where accuracy of measurements is very high. Thus using single mode tunable laser (with very narrow bandwidth) it has been possible to detect ionization potential within few wave number. One can also detect positive and negative ions (C_2^-, I^-, CN^-, N_2^+...) using this technique. Certain elements/molecules whose melting points are very high and need high temperature to produce appreciable vapour for absorption/emission studies. These refractory materials can be studied using this technique easily at room temperature. Actually when one runs a discharge, electrode materials (atoms/molecules), electrons, ions are released from the electrodes due to electron and ion bombardments. This increases the concentration of

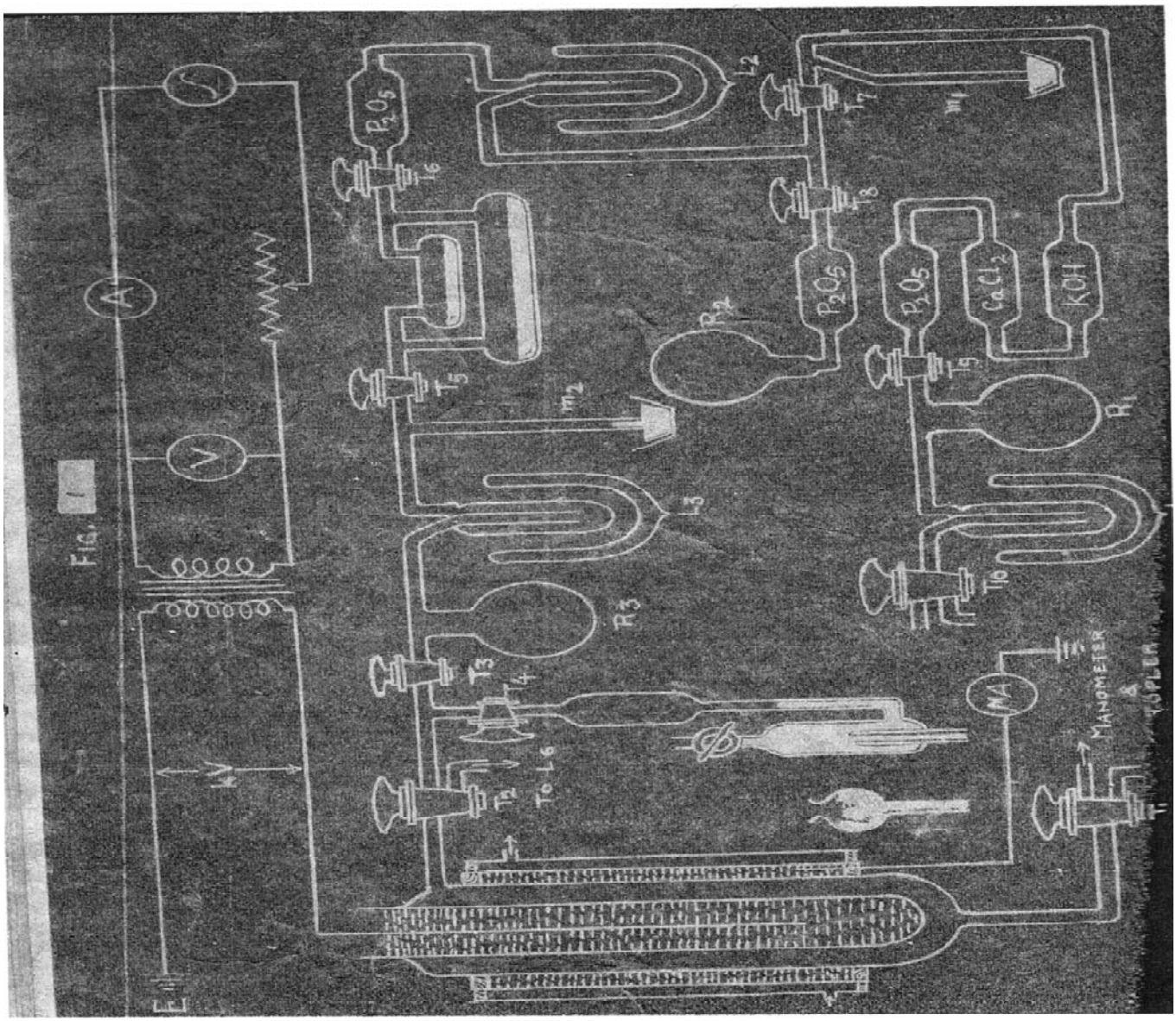

Fig. 1. The experimental set-up used by Prof. Joshi and group.

Optogalvanic Experimental Setup

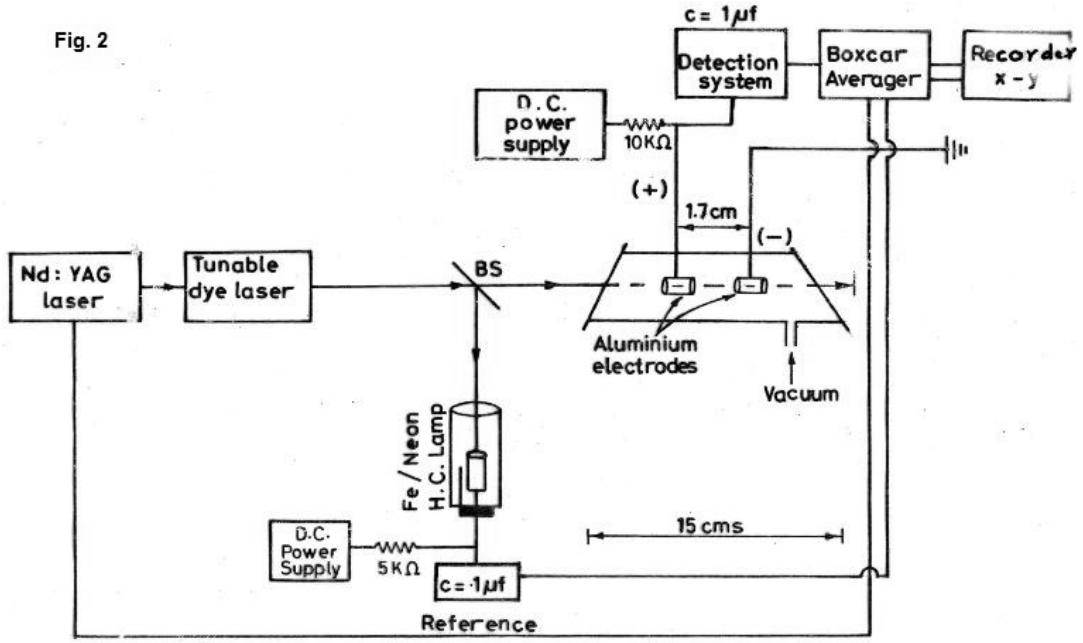

Fig. 2. The experimental set-up used in recent time.

Optogalvanic Spectrum of Ne

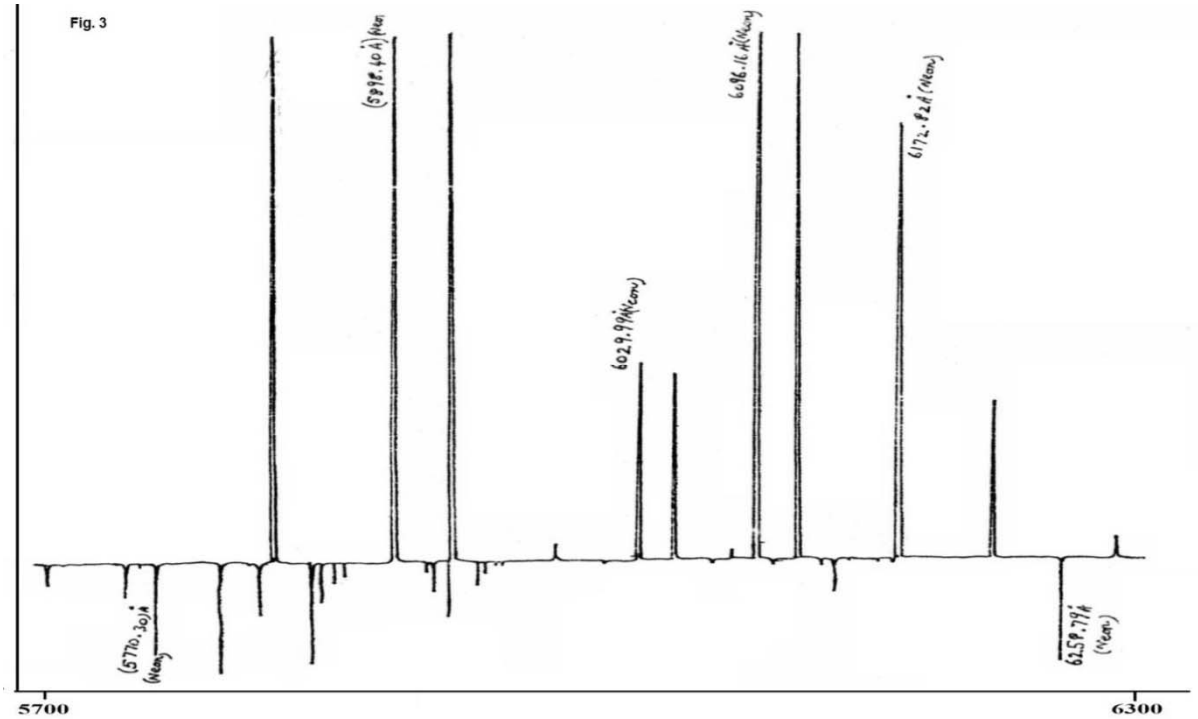

Fig. 3. Optogalvanic spectrum of Neon.

electrode material in the discharge and gives its glow. Thus if we use the electrodes of refractory material in the discharge an appreciable concentration of the electrode material can be obtained which is sufficient to monitor signal. The most important thing with this technique is that the experimentation is very easy with high signal to noise ratio. Due to its simplicity the spectra of inert gases or rare earth elements monitored by this technique are used as calibration spectrum in laser laboratories. In sophisticated laser laboratories the signal is used to stabilize the single mode tunable lasers. A slight drift in wavelength causes a large change in strength of the signal. A change in the strength of the signal generates a reverse signal from PID (proportional integral differential amplifier) to maintain the earlier conditions.

Experimental Set-up

The experimental set up used by Prof. Joshi is shown in Fig 1. The right part of the set up represents the method used to prepare the sample which looks very complex. However the whole effort is to get highly pure water free vapour of the sample in the discharge. The left part of the figure represents the discharge of the sample (inner cylinder).The outer coaxial cylinder contains an inert gas or vapour of certain element/molecule, the discharge of which provides the excitation radiation. The excitation wavelength should be such that it is absorbed by the sample. Generally the sample/inert gases emitting the broad continuum have been used.

The recent experimental set up (shown in Fig. 2) consists of a discharge tube (DC or microwave or radio discharge tube) attached with inlet and outlet for introducing and evacuating the gaseous sample. The DC discharge tube contains electrodes which sometimes gives the chances of impurity in the discharge. Therefore electrodeless discharge tubes (microwave or radiofrequency discharge) are preferred. The signal is detected throw R-C coupled filter circuit connected in the main discharge voltage circuit. The light from a tunable dye laser of desired wavelength is focused inside the discharge. The laser power required to observe the signal is very limited (of the order of mw). When the laser light is absorbed by the atoms/molecules, they are promoted from one energy state to other. The change in energy state causes a change in the impedance of discharge. This results into an instantaneous change in the voltage/current which can be monitored throw R-C filter circuit. The Joshi effect signal in the case of large number of atoms and molecules viz Ne, Xe, Al, Pb, N_2, Br_2, Cl_2, CN etc has been studied in our laboratory. A noise free intense signal in the case of neon is shown in Fig. 3.

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SEX DIFFERENTIALS IN UNDER-FIVE MORTALITY IN INDIA: A REGIONAL ANALYSIS

KRISHNA KUMAR PANDEY AND PROF. HEMKHOTHANG LHUNGDIM***

Infant and child mortality rates are sensitive indicators of living and socio-economic conditions of a country. This recognition has made the international organizations as well as National Governments to intensify their efforts to reduce infant mortality and improve child survival. Therefore reduction in infant and child mortality is likely the most important objective of the Millennium Development Goals-4 (MDG-4). As a result, there have been considerable improvements in the infant and child mortality rates in recent years.

Gender disparities constitute a critical yet understood issue regarding Indian infant & child mortality. The high ratio of male births to female births in India is thought to reflect sex selective abortion and undocumented female infanticide and other infant death. These gender based disparity extends to child mortality in India, an estimate 70 out of 1,000 boys born will die before age 5 years, while this estimate is 13 % higher for girls at 79, of 1,000 born. In this paper an attempt is made to find out the existence of sex differential in mortality for children under five age group in India across the states and region.

Review of Literature

Most studies on gender differential in under-five mortality established relationship with socio-economic conditions. Research has revealed on a number of predictors of excess female child mortality including poverty, family size, education, women's education, employment & empowerment. There are studies that dealt with the sex differentials in child mortality such as regional patterns of sex bias and excess female child mortality in India (Arokiasamy[1], 2004). Excess female child mortality in India varies considerably from one region to another, reaching its highest levels in North. The female disadvantage remains a great challenge for achieving gender equity. Eliminating such differences may substantially reduce overall child mortality. A study on women's autonomy and sex differential in child mortality in India concluded that the sex differential in child mortality for children in the states of Punjab, Haryana, Rajasthan and Uttar Pradesh actually worsens with the improvement in autonomy of their mothers (Singh[8], *et al.*, 2007).

It is also evident from studies that differential mortality experienced by male and female children during childhood may be result of differential allocation of food (Bairagi[2], 1986; Basu, 1989). It is suggested that the reduced length of breast feeding and differential preventive and curative care given to the children of two sexes also creates a differential in child mortality among males and females in their childhood (Miller[7], 1981; Das Gupta[3], 1987). Rao *et al.* (Rao[10] *et al.*2004) revealed that maternal education and living standard of the house hold have positive effect on oral rehydration treatment rate for boys not for girls and it is especially prevalent in the central and eastern regions of India. Providing more support to for these observations, Kishor[5] (1993) finds that in more developed districts the survival chances of girls reduced .

Besides biological basis, excess mortality of girl children in the northern states is attributed to the patriarchal structure of society and the consequent inferior position of women. Dyson and Moore[4] (1983) demonstrated basic social and demo-graphic differences between northern "Aryan" speaking and southern "Dravidian" speaking cultural areas in India. They related the northern Indian kinship structure to low female autonomy, a strong preference for sons and very high levels of sex differentials in child mortality (Karve[6], 1965; Sopher[9], 1980). The differentials in mortality between boys and girls in northern India are argued to be largely the result of discrimination against girls in terms of food allocation and medical care.

Need for the Study

The magnitude of difference in the risk of U-5 mortality differs significantly across the region. Therefore it becomes necessary for the researcher to

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understand and identify the determinants of the phenomena very carefully. Knowing the determinants affecting sex difference in child survival will help in proper preventive and curative care and many lives can be prevented to reduce gender gap. To reduce child mortality and minimise the sex differential it is necessary to understand the various factors affecting them, so that appropriate intervention can be implemented in the country as well as across the states and regions.

Objectives

i) To estimate the under-five mortality by sex in India.
ii) To examine the pattern & factors that affect sex differential in under-five mortality across the region.
iii) To bring out the policy implications to reduce under-five mortality across the region.

Data and Methodology

The data for this study come from the National Family Health Survey –III conducted in 2005-2006. This is a nationwide survey with a random sample of 1,24,385 women aged 15-49 and 74,369 men age 15-54. The current paper focuses on all children born in the past 10 years, giving us a sample of 1,19,444 children. Of these, 9,326 children died before reaching age 5 and 1,538 children died between age1 and 5. In our ongoing work, we examined the impact of independent variables of interest, wealth Index, parental education and their work, mother's parity, health status and several other measures has been taken on gender differences in mortality among under five. All the 28 states of India is classified into five regions in appendix 1.

Appendix 1: The classification of states into regions as used in NFHS-3, 2005-06

Region	States within the region
North	Delhi, Haryana, Himachal Pradesh, Jammu & Kashmir, Punjab, Rajasthan, Uttaranchal
Central	Chhattisgarh, Madhya Pradesh, Uttar Pradesh,
East	Bihar, Jharkhand, Orissa, West Bengal
Northeast	Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura
West	Goa, Gujarat, Maharashtra
South	Andhra Pradesh, Karnataka, Kerala, Tamil Nadu

Dependent/Outcome Variable: We measure variable under-five mortality rate (U-5MR) by sex, as it is important indicator of average population health and are widely used to document the progress in the achievement of the fourth Millennium Development Goal (MDG-4: a commitment to reduce under-five mortality by two-thirds, between 1990 and 2015). The U5MR is a measure of the probability of death among children before their fifth birthday.

Independent/Exposure Variables: The study utilizes eight main exposure variables, that is, residence, wealth index; parent's working status and their education, religion, mother's health status, parity and smoking/alcoholic habit.

The demographic tool/techniques used

Relative Risk (RR): Relative risk may be defined as the number of female deaths per male deaths

$$\text{Relative Risk (U-5)} = U5MR_f / U5MR_m$$

where, $U5MR_f$ = female under -5 mortality rate & $U5MR_m$ = male under-5 mortality rate.

Cox proportional hazard model: This paper focuses on the relationships between survival time of children and background characteristics, by applying the Cox proportional hazard model. The Cox model is expressed as:

$$h(t, x) = h_0(t)\, e^{Xi\beta}$$

Where h0(t) is an unspecified time-dependent function, x is a vector of covariates, and is a vector of unknown coefficients. Thus, the risk of dying is allowed to vary with time and a set of exogenous variables. The interpretation of the coefficients is rather simple. A positive β implies that when x increases, the probability of dying at each duration (time) also increases and vice versa. Since most explanatory variables are specified as binary variables, a positive implies that when x takes the value one, the likelihood of dying increases.

Findings

Trend in sex differential in under-5 mortality in India:

There are several studies which show the gender differential in care, nutrition, health facility, and educational attainment faced by Indian girls compared to boys, but in the present study, we mainly focus on the gender differences in U-5 mortality across the

region. Table 1 shows the difference is more in northern and central region but it is reasonable in east, north-east and west region however it is little favourable for female in southern region.

NFHS-3 figure shows that the risk of under-5 female mortality is higher in northern and central, east and north-east regions however it is lesser in western and southern region of India. The risk of dying for under-5 female in central region is 1.14 times higher than male under-5 male mortality; in the same fashion it is 1.12 times higher in northern region. Female under-5 mortality in Southern region is 14 % less than the male under-5 mortality.

Table 1: Under-five mortality for male and female according to region (weighted) NFHS-3, 2005-06

region six	$U\text{-}5MR_m$ (per 000 male live births)	$U\text{-}5MR_f$ (per 000 female live births)	Relative Risk (F/M)
India	75	77	1.02
North	66	74	1.12
Central	97	111	1.14
East	81	83	1.02
North East	80	82	1.03
West	61	60	0.98
South	63	54	0.86

Under-five mortality is considerably higher in rural areas than in urban areas for both male and female. The NFHS-3 estimates shows in table 2 are that the relative risk is greater in north and central region i.e. the female U-5 death is more in rural areas for central and north region whereas for east, north-east, west and southern regions it is higher in urban area. In north and central region the mortality is favourable to male in both rural and urban areas however it is favourable to female in east, north-east, west and south region. Among the religious groups, in the north, central and north-east regions, Hindu show higher under-5 female deaths, but in central and north-east under-5 female deaths are more among the Muslims. However in west and south regions the under-5 male mortality dominates female mortality among all the religious group. Similarly, in the east, west and south child deaths are more common in other religious groups.

NFHS-3 estimates shows an inverse relationship between wealth index and under-five mortality, that is as the people gets wealthier the under five mortality gets decreases and vice-versa. The under-five mortality is higher among poor people whereas it gets lowered in middle and rich people in all the six regions. Gender disparity in under-5 mortality is more apparent in northern and central states than in urban areas for both sexes whereas it is less visible in east, north-east, west and southern regions of India. There are more deaths among those under-5 whose mother's have more than 2 parity. In all the regions, working mothers experience more under-5 child deaths as compared to non-working mothers. In north and central regions, under-5 female deaths are higher among male U-5 to both working and non-working mothers. The under-5 mortality is highest for the uneducated mothers and it is substantially lowest for highly educated.

Risks of dying among under-5 by selected characteristics and region (Results of Cox Proportional Hazard Model)

The relative risk of dying among young children age under-5, Cox proportional hazard model has been used. The results of proportional hazard model of Cox are presented in Table 3. In Table 3, the nation as a whole is taken to see the risk of dying of under-5 mortality by the given covariant for both male and female. The effects of the exposure variables on under-5 mortality are statistically significant and in the expected direction. This table shows that once other factors are controlled, mother's education & wealth index emerge as one of the most important factors affecting under-5 mortality. In fact, the risk of dying for under-5 female children in rural area is 1.48 times higher than the risk for under-5 female urban children whereas the risk of under-5 male mortality in rural is 1.30 times higher than under-5 urban male mortality ($p=0.05$).

Mother's education is one of the most important factors affecting child mortality. Higher the level of education of the mother reduces the risk of dying. Under-5 male whose mother's educated are 1.14 times less likely to die than under-5 male children of illiterate women. Under-5 female children 1.5 times more likely to survive than under-5 female children of illiterate ($p=0.05$). Caste had little effect on the survivorship of the children in under-5 age group. The under-5 children (both male & female) in OBC/Others are almost 1.17 times more likely to survive than their SC/ST counterparts ($p=0.05$).

Table 2: Distribution of sex differential in under-five deaths across the six regions in India by selected background characteristics, 2005-06.

Background Variable\Region	North			Central			East			North-East			West			South		
	Male	Female	RR	Male	Female	RR	Male	Female	RR	Male	Female	RR	Male	Female	RR	Male	Female	RR
Type of Residence																		
Urban	55	56	1.02	81	88	1.09	63	57	0.90	56	49	0.88	41	37	0.90	45	37	0.82
Rural	69	79	1.14	98	112	1.14	82	84	1.02	81	83	1.02	72	72	1.00	70	62	0.89
Mother's Education																		
No Education	73	92	1.26	106	117	1.10	92	96	1.04	103	106	1.03	84	91	1.08	88	79	0.90
<5 years complete	70	72	1.03	93	105	1.13	59	66	1.12	88	81	0.92	68	55	0.81	60	59	0.98
5-10 years complete	56	34	0.61	65	78	1.20	62	45	0.73	47	46	0.98	42	37	0.88	44	36	0.82
11 or more years complete	24	21	0.88	34	46	1.35	6	15	2.50	0	56		27	5	0.19	28	16	0.57
Father's Education																		
No Education	73	91	1.25	115	125	1.09	85	99	1.16	94	102	1.09	75	94	1.25	91	91	1.00
<5 years complete	100	98	0.98	98	125	1.28	96	65	0.68	95	99	1.04	79	75	0.95	65	59	0.91
5-10 years complete	56	61	1.09	86	94	1.09	67	73	1.09	63	50	0.79	53	46	0.87	49	35	0.71
11 or more years complete	41	36	0.88	45	52	1.16	52	37	0.71	25	56	2.24	41	25	0.61	37	29	0.78
Mother's Working Status																		
Non-Working	60	32	0.53	92	105	1.14	74	79	1.07	78	76	0.97	49	47	0.96	49	45	0.92
Working	74	77	1.04	99	111	1.12	91	81	0.89	74	82	1.11	71	77	1.08	78	65	0.83
Father's Working Status																		
Non-Working	81	63	0.78	102	102	1.00	87	46	0.53	97	98	1.01	56	83	1.48	49	61	1.24
Working	64	73	1.14	94	107	1.14	78	81	1.04	76	77	1.01	59	56	0.95	62	53	0.85
Religion																		
Hindu	67	78	1.16	97	109	1.12	76	78	1.03	64	80	1.25	63	63	1.00	65	58	0.89
Muslim	64	59	0.92	87	98	1.13	82	83	1.01	101	93	0.92	35	28	0.80	48	34	0.71
Christian	NA	NA		NA	NA		94	86	0.91	75	53	0.71	0	19		43	17	0.40
Others	53	47	0.89	41	NA		118	111	0.94	111	77	0.69	66	47	0.71	59	48	0.81
Caste																		
SC/ST	71	86	1.21	107	113	1.06	98	77	0.79	68	55	0.81	66	59	0.89	57	59	1.04
OBC	61	65	1.07	89	98	1.10	71	88	1.24	61	62	1.02	61	54	0.89	57	47	0.82
Others	47	39	0.83	65	77	1.18	72	61	0.85	56	48	0.86	41	46	1.12	40	38	0.95
Wealth Index																		
Poor	81	108	1.33	108	119	1.10	88	91	1.03	100	98	0.98	83	84	0.95	84	78	0.93
Middle	76	63	0.83	91	110	1.21	69	68	0.99	65	67	1.03	62	68	1.10	72	58	0.81
Rich	50	51	1.02	62	71	1.15	56	51	0.91	36	38	1.06	43	36	0.84	39	32	0.82
Parity																		
<=2	35	36	1.03	58	71	1.22	66	45	0.68	40	46	1.15	30	28	0.93	33	29	0.88
>2	83	99	1.08	106	116	1.09	86	96	1.12	101	96	0.95	85	78	0.92	99	82	0.83
Anaemia																		
Any Anaemia	74	77	1.04	99	115	1.16	84	82	0.98	85	84	0.99	67	64	0.96	67	58	0.87
No Anaemia	57	70	1.23	88	99	1.13	68	75	1.10	59	71	1.20	50	55	1.10	55	46	0.84
Smoking/Alcoholic																		
No	64	71	1.11	94	106	1.13	76	77	1.01	73	75	1.03	59	56	0.95	59	52	0.88
Yes	115	134	1.17	113	126	1.12	118	122	1.03	108	102	0.94	101	196	1.94	120	97	0.81

Table 3. Cox regressions estimates showing risk of mortality in Under-five for the both male and female sexes by the given Covariates (background characteristics), across the regions 2005-06

Covriates		North		Central		North-East		East		West		South	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
		Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)	Exp(B)
Residence	Urban®	1	1	1	1	1	1	1	1	1	1	1	1
	Rural	1.616	1.428	1.51*	1.283*	1.334*	1.197**	1.1	1.327	0.881	1.052	1.305**	1.183**

APPLICATIONS OF STATISTICS IN BIO-MEDICAL SCIENCES*

PROF. B.B. KHARE**

An explosive growth in the development of statistical methodology over the few decades has taken place in the research of medical and public health. The related areas of research are Biostatistics, Clinical trials, Observational studies, Epidemiology, Molecular Biology and Genetics. Biostatistics has become a discipline in itself mainly not enriching the medicine but also Statistics in general. The epidemiological researches are very much useful in finding out the source of diseases and their impact on the society. Several diseases are taking place day by day due to the rapid decline in the environmental status which indirectly generates various problem for human health. Development of cities also decreases the energy level of the cities than the open area environments. Now a days, the use of Statistics has been increased in studying the impact of Social factors, environmental factor, transport and communication, increase in the population density etc. The Statistics plays a vital role in finding out the factors affecting human growth and in suggesting remedies to the problems. It is also important to study the pattern of disease prevailing in different sectors of the population and also to find out drugs which are sensitive to the prevailing problems. It is also possible to prescribe doses of different drugs in the various disease prevailing in the population in different situations. Statistics is not only useful in the study of morbidity prevailing in the population but also helps in finding out the survival of prevailing patients at different levels in the chronic disease like cancer, hypertension, epilepsy, leprosy, kidney and renal disease, TB, diabetes and glaucoma etc. The applications of the Statistical methods can be seen in the recent journals JASA and JRSS in addition to specialized Journals Biometrika, Biostatistics, Biometrics, Statistics in Medicine and Statistical methods in medical research. Altman and Goodman[1] have given a detailed description regarding the transfer of technology from statistical journal to the Bio- Medical literature in context of past data and future prediction.

Researches in Public Health and Medicine

In medical sciences, the study of growth and development of boys and girls during adolescence is an important factor. Physical growth analysis plays a vital role in assessing the growth retardation due to malnutrition and clinical disorder. The adolescence growth study in relation to growth characteristics, physiological aspects and environmental factors has been reviewed by Sathyavathi and Agarwal[2,3]. Khare[4] has reviewed the various Statistical methods used in the analysis of physical growth data. It was aimed to study the growth pattern of the boys and girls of different sections by different researchers but no proper study has been carried out which gives a norm values of healthy boys and girls during adolescence.

The growth studies are of different types:

1. Cross sectional Study
2. Longitudinal Study
3. Mixed Longitudinal Study

In cross sectional study the children are examined once and the norm values are observed for growth characteristics. In India, the growth studies using this methods has been carried out by Udani[5], Ghai et al.[6], Agarwal et al.[7], Tripathi et al.[8,9], Rath et al.[10] etc. These studies have bias in norm values due to heterogeneity in population in relation to nutritional status, education, occupation, place of residence and living standard. Some longitudinal studies have been conducted in early age up to two years in the western countries by Boas[11], Davenport[12], Meredith[13], Raynold and Wines[14], Frisch and Revelle[15] and Tanner et al.[16]. Tanner and Whitehouse[17] have reported the study of height and weight during adolescence based on longitudinal study. In India, no longitudinal study from birth to maturity has been conducted. However, a semi longitudinal method of growth evaluation for birth to fourteen years age for different socio economic group has been adopted by Datta Banik[18].

Some growth studies have been conducted for the upper socio economic group of Varanasi boys and girls during adolescence after a routine medical checkup which establishes the norm values during adolescence of boys and girls (Pereira *et al*.[19], Tripathi

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et al.[20], Agarwal et al.[21]). The mixed longitudinal studies with assessment at fixed interval of time are a compromised methodology between cross sectional and longitudinal studies. The procedure of analysis based on this method has been introduced first by Tanner[22]. In India, the mixed longitudinal studies on human growth and development have been made by Vijayaraghavan et al.[23], Sathyavathi et al.[24] and Katiyar et al.[25]).

To reduce the infant mortality rate in the country it was felt necessary to plan a country- wide study on current trend on infant and early childhood feeding practices. This helps in finding the current trend of infant and early childhood feeding practices covering all the states and union territory of the country. It was also aimed to identify the impact of parental education, caste, socio economic status, place of residence etc on the infant feeding and also other practices prevailing for hygienic condition used during breast feeding are also studied in different caste, region and socio economic group. The research work on the "Current status of infant and early childhood feeding practices" (report on collaborative study sponsored by Indian Academic of Pediatrics, India) has been published by Agarwal et al.[26] and a state wise study for feeding and weaning practices in India by Khare et al.[27].

Epidemiological Study

The main objectives for in this study are given as follows:

1. It helps to study how and why the diseases occur in different groups of people. Epidemiological information is used to plan and to evaluate the strategies for the remedy of the problem.
2. Finding the causes of diseases and their relationship with different medical and non medical factors.
3. Controlled, Cross sectional and Cohorten study is being conducted to achieve the objectives of the research.

Clinical Trials

Clinical trial is a specific discovery which can lead to a better ways of preventing, detecting and treating diseases under the specified and controlled medical conditions. Most of the hospitals are now taking parts in clinical trials, which have only begun after laboratory studies, which confirm that the new treatment or procedure is apparently safe, and has the potential to work better than existing options. In this method, the suggested use of Statistics is randomization schedules, advise on sample size, specify criteria for measuring treatment differences and analyze response rates.

Statistical Areas of Interest in Medicine

The use of statistical methods such as generalized linear models, multiple linear regression model, survival analysis, categorical data analysis and Bayesian methods are being used in medical sciences. Altman and Goodman[1] have suggested Bootstrap and computer-intensive method in Bio Medical research.

New Issues in Survival Analysis

In case of time-to-event data, the data shall be analyzed frequently, viz. In oncology, the patient's time of survival depends on surgical intervention. In this case censoring and truncation method are used. Truncation usually occurs when some patients can't be observed for some reasons related to the survival itself (viz. HIV/AIDS studies). In Bioinformatics, the recent advances in Molecular Biology and Genetics with advanced Statistics and Computer Science have been used.

Spatial Statistical Methods in Health Studies

The analysis of the geographical distribution of the incidence of disease and its relationship to potential risk factors has an important role to play in various kinds of public health and epidemiological study.

The broad areas in this methods can be given as follows:

1. Disease mapping aims to produce a map of the true underlying geographical distribution of disease incidence.
2. Ecological studies-Incidence rate of disease with group risk factors.
3. Disease clustering studies.
4. Environmental assessment and monitoring.

Statistical Applications in Biological sciences

In Biological sciences, the main objective is to find the factors and the effectiveness of different methods used during the experiment. The measure points to be focused are as follows:

1. Determination of sample size: A proper sample size is determined prior conducting an experiment which is based on the efficiency of the estimator and the cost available for survey.

2. Design of experiment: The experiments are designed in such a way that the data provides efficient and valid estimates with minimum cost.

3. Study of relationship between main and auxiliary variables: While studying the main study variable it may be useful to identify the auxiliary variable which is cheaper, closely correlated and easily available.

Analysis of Data

While analyzing the data sometimes, we are interested in estimating the parameter of the variable under study. In such cases, one may use different estimation procedures for the data available under the study along with the other auxiliary information. Some times the value of the parameter is available from the past data then one may be interested in testing the value of the parameter on the basic of sample observations using test of significance. Various test Statistics such as Z, t, chi square and F are used to test the significance according to need.

Dose and Response relationship establishing the normal values

While studying the dose and response relationship, one may be interested in fitting a regression model for the available data. Sometimes, curves are fitted to the available data and a testing of goodness of fit is carried out. In case of studying the effect of attributes on each other, a test of independent is also applied.

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MEASUREMENT ERROR AND AUXILIARY INFORMATION

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Survey data are not just the data collected from the responding sample. There are typically many other sources of information about the characteristics of the sampled population that can be used to improve inference. The data contained in these sources is often referred to as auxiliary data in the survey sampling literature. Inference using the survey data that exactly recovers key population characteristics associated with this auxiliary information is said to be calibrated on these characteristics, and is typically viewed as superior to inference that does not necessarily achieve this outcome.

Unfortunately, in most practical situations auxiliary information is not precise. For example, a common situation is where the population mean values of a set of auxiliary variables are assumed known, and survey weights are constructed so that survey estimates of these population means equal their known population values. Weights that are calibrated in this way are used extensively by national statistical agencies. However, it is not unusual that the so-called true values of the population means of the auxiliary variables that are used in construction of the calibrated weights are themselves estimates, perhaps based on administrative records that contain errors, or more often, population means of closely related, but not identical, variables measured by administrative systems. In such cases, the superiority of inference based on weights that are calibrated to incorrect population values is debatable[1].

In sample survey, we estimate the population parameter on the basis of collected data. It may originate from various kinds of sampling methods such as simple random sampling, stratified sampling, systematic sampling etc. Various methods of estimation are used under the assumption that observations collected are true (error free). In real life this kind of situations are not tenable. The real data contains observational error due to many reasons like memory failure, over- reporting, under-reporting, prestige bias etc. (see Fig. 1). These are also called measurement errors[2].

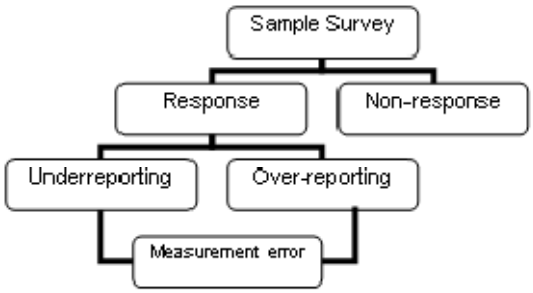

Fig. 1.0

Assume that an agency is conducting a survey of army solders to know income and expenditure pattern. Since income is a subject of high privacy and sensitivity, the surveyor could not get true information. There may be two things, either he got incorrect response or non-response. Several methods are available in the literature of survey sampling to handle the non-response but if the informer provides incorrect information the additional methodologies are required. There may be some observational errors also due to investigator.

Which are the real phenomena behind the assumed systematic interviewer effects in the model? For example, if survey instructions or definitions are unclear, they can be interpreted in different ways by different interviewers and for each interviewer may have his or her own way that is consistent through all his or her interviews. Likewise, each interviewer may have his or her own way of handling ambiguous or unclear responses. Personal characteristics of an interviewer such as age, race, gender, social class,

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education, attitudes, and beliefs, may have a tendency to systematically influence the measurements made by the interviewer. Other external factors that could explain the interviewer are for example: the questionnaire, the mode of interview, methods of training, supervising, and monitoring the interviewer routines.

Application in Econometrics

In the ordinary least square estimation we make an assumption that the variables Y and X are recorded without the measurement error. But this is not true in practical situations. We, generally encounter two situations[3] :

Errors of measurement in the dependent variable Y:

Consider the following model:

$$Y_i^* = \alpha + \beta X_i + u_i \qquad (2.1)$$

where, Y_i^* = permanent consumption expenditure

X_i = current income, u_i = stochastic disturbance term

Since, Y_i^* is not directly measurable, we may use an observable expenditure variable Y_i such that $Y_i = Y_i^* + e_i$

where e_i denote errors of measurement in Y_i^*. Therefore, instead of estimating (2.1), we estimate

$$Y_i = \alpha + \beta X_i + u_i + e_i$$
$$= \alpha + \beta X_i + v_i \qquad (2.2)$$

where $v_i = u_i + e_i$.

For simplicity assume that $E(u_i) = E(e_i) = 0$, cov $(X_i, u_i) = 0$ (assumption of CLRM),

And cov $(X_i, e_i) = 0$; and cov $(u_i, e_i) = 0$.

With these assumptions, it can be seen that β estimated from either (2.1) or (2.2) will be unbiased estimator of the true β; that is, the errors of measurement in the dependent variable Y do not destroy the unbiasedness property of the OLS estimators.

$$\text{var}(\hat{\beta}) = \frac{\sigma_u^2}{\sum x_i^2} \qquad (2.3)$$

$$\text{var}(\hat{\beta}) = \frac{\sigma_v^2}{\sum x_i^2} = \frac{\sigma_u^2 + \sigma_\varepsilon^2}{\sum x_i^2} \qquad (2.4)$$

Therefore, although the errors of measurement in the dependent variable still give unbiased estimates of the parameters, the estimated variances are now larger than in the case where there are no such errors of measurement.

Errors of measurement in the explanatory variable X :

Now assume that instead of (2.1), we have the following model:

$$Y_i = \alpha + \beta X_i^* + u_i \qquad (2.5)$$

Where, Y_i = current consumption expenditure

X_i^* = permanent income, u_i = disturbance term (equation error)

Suppose instead of observing X_i^*, we observe

$$X_i = X_i^* + w_i \qquad (2.6)$$

where w_i represents errors of measurement in X_i^*. Therefore, instead of estimating (2.5), we estimate

$$Y_i = \alpha + \beta (X_i - w_i) + u_i$$
$$= \alpha + \beta X_i + z_i \qquad (2.7)$$

Where $z_i = ui - \beta w_i$, a compound of equation and measurement errors.

Now even if we assume that w_i has zero mean, is serially independent, and is uncorrelated with u_i, we can no longer assume that the composite error term z_i is independent of the explanatory variable X_i because (assuming $E(z_i) = 0$)

$$\text{Cov}(z_i, X_i) = E[z_i - E(z_i)] [X_i - E(X_i)]$$
$$= E (w_i) (u_i - \beta w_i) = E(-\beta w_i^2)$$
$$= - \beta \sigma_w^2 \qquad (2.8)$$

Thus, the explanatory variable and the error term in (2.7) are correlated, which violates the crucial assumption of CLRM that the explanatory variable is uncorrelated with the stochastic

disturbance term. If this assumption is violated, it can be shown that the OLS estimators are not only biased but also inconsistent, that is, they remain biased even if the sample size n increases indefinitely[3].

Also, we have

$$\operatorname{plim}\hat{\beta} = \beta\left[\frac{1}{1+(\sigma_w^2/\sigma_x^2)}\right] \tag{2.9}$$

Since the term inside the brackets is expected to be less than 1, eqn. (2.9) shows that even if the sample size increases indefinitely, $\hat{\beta}$ will not converge to β.

Therefore, measuremental errors pose a serious problem when they are present in the explanatory variable(s) because they make consistent estimation of the parameters impossible.

Solution: Use instrumental or proxy variable that, although highly correlated with the original X variables, are uncorrelated with the equation and measurement error term (i.e., u_i and w_i). If such proxy variables can be found, then one can obtain a consistent estimate of β. But this task is much easier said than done. In practice it is not easy to find good proxies. Besides, it is not easy to find out if the selected instrumental variable is in fact independent of the error terms u_i and w_i [3].

Application in Sampling

In survey sampling, the properties of the estimators based on data usually presuppose that the observations are the correct measurements on characteristics being studied. Unfortunately, this ideal is not met in practice for a variety of reasons, such as non response errors, reporting errors, and computing errors. When the measuremental error is negligibly small, the statistical inferences based on observed data continue to remain valid. On the contrary when they are not appreciably small and negligible, the inferences may not be simply invalid and inaccurate but may often lead to unexpected, undesirable and unfortunate consequences.

For a simple random sampling scheme, let (x_i,y_i) be observed values instead of the true values (X_i,Y_i) on two characteristics (x,y) respectively for the i^{th} (i=1.2….n) unit in the sample of size n. Let the measurement errors be

$$u_i = y_i - Y_i \tag{3.1}$$

$$v_i = x_i - X_i, \tag{3.2}$$

which are stochastic in nature with mean zero and variances σ_u^2 and σ_v^2 respectively, and are independent. Further,, let the population means of (x, y) be (μ_x, μ_y): population variances of (x,y) be (σ_x^2, σ_y^2) and σ_{xy} and ρ be the population covariance and the population correlation coefficient between x and y respectively.

Bahl and Tuteja[4] suggested an exponential ratio type estimator for estimating $\bar{y}$ as

$$t_1 = \bar{y}\exp\left(\frac{\mu_x - \bar{x}}{\mu_x + \bar{x}}\right)$$

Kumar et al. (2011) derived the bias and MSE expression for the estimator t_1 under measurement error as:

$$\operatorname{Bias}(t_1) = \frac{1}{\mu_x}\left(\frac{3}{8}R_m V_{xm} - \frac{1}{2}V_{yxm}\right)$$

where $R_m = \frac{\mu_y}{\mu_x}$.

$$\operatorname{MSE}(t_1) = \frac{\sigma_y^2}{n}\left[1 - \frac{C_x}{C_y}\left(\rho - \frac{C_x}{4C_y}\right)\right] + \frac{1}{n}\left[\frac{\mu_y^2}{4\mu_x^2}\sigma_v^2 + \sigma_u^2\right]$$

$$= M_{t_1}^{*} + M_{t_1} \tag{3.5}$$

Where $M_{t_1}^{*} = \frac{\sigma_y^2}{n}\left[1 - \frac{C_x}{C_y}\left(\rho - \frac{C_x}{4C_y}\right)\right]$ is the mean squared error of t_1 without measurement error.

and $M_{t_1} = \frac{1}{n}\left[\frac{\mu_y^2}{4\mu_x^2}\sigma_v^2 + \sigma_u^2\right]$ is the contribution of

measurement errors in t_1.

Koyuncu and Kadilar[5] suggested a regression type estimator t_2 as-

$$t_2 = \omega_1 \bar{y} + \omega_2 (\mu_x - \bar{x}) \tag{3.6}$$

Kumar et al.[6] derived the bias and MSE expression for the estimator t_2 under measurement error as:

$$\text{Bias}(t_2) = \mu_y (\omega_1 - 1) \tag{3.7}$$

$$\text{MSE}(t_2) = \mu_y^2(\omega_1 - 1)^2 + \frac{1}{n}\omega_1^2\sigma_y^2 + \frac{1}{n}\omega_2^2\sigma_x^2 - \frac{2}{n}\omega_1\omega_2\rho\sigma_y\sigma_x + \frac{1}{n}\left(\omega_1^2\sigma_u^2 + \omega_2^2\sigma_v^2\right)$$

$$= M_{t_2}^* + M_{t_2} \tag{3.8}$$

where,

$$M_{t_2}^* = \mu_y^2(\omega_1 - 1)^2 + \frac{1}{n}\omega_1^2\sigma_y^2 + \frac{1}{n}\omega_2^2\sigma_x^2 - \frac{2}{n}\omega_1\omega_2\rho\sigma_y\sigma_x$$

is the MSE of t_2 without measurement error and

$$M_{t_2} = \frac{1}{n}\left(\omega_1^2\sigma_u^2 + \omega_2^2\sigma_v^2\right)$$ is the contribution of measurement error in t_2.

We observe that we get different values for bias and MSE expressions for the estimator's t_1 and t_2, if we consider the effect of measurement error.

Conclusion

From the discussions made in above sections, we observe that if we ignore the effect of measurement error we get misleading results. So, while making observations, this may be the case of econometrics, sociology, economics etc. due attention must be given for making correct observations. And, if we feel the observations have some measurement error, we should make proper adjustments in the formulae which we are using.

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GROUND WATER PROSPECTING IN ANCIENT INDIA

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Ours is an ancient country with a rich heritage of culture. Its reminiscences are found in the inscriptions on rock pillars and other scriptures, to quote Prof. Sher Singh (the then Minister of Education, India) "The excavations of Pilibanga area in Rajasthan provide glimpses of the past history of ground water development practised by the Harappan civilisation. We also know from the Nalanda University excavations of the Buddhist culture in Bihar that they had adequate knowledge of water existence as seen from the ancient wells at these sites." (Address at the International Symposium of Ground Water Resources Organised in Madras on Nov. 26, 1973).

It is hardly necessary to emphasize the requirement of water for life. In the Vedic literature, water is said to have been present at the beginning of world and the life developed out of it.

सलिलं सर्व मा इदम्-ऋग्वेद

Water has been termed as nectar of life. This is more true in areas having scarcity of water. Not to speak of arid tracts it is required even in well-water regions by the inhabitants of kingly palaces and remote huts alike. Its necessity is not merely confined to drinking but also in other activities which supplement in sustenance of life. Important among these are agriculture and industry where role of water cannot be over emphasized. They have increased in leaps and bound with the advancement of civilization and scientific knowledge.

Our ancients had very cautiously explored the different sources of water on the Earth and also tried to exploit them to maximum possible extent. The various sources, in addition to rain water, include turbulent streams, calm ponds, tinkling springs and above all the ground water, which, too, did not escape the attention of our ancients.

The exploration and exploitation of ground water was assigned largely to astrologers in ancient times. They took help of the movement of stars, planets and asterisms in the sky to locate it. Also they could predict the direction of its movement. Besides celestial bodies the ancients made use of various surface and sub-surface indications such as lithology, faunal occurrences' and floral cover, either individually or combined. Further, the astrologers could indicate suitable site and time for the construction of well through which a perennial supply of ground water could be ensured of various purposes.

These indications differ for humid and arid tracts, and further for sweet and saline waters. Their critical account has been given in the following pages.

Occurrences

As we all know, the hydrologic cycle is continuously operating on the surface of the Earth, below it and above in atmosphere. The infiltration into the sub surface results to ground water. This process is greatly effected by vegetation. Normally a thick vegetation retards the surface run off. Hence, the water gets sufficient time to infiltrate along roots of plants, and the sub soil and soil zones become very spongy. Consequently, there is a quick percolation of water further into sub surface zones, and thus forming under ground streams "veins" as termed in "Dakargal") going deeper.

In arid regions the depth of these veins is likened with the camel's neck which is quite deep with reference to its mouth.

मरुदेशे भवतिशिरा यथा-तथातः संप्रवक्ष्यामि।

ग्रीवाकरभाणामिव भूतलसंस्था शिरा यान्ति।।[1]

Contexually, it may be added with interest that while going through for water in arid regions of Gujarat, the tube wells are constructed doen to depths of 100 to 300 m. (Pathak and Prasad 1973). Again in Rajasthan, the deepest well has been bored in Lathi formations of Jaisalmer area. Three individual saturated zones have been identified in the depth range of 67-100m, 150-200m and 240-280m. (Pathak and Prasad op cit).

The under ground streams flow in numerous directions and are named separately. Those following

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1. सारस्वत दकार्गल 62

the principal cardinal direction are named after the respective Lord of each of them.

Vegetation had been a very useful indicator to the ancients for locating ground water, both in arid and humid regions, for instance, in the former, JUJUBE (Zyzyphus sp.) and PILU (Salvadora persica) trees occurring together, a Date Palm (Phoenix dactylifera) treet, or an Indian fig tree (Ficus glomeras); and in the latter region, VAT tree (Ficus bengalensis) together with ASWATTHA trees (Ficus religiosa). This fact is acknowledged even today. To quote Fosberg (1965): "Phreatophytic vegetation, that which is deep rooted enough to tap ground water, will often show the course of under ground channels and the location of ground water at relatively shallow depths in areas where no surface water is evident." Further, the vegetation may also serve as a negative evidence, e.g.

सुषिरा जर्जरपत्रा रूक्षाश्च जलेन संत्यक्ता:[2]

Meaning that hollow and rough trees with shattered leaves do not indicate water.

Vegetation coupled with fauna proved more useful in predicting existence of ground water both in humid and arid tracts. Saraswati Dakargal is replete with examples. For instance, ant hill near a JAMBU tree (Syzygium cumini) or beneath a JUJUBE (Zyzyphus sp.) tree; a snake's hole either the south of KARANJA tree (Pongamia Pinnata) tree or to the north of MADHUKA tree (Madhuka indica) and KARIR tree (Bombax), etc. In this connection it may added that the various animals reported by the ancients are mostly of hibernating nature. Their presence near a ground water source is but natural.

On the above bases (vegetation and fauna) taken together the ancients could also indicate the direction of ground water 'vein' as well as quality (both physical and chemical) of the water.

More interesting from a geologist's standpoint are the lithological indications taken into account by the ancients. The nature of the rock types either alone or combined with floral/fauna factors had been utilized by them. In respect to humid tracts it has been stated:

(i) **नदतिमहीगम्भीरं यस्मिं चरणहता जलं तस्मिन्।**
साधैस्त्रिभिर्मनुष्यै: कौबेरी तत्र च शिरा स्यात्।।[3]

Meaning that where the ground responds sweetly to stamping of feet there a northerly vein of water flows at a depth of 15.1/2 cubits.

(ii) **स-पलाशा यत्र शमी पश्चिमभागेऽम्बु मानवै: षष्ठ्या।**
अर्धनरेऽहि प्रथमंश-बालुका पीत मृत्परत:।।[4]

Meaning that where S'AMI tree (Prosopis Specigera) is occurring together with PALASA tree (Butea monosperms), yellow clay mixed with sand at depth of 2.1/2 cubits will be found and water will be found at a distance of five cubits to the west of the tree at a depth of 300 cubits.

(iii) **नमते यत्र धरित्री सार्धे पुरुषेऽम्बु जांगला नेपू।**
कीटा वा यत्र बिना लयेन बहवोऽम्बु तत्रापि।।[5]

Meaning that in a humid tract or even less humid tract water will be found at a depth of 7.1/2 cubits where the ground goes when trodden upon and numerous insects are living without their houses.

1 cubit = 1. 1/2 feet

Again, for arid tracts it has been observed as follows—

(i) **यत्र स्निग्धा निम्ना स-बालुका सानुनादिनी वा स्यात्।**
तत्रार्धपंचमैवारि मानवै:पंचमिर्यादि वा।।[6]

meaning water occurs at a depth of 20-25 cubits where the ground is smooth, depressed, sandy and produced sound on stamping,

(ii) **पश्चार्दुम्बरस्य त्रिभिरेव करैर्नरद्वये सार्धे।**
पुरुषे सितो हिरश्मांजनोपयोऽध: शिरा सुजला।।[7]

Meaning that if an Indian fig tree (Picus glomerata) is found in a waterless tract then 3 cubits to its west will be found a white snake at a depth of 5 cubits and thereafter a black colored stone, and water will be found at a depth of 12.1/2 cubits.

2. सारस्वत
3. सारस्वत, दकार्गल 54
4. सारस्वत, दकार्गल-83
5. सारस्वत, दकार्गल 63
6. सारस्वत, दकार्गल 61
7. सारस्वत, दकार्गल 11

(iii) **जलपरिहीने देशे वृक्षः कम्पिल्लको यदा दृष्टः।**
प्राच्यां हस्तत्रितये बहति शिरा दक्षिणे प्रथमम्।।
मृन्नीलोत्पलवर्णा कापोता चैव दृश्यते तस्मिन्।
हस्तेऽजगन्धिको मत्स्यो भवति पयोल्पं च सक्षारम्।।[8]

Meaning that where in a waterless tract KAMPILAK tree (Mallotus phillippinensis) is occurring, firstly a blue colored clay will be found which is followed below yellow or dove colored clay capping the ground water at a depth of 3.1/4 cubits. The water vein will be flowing in a southerly direction and it will be less in amount and brackish in nature.

Also, a fish smelling like a goat will be found at a depth of one cubit.

(iv) **यदि वेतसोऽम्बुरहिते देशे हस्तैस्त्रिभिः ततश्चपश्चात्।**
सार्धे पुरुषे तोयं बहति शिरा पश्चिमा तत्र।।
चिन्हमपि चार्धं पुरुषे मण्डूकः पाण्डुरोऽथ मृत्पीता।।
पुटभेदकश्च तस्मिन् पाषणो भवति तोयमधः।।[9]

Meaning that if VETAS tree (Salix caprea) is found in a waterless tract, then 2 cubits to its west and at a depth of 15 cubits a vein coming from west will be found and at a depth of 2.1/2 cubits, there would be a pale white frog, thereafter yellow clay, and farther down very hard stone and underneath which thee will be water.

Further, the depth at which a 'vein' would occur could be judged by the sound produced by stamping of feet on the rock; for instance, if the sound is sweet, water vein will be found flowing in northerly direction at a depth of 15.1/2 cubit

(v) **नदति मही गंभीरं यस्मिन् चरणहता जलं तस्मिन् ।**
सार्धेस्त्रिभिर्मनुष्यैः कौबेरी तत्र च शिरा स्यातः[10]

Besides, the nature, color of the rock/soil offered negative evidence to ancient Indian hydro scientists. The sage Manu observes--

(i) **सूर्याग्नि भस्मोष्ट्र खरानुवर्णा,**
या निर्जला सा वसुधा प्रदिष्टा।*

Meaning that the land which is having color like Sun, fire, ash, camel and ass will be waterless.

(iv) **ताम्रैःसमेता पृषतैर्विचित्रैरापाण्डुमस्मोष्ट्रखरानुरूपा।।**
भृंगोपमांगुष्ठिकपुष्पिका वा सूर्याग्निवर्णा च शिला वितोया।।*

Meaning that a land having rocks, which bear red or variegated spots, or pale white in color or ash colored or camel or donkey or fire or Sun or a base will be without water.

The various factors outlined above, in regard to locating of ground water are summarized.

Drilling of water

Not only the indications of occurrences of ground water are important but also the suitable methods of rock breaking and drilling for successful exploitation of ground water, especially in hard terrains where specialized types of drilling equipments like the bits are needed. Our ancients had recommended various methods of rock breaking such as hammering, repeated heating and cooling, and pouring special chemical solutions on the rock surface, which were prepared by mixing medical plants and other things. Ancient thinker Manu observed that a rock will break if it is heated and dripped with solution of mixture of the ashes then reeds is sprinkled on it seven times.

तोयं सूतं मोक्षकमस्मना यत् तत् सप्त कृत्वः परिषेचनं च।
कार्यं शरक्षारयुतं शिलायाः प्रस्फोटनं वह्निविताषितायाः।।[11]

Moreover, during the courses of drilling if a rock cannot be broken by even hammering, fire should be made on it with the logs of PALASA tree (Butea monosperma) and TINDUKA tree (Diasypros embryopteris) until the rock assumes the color of fire, and then lime water be sprinkled over to break it. There are many more suggestions for breaking rocks.

As compared to these simple processes, the modern methods of rock breaking to loosen the rock cover involves operation of heavy drilling rigs and hence, expensive too. Further for, drilling through hard rocks the drilling bits made of special forged steels are hardened by "heat treatment". But the ancients, on the

8. सारस्वत, दकार्गल 21-22
9. सारस्वत, दकार्गल 6-7
10. सारस्वत, दकार्गल 54
* 1 हस्त = 18 inches = 1.5 feet = 1 cubit
11. मनुदकार्गल 113

other hand, have recommended easy and less expensive methods of hardening "TANKEE".

आर्कं पयोहुड विषाण-मषीसमेतम्
पारावताखु शकृता च युतः प्रलेपः।
टंकस्य तैल मथितस्य ततोऽस्य पानम्
पश्चाच्छितस्य न शिलासुवेद विधातः।।[12]

Meaning that a "TANKEE" rubbed with oil and them smeared with an unguent prepared with the milky juice of MADHUKA (Madhuka indica) plant, the ashes of the goat's horn and the excreta of doves and mice and then whittled, will not break while breaking a stone.

क्षारे कदल्या मथितेन युक्ते,
दिनोषिते पायितमायसं यत्।
सम्यकक्षितं चाश्मनि नैति भंगं,
न चान्य लोहेष्वपि तस्य कौण्डम।।[13]

Meaning that an iron weapon treated with day-old mixture made of the burnt powder of plantain and butter-milk, and then sharpened properly will not become blunt on stone or other iron instruments.

Protection and purification of water

India is a tropical country. The chances of water losses through evaporation due to Sun's heat and hot gale, from well exposed surfaces of water bodies like wells and ponds are greater. Further, the tropical climate rears numerous types of animals, mostly inspects and bacteria. These small creatures are very much responsible for polluting the atmosphere and water bodies, more so the wells and ponds.

These facts did not escape the attention of ancient hydro scientists.

Manu has recommended planting of trees near a water body like a well or pond to save heavy evaporation of water. These trees may of ASHOKA (Saraca indica), AMRA (Mangani-fera indica), IMLI (Tamarindus indicus) and VAT (Ficus bengalensis). Naturally, under the thick shade of these trees, evaporation from surface of water body will be lessened. Further, to counteract the effect of hot gale Manu has recommended the construction of wells and ponds in the an east-west direction rather than in North-South direction. He writes:

पाली प्राग परायताम्बुसुचिरं धत्ते न याम्योत्तरा।
कल्लोलैखदारमेति मरुता सा प्रायशः प्रेरितैः।।[14]

In regard to purification of water Manu observed that the water will become clear, tasty, good smelling and endowed with other good qualities by adding a powdered mixture of ANJAMA (antimony), NAGARMOTHA (Cyperus rotundus), KHAS (Andropogon Sp.), and TAROI or RAJKOSHATIKI (Luffa egyptiaca) and seeds of KATAKA or NIRMALI (Strichnos potatorum) to the well water which is muddy, punget, saltish or bad in taste.

Conclusion

In the preceding pages an attempt has been made to outline the criteria employed by ancients for prospecting ground water. They may be utilized with advantage even today. They can particularly be helpful in reducing the cost of test borings. With the application of modern resources and techniques, however, greater precision and success can be achieved. The late Prime Minister, Indira Gandhi had once remarked "Modernisation does not mean that we should totally disregard the old values. Coordination between modern science and ancient teachings of sages is necessary for the development of humanity."[15]

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15. Natural Sciences

MOMORDICA CULTIVATION: SCOPE FOR REMUNERATIVE VENTURE FOR FARMERS

PRASANN KUMAR* AND PROF. PADMANABH DWIVEDI**

Momordica (Spine gourd) is a rhizomatous, perennial and dioecious species of the family Cucurbitaceae and grows widely in many parts of India (Table 1). Vernacular names are Kartoli, Kakrol, Meethakarela, Padora, Bhatt Karela, Palupagal, Tumba, Tumpai, Golkandra, Kankad, Kankera, Bara-Karela, Kankoda, Kankodan, Kantola, Spine gourd and Phalguni. In India, it is mainly grown in Odissa, Bihar and West Bengal. It is found in nature in Punjab, Uttar Pradesh, Rajasthan, Madhya Pradesh, Kerala and Maharashtra especially in areas with the least human interference. Its delicacy is typical and attributed to high seed protein content. It also contains high amount of carotene (160 microgram / 100 g of edible portion) and its tuberous roots have medicinal values too. It is a cheap source of vitamin and minerals. This vegetable is gaining popularity because of its high demand in market. Certain limitations like lack of awareness among farmers, non availability of quality planting materials of standard variety, unpredictable sex ratio in seedling progenies are restricting the expected spread of this nutritious vegetable.

Table 1: Taxonomic classification

Kingdom	Planate
Order	Cucurbitales
Family	Momordica
Genus	Momordica
Species	*Momordica dioica*

[Source: Handbook of Horticulture]

COMPOSITION AND USES

Food value

It has high food value containing high amount of carotene amongst the cucurbitaceous vegetables and high amount of protein and fair amount of phosphorus, calcium and iron. It is a cheap source of vitamin and minerals (Table 2).

Table 2: Nutritive value (per 100 g of edible portion)

Constituents	Amount
Moisture	84.1g
Energy (kcal)	52 kcal
Protein	3.1g
Fat	1.0g
Minerals	1.1g
Fiber	3.0g
Carbohydrate	7.7g
Calcium	33mg
Phosphorus	42mg
Iron	4.6mg
Carotene	162mg
Thiamine	0.05mg
Riboflavin	0.18mg
Niacin	0.6mg

[Source: Handbook of Horticulture]

Edible uses

Immature tender green fruits are cooked as vegetable. Young leaves, flower and tuberous roots are also eaten. Fruits are available from July to October in north India.

Medicinal uses

Momordica possesses medicinal and curative properties. Decoction of leaves reduces fever, tuberous roots help in relieving headache, excess sweating, stone formation and migraine, while fruit is quite helpful in controlling diabetes and blood pressure. Raw fruits act as an appetizer and astringent, fruits also contain aliphatic compounds. Tuberous roots are used for curing diarrhea, fever and rheumatism by tribals. Seeds are used against chest problems and stimulate urinary discharge.

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CLIMATE AND SOIL REQUIREMENT

Momordica is a plant of warm season. For prolific growth of vine, high humidity and 25-30^{o}C temperature are required. It can successfully be raised in areas where average rainfall is 150-250 cm. For excellent vegetative growth and fruiting, a temperature range of 32-40^{o}C is conducive. In severe winter, underground tubers undergo dormancy. Being a hardy crop, it can be grown in different kinds of soil. However, sandy soil rich in organic matter with provision of good drainage are considered ideal. Soil pH should be in the range of 6 and 7. Before planting, field should be deeply ploughed 3-4 times and thereafter harrowing is done to remove the pieces of perennial weeds.

IMPROVED VARIETIES

At Indian Institute of Vegetable Research, Varanasi two genotypes namely MS-15 and MS-18 are identified for maximum yield i.e. 2.85 and 2.8 kg/plant, respectively from a collection of 18 genotypes from Vindhyachal hills of Mirzapur in Uttar Pradesh. A total of 40 divergent genotypes were collected from different parts of Odissa and are being maintained at Central Horticulture Experimentation Station, Bhubaneswar, a regional station of Indian Institute of Horticulture Research, Bangalore. *Indira kankad I*- is released by RMD College of Agriculture and Research Station (Indira Gandhi Agriculture University), Ambikapur (Chhattisgarh). It is resistant to major pests. Its fruits are very attractive and dark green in colour and weigh about 14 g each. On an average the fruit yield is 8-10q/ha in first year, in second year 10-15q/ha and third year onwards 15-20q/ha. One plantation continues to yield satisfactorily for about 5-6 years.

PROPAGATION

Spine gourd is propagated by seed as well as vegetative means.

Seed propagation

Seeds of spine gourd rest in dormant conditions, hence, freshly extracted seeds should not be sown for 5-6 months. Seed dipping in tap water for 24 hours before sowing stimulates germination process. The major problem of seed production is 1:1 ratio of male and female plants and delay in fruiting. In seed propagation sex of plants from seeds can not be pre-determined. So 4-5 seeds can be sown in a pit. After flowering, male plants should be removed from the pit leaving 2-3 healthy female plants.

By tuber

Tuberous roots do not have dormancy and plants raised through tubers are healthy. Tubers are obtained from 2 -3 years old plants and 80-120 g pieces are made for planting. Every planting piece of tubers must have at least 2 buds for sprouting. Enhanced sprouting of tuberous root cuttings (87.5%) could be obtained following dipping in 1% Thiourea whereas untreated tubers produce only 18.3% sprouting. Planting may be done in month of early September-October or February-March. Agricultural scientists reported the best time for planting tubers as February under irrigated conditions and June –July in rainy season. Tuberous roots are planted at spacing of 3 meter.

By stem cuttings

For raising plants by this method, cuttings are made from terminal portions. Terminal cutting produced more nodes per plant and leaves, leaf area and inter nodal length than basal cuttings.

Grafting

Spine gourd is grafted on root stock of *Cucurbita moschata*, *Cucurbita trifolia* or F1 hybrids of *Cucurbita maxima* X *Cucurbita moschata.*

PLANTING METHOD

Tubers are planted in the field in trench method. 30-35 deep trenches are made and filled with FYM. Large size tubers (80-100g) should be placed in furrows at a depth of 8-10 cm maintaining a spacing of 1m x 1m (Ali et al., 1997).

MANURES AND FERTILIZERS

Recommendations based on experimental basis for nutrient requirements of spine gourd are not available. In general, 200-250 q/ha FYM are mixed in soil at the time of field preparation. During March-April, 20-30 g urea/plant is applied and the same amount is repeated at the time of fruit formation. It is recommended to apply 30 kg per ha each of N, P and K for higher yield and fruit size (Table 3).

Table 3: Recommendation of Fertilizers

FYM	20-25t/ha or 2.6-3.3 ton/bigha
Urea	108.5kg/ha or 14.35kg/bigha
SSP	250kg/ha or 33kg/bigha
MOP	83kg/ha or 10.97kg/bigha

[Source: Handbook of Agriculture]

IRRIGATION/ WATER MANAGEMENT

Just after planting, a light irrigation is required for proper establishment of cuttings. During summer months, frequent watering is desired. In rainy season care should be taken for proper drainage as plant is quite sensitive to water logged conditions.

INTERCULTURAL PRACTICES AND WEED CONTROL

During early stage of vine growth, 2 to 3 hand weeding may be followed to reduce the infesting weed population. Crop of spine gourds does well on bushes or hedges. For staking of vines, bower may be made at height of 4-5 feet above the ground. Training must be started just after 30 cm of vine length from the ground level.

Training and pruning

As the crop is climbing in nature, provision of supporting structures encourages proper vegetative growth and thereby contributes to good yield of quality fruits. Different systems of training viz., single stake system, bower and knifing are followed as per availability of training materials. As bower and knifing systems are expensive, plants are allowed to grow on waste bushes. But higher yield and better quality fruits are obtained in vertical net trellies where hand pollination could be performed perfectly, quickly and easily when compared with other systems of training.

PLANT PROTECTION PRACTICES

Insect pest

1. *Epilachna* beetle (*Epilachna vigintiopunctata*)

Fig. A. Adult of *Epilachna* beetle

Both adult and grubs feed on leaves. As a result feeding by both grubs and adults on green chlorophyll, characteristic sketletonized patches, which present a lace like appearance on leaves, are developed and turn brown, dry up and fall down (Figure A). This pest can be controlled by hand picking of grubs, adults and egg along with infested leaves during early stage of attack and destroying them are suggested to reduce the infestation. The genotype RMF37 is tolerant to the pest.

2. Fruit borer (*Diaphania indica*)

Fig. B. Adult of *Diaphania indica*

It is a major pest of spine gourd. It scraps the tender tissue of leaf in vegetative stage of crop. In fruiting stage, it scrapes tender skin of fruit. When it is grown up it bores into the fruit (Figure B). It can be effectively controlled by spraying Bt@1g/ l of water.

3. Fruit fly (*Bactocera cucurbitae*)

Fig. C. Adult of *Bactocera cucurbitae*

Damaged fruits give foul odor. It lays eggs inside the fruit (Figure C). This pest may be controlled by:

1. Collection and destruction of infected fruits.
2. Use of cue lures traps @ 10 per hectare.
3. Spraying of Malathion (2 ml) and jaggery (10 g) in 1 liter of water at weekly interval.

DISEASES

1. Anthracnose

Fig. D. Affected leaf with Anthracnose

Symptoms: Spots appear as small yellowish, water soaked areas, which enlarge in size, that later coalesce and turn brown to black in color (Figure D).

Control: Seed treatment, proper rotation and clean cultivation minimize initial inoculums.

2. Powdery mildew

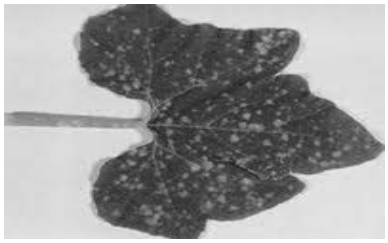

Fig. E. Affected leaf with Powdery mildew

Symptoms: Symptoms first appear as nearly white or fluffy, somewhat circular patches or spots which appear on under surface of leaves. Severely attacked leaves become brown and shriveled and defoliation may occur (Figure E).

PHYSIOLOGICAL DISORDER: Unfruitfulness

Unfruitfulness is mainly associated with dioecious cucurbits where staminate and pistilate flowers are produced on separate plants. In these cucurbits only female plant produce fruits and male plants act as pollen donor. Therefore, it is necessary to grow desired number of male plants, approximately 10% in the field to ensure proper fertilization, pollination and fruit set (Peter, 2007). It can be controlled by:

1. Maintaining the desired population of female 90% and male 10% plant in the field.
2. Avoiding application of plant protection chemicals in the morning hours to increase the movement of pollinating insects.

HARVESTING AND YIELD

Fruits take 25-27 days to reach maturity. Marketable fruits are obtained 12 days after fruit set. Green fruits at proper stage of maturity should be harvested. Delay in harvesting causes yellowing of fruits colour of pedicel, pericarp and spine remain green until12-13 days after flowering and thereafter the color changes.

Maturity indices

There are several parameters which can be selected for measurement of maturity index of harvested crop, such parameters are [1] pedicel color, [2] spine color, [3] specific gravity, [4] respiration rate, [5] chlorophyll content and, [6] dry weight. Harvesting is done in frequent intervals. Fruits are ready for harvest within 75-80 days in first year and 35-40 days from second year (tubers formed during first year) onwards up to 5-6 years. Fruits yield thereafter declines. Harvesting of fruits twice a week increases yield of crop. Fruits should be harvested at mature green stage and seeds become hard if harvesting is delayed for a day or two. Fruits attain marketable maturity within 7-10 days of pollination. Under optimum crop condition spine gourd yields 75-100 quintals fruits per hectare.

SEED PRODUCTION

The seed crops are not grown in any way differently from that of the table crop. The only difference is that instead of picking fruits at vegetable maturity the fruits are allowed to mature fully on the plant itself. This also requires long dry and warm season for seed production. General agronomic practices are almost similar to that of muskmelon or watermelon. For getting early crop, the seeds can be sown in polythene bags and transplanted later in the field. The seed field should be separated from the fields of other variety not conforming to varietal purity requirements for certified seed.

Harvesting of Fruit for Seed Extraction

For seed extraction fruits should be harvested at full maturity (Figure F). Several factors are taken into consideration to judge the maturity in spine gourd :

1. When fruit colour changes to yellow or yellow orange or straw colour,
2. When the peduncle becomes straw coloured,
3. When the vines start drying. Any deformed fruit should be removed earlier

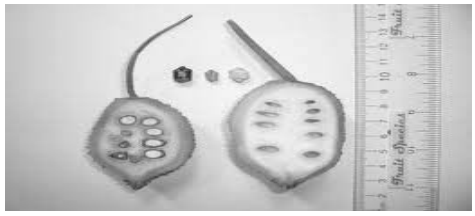

Fig. F. Fruit for seed extraction

Seed Extraction and Washing

Before seed extraction fruits should be stored at room temperature for 4 to 7 weeks. Spreading is done in one single layer with a space between the fruits, preferably in a cooler dry place. Afterward, the fruits are cut into half and scoop out the seed by hand. Some placenta may remain with the seeds which are to be separated by rolling and raking simultaneously. Then

the seeds are to be washed with water in troughs.

Seed Drying

The washed seeds should be dried quickly. For this, trays with screen wire or burlap bottoms may be used. The seeds are spread on trays and placed in the shade and gradually to sun to dry and continued up to a moisture level of 7 percent. Frequent turning of seeds ensures uniform drying. Seeds may be dried more rapidly in a drier or dehydrator employing artificial heat and forced air circulation for large quantity. Seed should be dried carefully at a temperature not exceeding 38-42°C.

Seed Storage

For safe storage, moisture content of the seeds should be seven percent. Moisture determinations should be made on properly drawn samples of seed at the temperatures prevailing in the seed storage facility. The well dried seeds are placed in containers and stored in a cool, well-ventilated room, preferably provided with some means of dehumidification and with protection from rats and other pests. For retail sale, tin can with moisture resistant polyethylene or aluminum foil as wrap or liner can be used.

Seed Yield

The average seed yield is about 500-1000 kg per hectare depending upon the cultivar, pollination and cultural managements.

ROUGING OF SEED CROP

The existence of off-type plants in the seed crop is a potential source of genetic contamination. The removal of such plants is termed as rouging. Not only the off-types but the diseased and abnormal plants are also to be removed. The number of rouging required for the seed crop will vary with the kind of vegetables, purity of the seeds sown, nature of the previous crop, etc. Rouging may be done at the following stages as soon as the off-types are recognizable:

1. Vegetative stage
2. Flowering stage
3. Maturity stage

In the seed crop, off-type plants should be rouged out at different times of the day by walking in different directions of the plot. In general, the cross-pollinated vegetable crop for seed production should be thoroughly rouged before flowering. Regular supervision by trained manpower is important.

WASHING AND DRYING OF VEGETABLE

Most of the vegetables are washed after harvesting to improve their appearance, prevent wilting and remove primary inoculums load of microorganisms. Hence a fungicide/bactericide should be used in washing water. Washing improves shelf life. After washing excess of water should be removed as this otherwise might encourage microbial spoilage.

Grading

Immature, diseased and badly bruised vegetables are sorted out. Most of countries are having their own set of standards of domestic trade and for international trade; standards have also been defined. Grades are based on size, weight, color and shape. Grading is done manually or mechanically.

PACKAGING AND STORAGE

A wide range of packages - gunny (hessian) bags, woven, bamboo, reed and grass stem baskets, Palmyra mats, wooden cases, earthen pots, corrugated fiber board cartons and rigid plastic crates are used. More than one type with different sizes and shapes of packaging is used for individual commodity either due to availability of the particular packing material in the local market or due to nature and cost of material to be packed.

Summary

Momordica is a rhizomatous, perennial and dioecious species of the family Cucurbitaceae and grows widely in many parts of India, mostly confined to eastern and south eastern states. In India, it is mainly grown in Odissa, Bihar and West Bengal. Its delicacy is typical and attributed to high seed protein content. It is a cheap source of vitamin and minerals, and hence has a great market value. Certain limitations like lack of awareness among farmers, no availability of quality planting materials of standard variety, unpredictable sex ratio in seedling progenies are restricting the expected spread of this nutritious vegetable.

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MICROBIAL FORMULATIONS: AN APPROACH TO SUSTAINABLE AGRICULTURE

SUDHEER KUMAR YADAV*, ANURADHA RAI*,
PRADEEP KUMAR RAI* AND PROF. SURENDRA SINGH*

Sustainable agriculture is most important now-a-days because of its capability to fulfill our agricultural needs which can not be accomplished by conventional agriculture. It uses a special farming technique wherein the full utilization of environmental resources guaranteed that there is no harm from it. This technique is ecofriendly, ensuring safe and healthy agricultural products. Microbial populations are helpful to drive the stability and productivity of agro-ecosystems and the use of microbes in agriculture is considered to be a very good technology for replacing conventional agriculture. These microbes can be used and stored in the form of different formulations. Such formulations have the capability to store microbes for a long time and easy to use for further application in different crops.

In the last three decades the extensive and indiscriminate use of synthetic chemicals has increased the number of ecological problems. Considering this, recently scientists from all over the world have focused their attention towards the sustainable agriculture by searching and using the beneficial microbes. Potential microbes have the capability to increase the plant growth and reduce disease incidence resulting enhanced crop yield. The biocontrol agents (BCAs) improve plant growth by producing several plant growth promoting compounds. BCAs activate the defense mechanism of crop plant and increase the biomass production and yield. These microbes secrete antibiotics, volatile toxic compounds, enzymes to parasitize over the pathogenic microbes by creating competition for space and nutrients. Recently attention has also been focused on the use of BCA with plant growth promoting rhizobacteria (PGPR) directly on the seed. In this case, PGPR and BCA are mixed with carriers to prepare formulation for easy application, storage, commercialization and field use. BCA and PGPR have been found useful in the management of various plant diseases but are highly sensitive towards the different environmental conditions and inconsistent in their performance in agricultural field[1]. Thus, there is also an urgent need to improve the consistency and efficacy of BCA and PGPR. Formulation prepared by mixing of compatible beneficial microbes (consortium mode) is one way to improve the formulation efficacy.

For the development of microbial formulations, microbes should have the following characteristic features: (I) they should have high rhizosphere competence and competitive saprophytic ability to survive in rhizosphere of the plants, (II) they should easily multiply for broad spectrum action, (III) they should be compatible with other beneficial rhizobacteria and should not have any hazardous effects on the environment, (IV) they should be able to enhance plant growth, development and yield, and (V) they should have the capability to tolerate desiccation, heat, oxidizing agents.

Microbial formulations thus developed should have the following characteristics: (I) it should tolerate adverse environmental conditions to increase shelf life of microbes and should be easily dissolved in water to release the microbes at the target, (II) it should not be toxic to the crop plants and human and should be compatible with other agrochemicals, (III) it should be cost effective and should provide good control of plant diseases, (IV) it should have good microbial load of 10^7cfu/g and shelf life of more than six months, (V) it should be free from contaminants and meet the specific standard of BIS, (VI) the carriers should be cheap and readily available, and (VII) it should perform well under different climatic zone.

The microbial formulation is delivered through biopriming, seed treatment, seedling treatment, soil treatment, foliar spray, fruit spray, sucker treatment, setts treatment and various multiple delivery systems.

Preparation of microbial formulation

Microbial formulation is a carrier based preparation technique to preserve microorganisms with higher survival and high cell number for long time[2]. For preparation of microbial formulation, carriers play

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an important role. Selected microbes were further formulated in suitable carrier and stored for long time. Microbial formulations are easy to use as effective PGPR based biofertilizers and are very helpful to increase the crop production in agricultural field. Survival and active establishment of these formulations in soil play a significant role as far as their efficiency is concerned. The bacterial cell suspension is not suitable for large scale application and therefore peat formulation has been developed where the bacteria can survive for two month[3]. The viability and self life of microbes in formulation is also an important characteristic as far as the storage and commercialization of these microbial formulations are concerned. The viability and self life of microbes also increase after the preparation of formulation. Majority of microbial formulation are prepared by using either charcoal[4,] talc or some other inert carrier compound[5]. The formulation of *Pseudomonas fluorescens* has been developed and used against foliar diseases by the Indian farmers[6]. The formulation of PGPR with biocontrol activity has been prepared from the bacterial suspension mixed with talc and 1% carboxymethyl cellulose (CMC). From the last decades polymers are used as bacterial carrier in formulation development[3]. The living cells are encapsulated in polymer formulations which protect the microbes from various environmental stresses. The advantage of polymer formulations is that it can release the microbes into the soils in large quantities because polymer is degraded by soil microbes at the time of seed germination and sprouting. The alginate based formulations of *B. subtilis* and *Pseudomonas corrugata* showed very good result in respect to plant growth parameters and colony farming unit (cfu) of microbes present in rhizosphere of maize plant. Alginate based formulations are easy to dry and can be stored up to 3 years. It provides good quality and consistency in the environment for microbes. The preparation of *Trichoderma* bioformulation and its effect on chickpea has been shown in Figure 1.

Solid formulation

Solid microbial formulations are prepared by using solid inert carrier such as talc, bentonite, charcoal, chitin, chitosan, lignite, neem cake, vermicompost and/or alginate. Several solid formulations of microbes including *Trichoderma* spp. *Pseudomonas* spp. *Bacillus* spp. either individual or in consortium have been reported[7]. The delivery of these formulations is made in the form of seed treatment, biopriming, soil treatment or foliar spray.

Talc is magnesium silicate [$Mg_3Si_4O_{10}(OH)_2$] and is available as powder form with various application. Inert nature, cheap cost and easy availability of talc makes it preferable to be used as carrier in the development of microbial formulations. Talc based formulation has been already described for biocontrol agents and PGPR against the management of different plant diseases. Talc based formulation of *P. fluorescens* has been developed against root rot of pea (*Fusarium solani* f. sp. *pisi*). In talc based formulation talc is mixed with bacterial suspension (10^7 cfu/g) in the ratio of 2:1 w/v having 1.5% calcium carbonate and 1% CMC.

Peat (turf) is organic matter of partially decayed vegetation. In peat based formulation peat soil is used as carrier like talc. The shelf life of *Azospirillum brasilense* in peat based formulation is reported up to 4 months having the population of 10^7 cfu/g. Peat based formulation of *P. fluorescens* has shelf life up to 8 months with 2.8×10^6cfu/g.

In sugar industries sugar press mud (SPM) is come out as a byproduct. Before being used as carrier, SPM is composted using vermin-composting technique. SPM formulation of *Azospirillum* spp. has showed better survival and shelf life than lignite formulation because SPM acts as nutrient apart from carrier.

Vermiculite is light mica like mineral and has improved aeration and moisture content. It is used as carrier for microbial formulation development. Whereas vermiculite based formulation of *P. fluorescens* has shelf life up to 8 months with 10^6 cfu/g, the same formulation of *Azospirillum* has shelf life up to 10 months with 1.3×10^7 cfu/g viable cells.

Microencapsulation is a technique in which microparticles are generated through cross linked polymer coated over liquid phase of dispersed microbes. In microencapsulation, gelatin and polyphosphate polymer are mixed in the ratio 81:19 w/w at slightly low pH with oil suspension of rhizobacteria. This technique has its own limitation because shelf life of microbes is reduced very fast due to polymer which acts as a barrier for oxygen supply. However, the technique has been improved by the development of microcapsules using spray drying. To make easy release of microbes, microencapsulated pellets were dipped in aqueous buffer for 15 min.

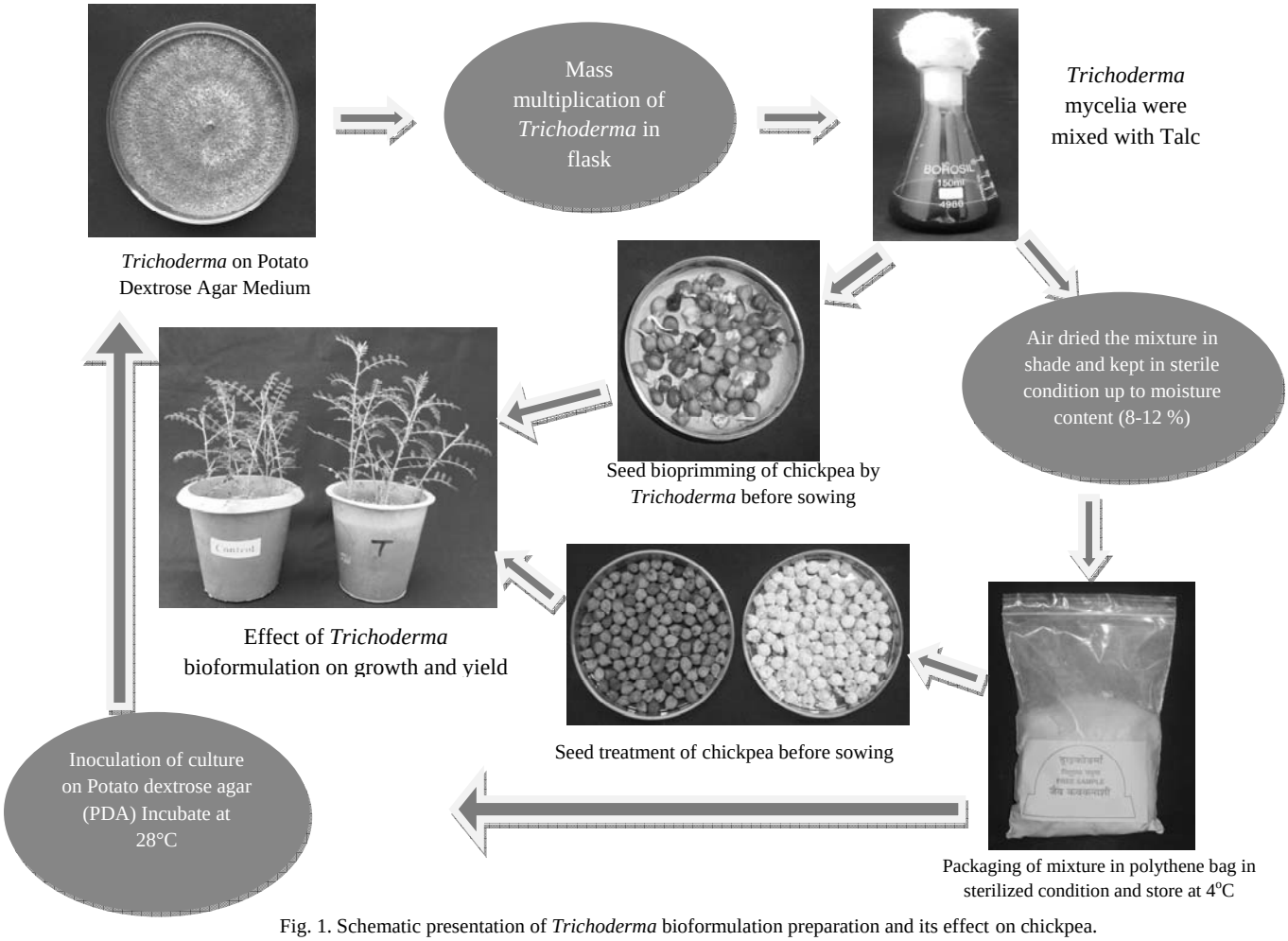

Fig. 1. Schematic presentation of *Trichoderma* bioformulation preparation and its effect on chickpea.

Charcoal based formulation was prepared by growing microbes in tryptone yeast extract agar at optimal temperature. The microbes were harvested and the number of cells was adjusted to 10^9cfu per ml. The slurry of 150 g of sterilized charcoal containing 10g gur (local sugar) and 150 ml of microbial suspension was prepared properly in sterile condition and air dried for overnight. The viability of *B. subtilis* and *P. fluorescens* in charcoal based formulation is up to 6 months.

Alginate based formulation preserves the beneficial properties of microbes during the storage. Alginate pellets of *T. viride* and *Gliocladiun virens* should be stored at 5^oC because low temperature ceases the division and metabolic activities of microbes. The 50 ml of microbial culture in their respective broth medium was mixed properly with alginate solution. The mixture was added into sterile 0.1 M $CaCl_2$ drop by drop with the help of micropipette at room temperature. The beads containing microbial culture were kept at room temperature for 2-3 h to form solid beads. The beads were collected and washed twice with sterile water. The beads were air dried under sterile conditions. The alginate based formulations of *B. subtilis*, *P. fluorescens* and *P. corrugata* have been developed. The microbes in alginate based formulation remain viable up to 6 months. Once the microbial formulation is developed, it is air-dried, packed in sterile polythene bags, labeled with culture code, instructions for its use and manufacturing and expiry date. It should be stored at low temperature to maintain the cell viability.

Liquid formulation

Liquid microbial formulation is also very effective and helpful in managing the plant growth, health and productivity. In liquid microbial formulation various compounds such as glycerol, vermicompost wash, indole acetic acid, malic acid or even formaldehyde have been used. Since the maintenance of quality and type of liquid formulations influence the shelf life of the formulations, the amendments are, however, required to manage the quality and storage process according to the inoculums conditions. Liquid formulation of plant growth promoting microorganisms (PGPMs) in consortium mode (*B. licheniformis* + *Bacillus* sp. + *P. aeruginosa* + *Streptomyces fradiae*) showed good microbial population after 120 days of storage. One liter of sterile solution having 2% polyvinyl pyrrolidine (PVP), 1.5% polyethylene glycol (PEG) and 2.5% glycerol is inoculated with 500 ml of PGPMs consortium. In sunflower the seed germination and plant height were increased following the liquid formulation treatment.

The Incidence of sunflower necrosis virus disease (SNVD) was also reduced after the application of liquid formulation of PGPMs and resulted in the enhanced production in field conditions. The liquid culture and formulation of *P. fluorescens* has been developed for the management of take-all disease of wheat.

Conclusion

India is an agricultural country and its economy is maximally dependent on agriculture. Ninety percent of the rural population is dependent on agriculture. In the recent years, the employment through agriculture has tremendously declined from 85% to 15% because of unsustainable agriculture. Due to this, the people from the rural areas are migrating to the urban areas for getting employment as well as for their livelihood and thus creating problems to the urban slums. To make the agriculture sustainable by use of microbial formulations, it is important to gain the confidence of the farmers. The transfer of microbial formulation from laboratory to field is necessarily required and the success of the process depends on the types of the microbes present in the formulations and their successful use in suppression of pests and diseases of crop plants. The commercialization and extension of microbial formulation products are also needed. Success of commercialization of microbial formulation depends upon efficacy of the product after several tight screening strategies. The performance of formulated product should be periodically checked at both laboratory and field conditions of various diversified microbial populations and climatic conditions. It would definitely help to develop better formulation of microbes. The microbial formulation market is increasing day by day and therefore the awareness in farmers about the use of BCAs and PGPR formulation is most important. This can be done by publicity, field demonstrations, biovillage adoption and conducting regular training programme for commercial producers and farmers.

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RASA SHASTRA : AN APPRECIATION

PROF. C.B. JHA* AND PROF. K.K. NARANG**

Modern theory of creation of Universe believes in a Big Bang, which occurred several billion years ago with the bursting of an extremely Dense Dot composed of Space- Time – Energy. For believers, the Creator of the Universe is Trinity—Generator, Operator and Destroyer (GOD) and in Hindu mythology it is Brahma, Vishnu and Mahesh

^^" tUek|L; ;r%** **(*Janmadyasya yatah)* ~**

The entire Universe is composed of Energy or it is created from ^^vkfn 'kfDr** (Adi Shakti). The enrgy takes up several forms – Solid, Liquid, Gas, Plasma and even exists as Dark Energy. In absence of self burning Sun and the like Stars, the Universe is nothing but an infinite Ocean of Dark Matter or Dark Energy in which Matter and Anti Matter continues to generate and annihilate to give Energy.

Ever since man descended on Earth, he has learnt the art of maintaining good health, from even the animals. Man has proved superiority over other animals by creating Fire (Agni) and perpetuating it for use in coming times. The very first Richa of Rigveda is about worship of Agni – Fire – Energy. Using this fire Man has passed through Stone Age, Bronze Age, Iron Age to Modern Age and now, we are very well in Advanced Scientific Age.

Some Five thousand years ago, Vedas were created for knowledge and governance of society during those times. They contained knowledge and experience of numerous sages of the times.

The sages used to experiment with materials in isolated places or in forests, away from society using Yagna Vidhi which provided Ash (Bhasma) and reduced metals or mixed metals or metallic compounds. ^^;Ku dYiUrke** ***(Yagyen Kalpantam)***. This process has also been used to please Rain God for rains in the regions. The smoke and the inherent particulate matter served as seed for cloud building causing rain. As the time passed the Fire was extensively used for domestic purposes, baked building materials, pottery and ceramic materials, extractive metallurgy, preparation of alloys and Bhasmas.

As per definition, Bhasma is a calcined material obtained from metals and minerals at high temperature to yield powdered material. No doubt, in the beginning the entire Earth was covered with dry and hot calcined material in the Crust. Virtually it was a Big Ball of Bhasma on which life has grown after it cooled down to moderate temperatures, filling the valleys with water, which now we call Oceans. **Life on Earth is due to Bhasmas**, which are nothing but metal compounds, mainly metal oxides and mixed metal oxides in polymerized Rocky state.

The soluble salts dissolved in rain waters and flowed down to collect in oceans. For this reason , the ocean waters are salty and brackish to taste.

It is only about 1000-1200 years ago that sages, who specifically experimented with Bhasmas keeping Ras (Parad or Mercury) at the centre that Ras Shastra was developed and given the name Rasayan ^^;TTkjk0;kfèkfo/ofi Ò"kt rn:Ik;ue** **(*Yajjara vyadhi Vidhwamsi Bheshajam tad Rasayanam*)**. The material which is able to remove/prevent the diseases and senility is considered as Rasayana. ***(^^ykHkkiik;kfgLrkuk jlkfnuk jlk;ue** Labhopayo hi sastanam rasadinam Rasayanam).*** The drug which is beneficial to produce healthy Rasa, Rakta, Mamsa etc and Dhatu in the body is considerd as Rasayana.

^^;TTkjk0;kfèkfo/ofi"k Ò"kt rn:Ik;ue**

Yajjaravyadhividhvamsti bheshajam tadrasayana

The one which destroys disease and old age is called Rasayana

In the beginning Ayurvedacharyas experimented with plant based drugs for the elimination of diseases. These drugs were given in large quantities to cure the patients but later they realized the importance of Bhasmas which were used in very small amount.¨vYiek=¨i;ksfxÙokn v:pjÁlxr% fNÁekj¨X;&nkf;Rokn©"k/kH;¨f/kd¨jl%AA** ***Alpmatropyogitwat***

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Arucherprasangatah chhipramarogya dayitwat aushadhebhyodhiko rasah).

Effective in small quantity and which does not give a feeling of bad / untoward taste, quickly effective in curing the diseases. It is also effective in dreadful and deadly chronic diseases. They are, therefore, far superior to other drugs.

The idea behind the development of Rasa Shastra was to achieve Salvation through healthy body. Hence the prime concern was to keep the body disease free, strong and healthy throughout life. *(^bfr/ku^'kjhjHH¨xkueRok vfuR;ku· lno;ruh;! eä%lPkKkukr· rPPkkH;klkr· l p fLFkjngAA*** ***Iti dhana sharira bhoganmatwa anityan sadaiva yataniyam. Mukteh sa cha gyanat tachchabhyasat sa cha sthire dehe)***

According to Raseswara darshan, salvation is possible by spiritual knowledge (***Gnana***) which one gets after continuous practice and for practice one needs a stable and healthy body. **(**fi.MLFk;ZikÿA;e· ***Pindesthairyopaya)*** which means one has to stabilize the body with the help of materials. Just as Mercury (Parada) is liquid, quick and unstable. If this is stabilized with the help of any other material / method it will help in stabilizing the body.

Even the present day scientists agree that metals play vital roles in the body and keep the organic structures turgid **For example; just one atom of Mg is present in large chlorophyll moiety and only one Fe atom in hemoglobin, one Zn atom in metallo enzyme and one Co atom in cobalamin.** The central metal atoms help the bio molecules to carry out their functions (Ref.1). If they are absent or are substituted by other atoms, the bio molecule fails to carry out its function. The metal at the centre of a large molecule is like a spider in the web, which catches the insects and consumes for its survival.

But unfortunately most of the experimented knowledge, which was successfully used on patients and shown some miraculous results remained with the siddhacharayas because they could not get a suitable disciple to share it.

^jlfon·|k ijkfo|k i«kL;kfi u dFîr**

Rasvidya para vidya putrasyapi na kashayte

Knowledge of ras shastra and super natural forces be not shared with even your son or unqualified recipient.

The ancient sages, Ayurvedacharayas, Ras shastris, Siddha charayas and others experimenting with the natural herbal materials and bhasmas for health of the Society during the olden times, must be profusely appreciated because just by visual examination of the patients and feeling their pulse, they could understand the symptoms of the disease the patient was suffering from and gave him appropriate medicine. They even kept a personal watch over the patient to see the effect of medicine and health of the patient.

In contrast, the Modern Medicine practitioners are largely dependent on analytical and instrumental data for assessment of deficiency or disease. The observations or conclusions of one doctor may still vary considerably. A particular disease is a result of several imbalances in the body. The Modern medicine is a targeted drug delivery system, whereas, Ayurvedic medicine cures and attempts to cure the body as a whole. **The Holistic approach of Ayurveda** seems to be more justified which the world now has fully agreed and appreciates. Probably for this reason, most of the Ayurvedic formulations are **Poly herbal and Poly mineral or Poly bhasmic** mixture for stabilizing the body as a whole and treat the root cause and the symptoms of the disease.

Since all the formulations seem to be time tested directly on the human body, knowing fully well that our body is capable of selecting or accepting the right kind of the material or chemical out of the material, to take corrective measures for healing the disease symptoms, and rest of the material is rejected. **The body serves as a two way industrial complex system. Food, fodder, drug material are fed from one end, the useful material is assimilated and the unused or the rejected stuff is expelled from the other end.** Despite elaborate researches, still the total mechanism of the body function is a mystery.

Ever since Robert B. Saper published a paper in JAMA (Ref. 2) regarding heavy metal toxicity, centering around Hg, Pb, and As in Ayurvedic formulations, there has been a spurt of research activity in Ayurveda. Several National and International symposia/ conferences have been held by now and even the modern scientists have associated with the researches (Ref. 3-5) but still, a lot more work is needed to justify the **Holistic approach of Ayurveda plus Ras shastra** in treatment of the disease. Coordinated research and frequent reviews are needed.

Every disease has a root cause, a seed like cause, which when gets contribution from the surrounding environment, grows into a giant and affects the whole body to cause pain, inflammation or any other visible symptom. Ayurveda believes in tridosah (Vata, Pitta and Kapha) The imbalances are the cause of the diseases *(कुपितानां हि दोषानां शरीरे परिधावताम् यत्र संगः खवैगुण्यात् व्याधिस्तत्रोपजायते।। (Kupitanam hi doshanam sharire paridhavatam, Yatra sangah khavaigunyat vyadhistatropjayate)* which means, vitiated Doshas moving in the body, where they come across obstruction, they accumulate and vitiate the duct, then become a disease and disease syndrome or multiplicity of diseases. In such an event, it can be only treated by polyherbal, poly mineral or simply an army of chemicals, multiplicity of drugs or Ayurveda plus Ras Shastra formulations. Our ancient sages had realized this aspect long long ago.

Probably, for this reason, the natural materials are used as such, after due Shodhan, which is just a processing technique mistaken for purification. The natural materials are processed, without understanding of the inherent impurities, and unmindful of addition or subtraction of impurities during the process. The net effect is the goal.

Since Mercury (Parada) is at the centre stage of Ras Shastra it would be interesting to highlight the experimentation of sages, the slokas and stories related with Parad during olden times and the modern chemistry of Mercury to explore why so much panic is associated with the use of Heavy metal like Mercury.

*^j¨x i̟dkfC/k eXukuk̟ ikjnkukPp ikjn%*** ***(Roga pnkabdhi magnanam paradanachch paradah).*** **Which means the material which takes out the body from drowning in the muddy ocean of diseases.**

It seems logical that Mercury had volcanic origin, it flowed through the crevices, meeting Sulfur to form HgS, or reacted with Sulfur in vapour state and settles as HgS in Cinnabar or other minerals, from which it is obtained easily. From Ras Shastra point the process and various properties and applications are compiled in a book form (Ref. 6). The hazards of using Merury compounds have also been researched and documented (Ref. 7).

c/n% Ik{kkr̟ Inkf'ko% ***(Baddhaha sakshata sadashivah)***. Which means, when Mercury becomes stable it gives stability to the body and is beneficial.

EfNRok gjfr : t̟e̟ ***(Murchchitwa harati rujam).*** Which means when it is reacted with Gandhaka (Sulfur) it destroys the diseases.

Mercury (Hg) is a soft metal, liquid at room temperature, atomic number 80 , member of d- block elements with outer electronic configuration 5d10,6s2, The 6s2 electrons participate in the chemical reactions. Being a soft metal Hg reacts preferentially with S even at room temperature on rubbing to yield HgS. With other non metals as well, Hg reacts to give binary compounds like HgX2, where X= F, Cl, Br, I and 1/2 O2. These compounds then further react to yield a variety of Mercury salts of organic and inorganic acids, molecular addition compounds, coordination compounds, chelates, polymers, organo mercury compounds, poly mercurated compounds. Mercury-carbon bonded compounds are generally called Mercurials. Mercury dissolves several metals to give Amalgams.

It has been reported that Hg in vapour state is monoatomic, which can easily go to human body during inhalation and deposit in lungs causing toxicity. Other salts and organo mercury compounds, depending on their aqueous or lipo solubility, show a variety of toxicity and their LD50 have been recorded. But HgS is highly insoluble in aqueous, acidic or organic solvents. HgS is only soluble in Aqua Regia, which is a mixture of three parts of concentrated HCl and one part of concentrated HNO3. This mixture produces nascent Cl which kills HgS to give HgCl2 + S. Such an acidic solution mixture cannot be produced in body. HgS is a three dimentional polymer with diamond type lattice. It is acclaimed to be non toxic and its LD50 is indeterminate.

Ionic Hg salts containing Hg+2 easily reacts with the S end of biomolecules in body to give Hg+2←S< bond, which is a coordination compounds. This process deactivates the system interfering with the growth of the cell. In the same manner Hg+2 substitutes Zn+2 in metallo- enzymes to make them non functional or inactive.

HgS prepared in the form of Kajjali in the presence of natural fluids and using Hg: S ratio 1: 6 by weight, has sufficient excess of S as compared to that required by HgS. The extra S along with the natural fluid may stabilize the HgS nano particles by serving as stabilizing agents. Further it has been clearly shown that HgS as Ras sindoor is bio non degradable in larvaes of bees (8).

However, most other salts, organo mercury salts

and organo mercury compounds have been shown to have a variety of physiological action and hence have toxic limits. Hg salts easily add on to unsaturated >C=C< bonds resulting in >CHg--C<, Hg –C bonded compounds.

Since Ras Shatra, Ayurveda and Siddha systems of medicine use mercury based drugs, great care is required in preparation of the polyherbal formulations using mercury based materials other than HgS, because all other mercury compounds are susceptible to interact with organic part of the herbal products resulting in some unknown products. However the HgS, in pure state can be safely used as carrier for the drug molecules in the body system. The dose, however, has to be prescribed by an expert practitioner.

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DENTAL IMPLANT – A NEW TREATMENT MODALITIES IN DENTISTRY

PROF. T.P. CHATURVEDI AND DR. RAJUL VIVEK***

Teeth are commonly absent from the dental arch either congenitally or as a result of disease, of which caries and periodontal breakdown are the most common. While it is not obvious that a missing tooth should always be replaced, there are many occasions where this is desirable to improve appearance, masticatory function or speech, or sometimes to prevent harmful changes in the dental arches, such as the over eruption or drifting of teeth. Tooth loss is also followed by resorption of the alveolar bone, which exacerbates the resultant tissue discrepancy.

In these situations, the treatment options include a traditional fixed partial denture, a resin bonded restoration and implant. Although each is a viable treatment alternative, the implant restoration has definite advantages. It has become an esthetic, functional restoration with long-term predictability,[1] A dental implant is an artificial tooth root (synthetic material) that is surgically anchored into jaw to hold a replacement tooth or bridge in place. The benefit of using implants is that they don't rely on adjacent teeth for support, they are permanent and stable. Implants are a good solution to tooth loss because they look and feel like natural teeth. Over the past decade dental implants have been proven to be an effective and reliable alternative for the replacement of missing teeth.

Types of Dental Implant

Three types of implants are extensively used and recognized as the most effective in masticatory and aesthetic functions restoration that is: Root form 2-piece implants, Compressive implants Basal implants. **Two component root form** implants are used to create single and multiple restorations with delayed loading in the upper and lower jaws in all types of bone tissue. **Compressive** implants are single-component implants with a compressive thread. They are used for multiple restorations with immediate loading in the upper and lower jaws with soft and hard bone in cases of deficiency of bone tissue. **Basal** implants are used to create multiple restorations in the upper and lower jaws and for placement directly into alveolar processes. The structural characteristics allow placement in zones with severe deficit of bone tissue width and height, in the sockets of extracted teeth, and transgingivally.

Diagnosis

The key to the ultimate success of the Implant restoration is effective diagnosis and planning of treatment prior to placement. These diagnostic aspects may include a medical and dental history, dental X-RAYS, CT scan X-RAYS (Fig. 1a, 1b), diagnostic models of patient mouth, and laboratory mock-ups of projected treatment.

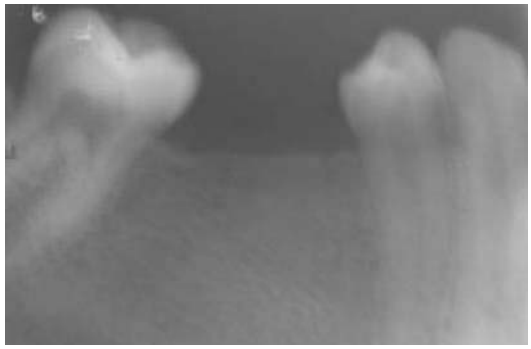

Fig.1 (a). Dental X rays

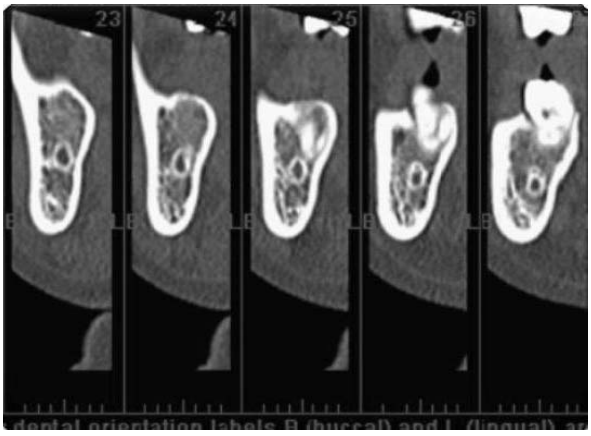

Fig. 1(b). CT scan

Procedure for Dental Implant

Procedure of dental implant is in three steps and time consuming process. Usually performed in the

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dental office with a local anaesthetic. In first steps the dentist surgically placed the implant in the jaw (Fig.2), with the top of implant slightly above the top of the bone (Fig 3a, 3b). A screw is inserted into implant to prevent the gum tissue and other debris from entering. The gum is then secured over the implant. The implant will remain covered for approximately three to six months while it fuse with bone, a process called as osseointegration. There may be some swelling, tenderness or both few days after first step surgery so pain medication should also prescribed to improve the pain. A diet of soft food, cold food, and warm soup often is recommended during the healing phase after first step of surgery.

Fig. 2. Flap Retraction

Fig.3 (a). Implant placement

Fig.3 (b). Implant placement in jaw bone

In the second step, implant is uncovered and dentist attaches an extension, called a post to the implant (Fig 4). The gum tissue is allowed to heal around the post. Some implant require a second surgical procedure in which a post is attach to the connect the replacement teeth. With other implants, the implant and post are a single unit placed in the during initial surgery. Once healed implant and post can serves as foundation for new tooth.

Fig.4. Post for impression

In third and final step, the dentist makes a crown, which has a size, shape, colour and fit that will blend with other teeth in the mouth (Fig 5). Once completed the crown is attached to implant post (Fig.6a, 6b). Instructions were given to patient about oral hygiene maintains for success of the Implant prosthesis.

Fig.5. Impression taken

Fig. 6 (a). Prosthesis checked in mouth

Fig.6 (b). Prosthesis cementation

Discussion

Implants were originally developed for patients with difficulty adapting to complete dentures but are increasingly used as the tooth replacement method of choice for the partially dentate patient. Since the early 1980s, the use of osseointegrated implants has become a well-established and predictable treatment. Initially, oral implants were used in the completely edentulous situation.[2,3] Later, a high degree of success was achieved with implants in partly edentulous jaws.[4,5] the single-tooth implant has also become a predictable treatment option.[6, 7]

Implants offer significant advantages over resin-bonded or conventional bridges. They prevent the needless restoration of sound teeth adjacent to the edentulous area as would be required for a fixed partial denture. The appearance of implant-retained prostheses may be unpredictable and is rarely better than conventional crown and bridgework. The placement of implants is limited by the availability and density of jaw bone.

Appropriate radiographs should be taken to locate incisive and inferior dental canals, nasal cavity, maxillary sinuses and the roots of neighbouring teeth. Developments in the field of implantology include the use of immediate implants that are placed into a prepared extraction socket following tooth removal.[8] They have the advantages that the number of surgical sessions is reduced, the waiting period for socket healing is eliminated, the alveolar ridge height and width is preserved and overall costs are reduced. Replacement of a single tooth, multiple teeth or the whole arch is now possible with implants. They can be considered the tooth replacement of choice for most clinical situations but are particularly useful when dealing with unrestored, heavily restored and spaced dentitions.

Conclusion

Dentistry has advanced significantly in the area of dental implant technology. Dental implants offer same day tooth replacement options. After a few months of tissue healing, osseointegration, and final crown delivery, patients will have a fixed restoration that enhances their oral health function and esthetic appearance. Many patients struggle with ill fitting removable full and partial dentures. The resulting conditions of periodontal bone loss, malnutrition, and overall low self esteem can occur. Fortunately, better options exist with today's implant technology. Dental implant is now a fast developing field which has a wide area of application. Though an expensive affair it is a treatment option that most patients opt for.

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HERBAL DRUG STANDARDIZATION

PROF. KAMAL NAYAN DWIVEDI* AND DR. SHIVANI GHILDIYAL**

In recent years, plant derived products are increasingly being sought out as medicinal products. According to an estimate of the World Health Organization (WHO), about 80% of the world population still uses herbs and other traditional medicines for their primary health care needs[1].Indian traditional system of medicine i.e. Ayurveda is a veritable cornucopia of a number of useful drugs belonging to vegetable, animal and mineral kingdom. Among them plant based drugs are most widely used and have always been at the foundation of medicine and therapeutics. In view of growing popularity and global interest in Ayurveda, and more particularly in its herbal druglore there is imminent need for a well coordinated research touching Pharmacognosy, phytochemistry, pharmacology and pharmaceutics. The treatise of Ayurveda stressed" he who studies only one science will not secure the determinate end of it, therefore he should enter into the understanding of other associated sciences for logical comprehension"[2]. Hence in the present scientific senario quality evaluation of herbal preparation is a fundamental requirement of industry and other organization dealing with Ayurvedic and herbal products. The growing use of botanicals (drug and other products derived from plants) by the public is forcing moves to assess the health claims of these agents and to develop standards of quality and manufacture. Moreover Phytomedicines may vary in composition and properties, and increasing reports of adverse reactions has drawn the attention of many regulatory agencies for the standardization of these formulations. In this context, correct identification and quality assurance is an essential prerequisite to ensure reproducible quality of medicine, which contributes to its safety and efficacy[3]. This review article deals with various techniques employed in extraction, characterization and standardization of herbal, polyherbal as well as nanoherbal medicines.

1. Herbal drug standardization

Standardization is a system that ensures a predefined amount of quantity, quality & therapeutic effect of ingredients in each dose[3]. Herbal product cannot be considered scientifically valid if the drug tested has not been authenticated and characterized in order to ensure reproducibility in the manufacturing of the product. Moreover, many dangerous and lethal side effects have recently been reported, including direct toxic effects, allergic reactions, effects from contaminants, and interactions with herbal drugs[6]. Therapeutic activity of an herbal formulation depends on its phytochemical constituents. The development of authentic analytical methods which can reliably profile the phytochemical composition, including quantitative analyses of marker/ bioactive compounds and other major constituents, is the need of time. In view of the above, standardization is an important step for the establishment of a consistent biological activity, a consistent chemical profile for production and manufacturing of an herbal drug[4]. The authentication of herbal drugs and identification of adulterants from genuine medicinal herbs are essential for both pharmaceutical companies as well as public health and to ensure reproducible quality of herbal medicine[5].

1.2 Standardization of herbal formulation

Standardization of herbal formulation requires implementation of Good Manufacturing Practices (GMP)[6-8]. In addition, study of various parameters such as pharmacodynamics, pharmacokinetics, dosage, stability, self-life, toxicity evaluation, chemical profiling of the herbal formulations is considered essential[9]. Other factors such as pesticides residue, aflatoxine content, heavy metals contamination, Good Agricultural Practices (GAP) in herbal drug standardization are equally important [10].

1.3 Standardization of polyherbal formulations

Standardization is an important aspect for maintaining and assessing the quality and safety of the polyherbal formulation as these are combinations of more than one herb to attain the desire therapeutic effect[11]. The polyherbal formulation of hyperlipdemia has been standardized on the basis of organoleptic properties, physical characteristics, and physico-chemical properties[12]. The standardization of various

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marketed herbal and polyherbal formulation [Madhumehari Churna (Baidynath) containing the mixture of eight herbal antidiabetic drugs *Momordica charantia* (seeds), *Syzigium cumini* (seeds), *Trigonella foenum* (seeds), *Azadirachta indica* (leaves), *Emblica officinalis* (fruits), *Curcuma longa* (rhizomes), *Gymnema sylvestre* (leaves), *Pterocarpus marsupium* (heart-wood)][13], Pancasama Churna known to be effective in gastrointestinal disorder[14], Dashamularishta, a traditional formulation, used in the normalization of physiological processes after child birth have been reported. But still there are many polyherbal formulations which require standardization as these are frequently used only on their ethanobotanical basis[15]. Standardization minimizes batch to batch variation; assure safety, efficacy, quality and acceptability of the polyhedral formulations[16]. TLC and HPTLC fingerprint profiles were used for deciding the identity, purity and strength of the polyherbal formulation and also for fixing standards for Ayurvedic formulation[17].

1.4 DNA fingerprinting technique

DNA analysis has been proved as an important tool in herbal drug standardization. This technique is useful for the identification of phytochemically indistinguishable genuine drug from substituted or adulterated drug. It has been reported that DNA fingerprint genome remain the same irrespective of the plant part used while the phytochemical content will vary with the plant part used.[18] The other useful application of DNA fingerprinting is the availability of intact genomic DNA specificity in commercial herbal drugs which helps in distinguishing adulterants even in processed samples[19]. Interspecies variation has been reported using random amplified polymormphic and random fragment length polymorphism DNA marker in different genera such as *Glycerrhiza*, *Echinacea*, *Curcuma* and *Arabidopsis*[20]. Proper integration of molecular techniques and analytical tools generated a comprehensive system of botanical characterization that can be applied in the industry level to ensure quality control of botanicals. DNA markers are helpful to identify cells, individuals or species as they can be used to produce normal, functioning proteins to replace defective ones. Moreover, these markers help in treatment of various diseases and helps in distinguishing the genuine herb from adulterated drug[20].

1.4.1 ISSR (Inter-Simple Sequence Repeat)

ISSR, a PCR-based application is unique and inexpensive popular technique of DNA finger printing which include the characterization of genetic fingerprinting, gene tagging, detection of clonal variation, phylogenetic analysis, detection of genomic instability, and assessment of hybridization[21]. *Cannabis sativa* and *Arabidopsis thaliana L. Heyne* have been differentiated from their adulterated species by using ISSR markers[20].

1.4.2. Molecular characterization by Sequence-characterized amplified region (SCAR) markers allows effective and reliable authentication and discrimination of herbs from their adulterants. In addition, morphologically similar plant species can be differentiated using SCAR markers[21].DNA based molecular markers have been found to be useful in differentiating different accessions of *Taxus wallichiana, Azarchdichta indica, Juniperus communis L., Codonopsis pilosula ,Allium schoenoprasum* L., and *Andrographis paniculata* collected from different geographical regions[22].

2. Techniques in extraction of herbals

2.1. Supercritical fluid extraction (SFE)

Supercritical fluid extraction (SFE) is the most preferable process for the extraction of the bioactive chemical from the medicinal and aromatic plants[23]. SFE has emerged as a highly promising technology for production of herbal medicines and nutraceuticals with high potency of active ingredients[24]. SFE techniques have been found useful in isolating the desired phytoconstituents from the herbal extracts[25].

2.2. Microwave-assisted extraction (MAE)

MAE technology includes the extraction of high-value compounds from natural sources including phytonutrients, nutraceutical and functional food ingredients and pharmaceutical actives from biomass[26]. MAE finds utility in production of cost effective herbal extracts and helpful in extraction of carotenoids from single cells, taxanes from taxus biomass, essential fatty acids from microalgae and oilseeds, phytosterols from medicinal plants, polyphenols from green tea, and essential oils from various sources. Compared to conventional solvent extraction methods, advantages of this technology include: a) improved product, -purity of crude extracts, -stability of marker compounds and use of minimal toxic solvents. b) reduced processing costs, increased recovery and purity of marker compounds, very fast extraction rates, reduced energy and solvent usage[27,28].

2.3. Solid phase extraction (SPE)

SPE technique is applied for isolation of analytes from a liquid matrix and purified herbal extracts. This technique has many advantages such as: high recoveries of the analyte, concentartion of analyte, highly purified extracts, ability to simultaneously extract analytes of wide polarity range, ease of automation, compatibility with instrumental analysis and reduction in organic solvent in comparison with more traditional sample preparation techniques[29].

3. Techniques in herbal drug identification and characterization

3.1 HPLC

Preparative and analytical HPLC are widely used in pharmaceutical industry for isolating and purification of herbal compounds. There are basically two types of preparative HPLC: low pressure HPLC (typically under 5 bar) and high pressure HPLC (pressure >20 bar)[30-31]. The important parameters to be considered are resolution, sensitivity and fast analysis time in analytical HPLC whereas both the degree of solute purity as well as amount of compound that can be produced per unit time i.e. throughput or recovery in preparative HPLC[32].Vasicine, the major bioactive alkaloid of *Adhatoda vasica*, was estimated by HPLC in two polyherbal drug formulations - Shereeshadi Kashaya and Yastyadivati, and its content was found to be 18.1 mg/100 g in Shereeshadi Kashaya and 0.7 mg/100g in Yastyadivati[33]. HPLC analysis of Senna leaves provided informations about sennoside content, kaempferol 3-O-D-gentiobioside, aloe- emodine 8-O-D-glucopyranoside, rhein 8-O-D-glucopyranoside, torachrysone 8-O-D-glucopyranoside and isorhamnetine 3-O-D-gentiobioside L[34]. Standar-dization of the Triphala(mixture of *Emblica officinalis*, *Terminalia chebula* and *T. belerica* in equal proportions) has been reported by the HPLC method by using the RP18 column with an acidic mobile phase[35].

3.2 High performance thin layer chromatography (HPTLC)

TLC is the common fingerprint method for herbal analysis. Four species of herbal medicines were identified easily by TLC of the resins[36]. Authentication of various species of Ginseng and Radix Puerariae is possible with this technique[37]. HPTLC fingerprint is mainly used to study the compounds with low or moderate polarities. HPTLC technique is widely employed in pharmaceutical industry in process development, identification and detection of adulterants in herbal product and also helps in identification of pesticide content, mycotoxins and in quality control of herbs and health foods[38] .HPTLC technique was reported for simultaneous determination of Withaferin A and beta-sitosterol-d-glucoside in four Ashwagandha formulations[39]. *Syzygium Jambolanum* was quantitatively evaluated in terms of stability, repeatability, accuracy and phyto constituents such as glycoside (jamboline), tannin, ellagic acid and gallic acid by HPTLC[40]. HPTLC was used for detection, monitoring and quantification of bacoside A & B in *Bacopa monnieria* and its formulations[41]. The standardization of *Cannabis stavia* was done by estimating the content of cannabinoidses HPTLC[42]. Chandanasava was standardised by organoleptic study, physico-chemical analysis, TLC and HPTLC[43].

3.3. Liquid chromatography- mass spectroscopy (LC-MS)

LC-MS has become method of choice in many stages of drug development[44]. Chemical standardization of an aqueous extract of the mixture of the 20 herbs provided 20 chemical compounds serving as reference markers using LC-MS[45].Two HPLC methods, one combined with a photodiode array detector (LC/UV) and another with mass spectrometry (LC/MS), were reported for the analysis of aristolochic acid I and II in herbal medicines[46].

3.4. Liquid chromatography- Nuclear magnetic resonance (LC-NMR)

LC-NMR improves speed and sensitivity of detection and found useful in the areas of pharmacokinetics, toxicity studies, drug metabolism and drug discovery process[47-49].

3.5. Gas chromatography (GC) and gas chromatography-mass spectroscopy (GC-MS)

GC-MS instruments have been used for identification of large number of components present in natural and biological systems[50]. The identification and quantification of chemical constituents present in polyherbal oil formulation (Megni) consisting of nine ingredients, mainly *Myristica fragrans, Eucalyptus globulus, Gaultheria procumbens* and *Mentha piperita* was analyzed by GC-MS method[51].

3.6 Supercritical fluid chromatography (SFC)

SFC permits the separation and determination of

a group of compounds that are not conveniently handled by either gas or liquid chromatography. SFC has been applied to a wide variety of materials including natural products, drugs, food and pesticide[52]. SFC enables the resolution of unknown components and known markers such as azadirachtin A and B, salannin, and nimbin in neem seed extracts[53].

3.7 Capillary electrophoresis (CE)

CE is a very effective technique for quality control of herbal medicinal products[54]. By virtue of CE two kinds of medicinal compounds i.e.alkaloids[55] and flavonoids[56] in herbal drugs have been studied extensively. CE was established to evaluate one herb drug in terms of specificity, sensitivity and precision, and the results were in agreement with those obtained by the HPLC method. Furthermore, the analysis time of the CE method was two times shorter than that in HPLC and solvent consumption was more than 100-fold less[57.]

Metabolomics technique

This technique has been used for identification of active phytoconstituents from herbal medicine[58-59]. Potential of metabolomics has been reported in the development of active secondary metabolites from medicinal plants as novel or improved phytotherapeutic agents[60-61]. The recent studies showed that NMR-based metabolomics approach combined with orthogonal projections to latent structure-discriminant analysis identified the purity of an herbal medicine[62].

3.9 Thermal analysis of herbal drugs

Thermogravimetric analysis (TGA), differential thermal analysis (DTA) and differential scanning calorimetry (DSC) have been employed to study any physical or chemical changes in various products including herbal drugs and also used to study preformulation or drug excipient compatibility[63]. TGA may be operated under subambient conditions to analyse ethanol in herbal formulations such as asavas and arista[64].The optimized extraction obtained by distillation showed the presence of volatile oil in dry ginger as a component of volatile oil-beta-cyclodextrin inclusion compound using DTA[65].

3.10. X-ray powder diffractometry (X-RPD)

This technique is used to identify minerals, crystalline materials and metallic based herbal formulations. A tin based herbal drug was estimated by XRD and the intense sharp diffraction peaks clearly confirmed the presence of high crystallinity in the sample drug[66]. X-RPD can be used to study trace amounts of chemicals with detection limits on the order of 10-8 M. Some heavy metals, including Pb, Cd, Zn, Cu and Fe were successfully identified and determined in chamomile and calendulea flowers by X-RPD[67-68]. Flavonoids in small amount of medicinal herb samples were determined by this technique[69].

3.12. Infrared spectroscopy

FTIR along with the statistical method principal component analysis (PCA) was applied to identify and discriminate herbal medicines for quality control in the fingerprint region 400-2000 cm-1. The ratio of the areas of any two marked characteristic peaks was found to be nearly consistent for the same plant from different regions, thereby; this method acts as an additional discrimination method for herbal medicines. PCA clusters herbal medicines into different groups, clearly showing that IR method can adequately discriminate different herbal medicines using FTIR data[70].

Conclusions and perspectives

Standardization of herbal drugs comprises total information and controls to essentially guarantee consistent composition of all herbals including analytical operations for identification, markers and assay of active principles. Fingerprinting of herbal medicines is utilized for the authenticity and quality control of herbal medicines and herbal preparations. Chemical fingerprints obtained by chromatographic, spectroscopic, thermogravimetric analysis, capillary electrophoresis and polarography techniques have become the most potent tools for quality control of traditional herbal medicines. Further, the combination of qualitative fingerprinting and quantitive multicomponent analysis is a novel and rational method to address the key issues of quality control of herbal medicines. The advancement of analytical techniques will serve as a rapid and specific tool in the herbal research, thereby, allowing the manufacturers to set quality standards and specifications so as to seek marketing approval from regulatory authorities for therapeutic efficacy, safety and shelf life of herbal drugs. The applications of high-technology oriented advanced hyphenated techniques will serve as a rapid and unambiguous tool in the herbal research, thereby, benefiting the entire pharmaceutical industry and mankind.

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BEHAVIOR PROBLEMS IN CHILDREN

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The present paper describes a variety of behavior problems in children. The paper covers definition of terms, diagnostic criteria, classification, factors and causes. It is useful for students, teachers, parents, social workers, clinicians, doctors, hospital staff and nurses.

Definition

"Behavior problems in children are not disease entities but are regarded as the deviation or departure from the normal behavior, differing only in degree, and are distressing to the child and to those involved with his welfare."

Classification

The two most common systems to describe various disturbances in childhood are DSM-IV and ICD-10. However the most convenient way to classify the common behavior problems is as follows –

- **Problems of eating behavior:** Pica, Food Refusal, Rumination Disorders, Over-Eating, (Bulimia), Anorexia, Food Fads, Vomiting.
- **Problems of sleep behavior:** Insomnia, Nightmares and Night Terrors, Sleep Walking and Sleep Talking, Hypersomnia.
- **Problems of elimination:** Enuresis, Encopresis.
- **Problems of scholastic behavior:** Scholastic Backwardness, Reading, Writing and Mathematical Disabilities, Repeated Failures, Absenteeism School Phobias, Destructiveness and Aggressiveness School.
- **Problems of speech:** Mutism, Disorders of Phonation and Articulation, Stuttering and Stammering.
- **Problems of habit:** Thumb Sucking, Nail Biting, Tics, Tremors, Head Banging, Hair Pulling, Teeth Grinding (Bruxism).
- **Conduct disorders:** Oppositional defiant disorder, Passive aggressive behavior.
- **Problems associated with personality dysfunctions:** Shyness, Timidity, Anger, Jealousy, Fears.

AETIOLOGY

Behavior problems in children are seldom due to one single cause but a host of factors contribute in causing behavior difficulty. They may be described as follows:

1. **Heredity factors:** The child as we see him clinically is a product of interaction between his inherited potentials and the influence of environment. Thus no behavior problem is directly inherited from parents to child but what is probably inherited is the predisposition to neurosis and psychosis.
2. **Emotional and Environmental factors:** Environmental factors either in the home or outside are the commonest cause of the behavior disorders. These environmental factors bring about emotional problem in the child which results into unstable and fundamental emotional needs of the child should be satisfied. These basic needs are:
   (a) Emotional security in the form of parental love;
   (b) Proper emotional growth;
   (c) Need of approval, recognition and response;
   (d) As early childhood is characterized by physical and play activities which is another very important emotional need and must be satisfied.

These emotional needs are satisfied only if the parent child relationship is healthy. The important environmental factors causing behavior problems are (i) Neonatal life and early upbringing, (ii) The parents: Parental attitudes, mentally disturbed parents disharmony between parents, broken homes, alcoholic parents, (iii) joint family, (iv) The child: Intelligence, constitution, personality, (v)The neighborhood, (vi) Cinema and television.

3. Physical And Organic Factors:

Epidemiology

Average prevalence – 10% among 5-10 year age group prevalence in Boys 10%, Girls-6% among 11-15 year age group prevalence in Boys 13%, Girls 10%.

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Eliminations Disorder

1. Non organic Enuresis
2. Non organic Encopresis

Enuresis

The word enuresis is derived from the Greek word 'enourein', which means to void urine.

Definition: "Involuntary passage of urine after the age bladder control is expected to have been attained in the absence of any identifiable physical abnormality."

Diagnostic Criteria for Enuresis (DSM-IV)

- Repeated voiding of urine into bed or clothes, whether involuntary or intentional;
- Behavior is clinically significant as manifested by either a frequency of twice a week for at least 3 consecutive months or the presence of clinically significant distress or impairment in socia, academic (occupational) or other important areas of functioning;
- Chronological age at least 5 years (or equivalent developmental level);
- The behavior is not due exclusively to the direct physiological effect of a substance (e.g. diuretic) or a general medical condition (e.g. diabetes, spina bifida, a seizure disorder).

Specify type: (1) Nocturnal only (2) Diurnal only (3) Nocturnal and diurnal both.

The tenth revision of International Classification of Diseases and related Health (ICD-10) uses a cut off age of 4 years after which wetting is considered pathological, if other criteria are met.

Classification: Enuresis can be divided into following types:

(1) **Primary enuresis (persistent):** Encompasses children who have never achieved continence 90% of all the cases.

(2) **Secondary enuresis (regressive):** When the child after having once obtained bladder control has again lost it.

(3) **Nocturnal only:** When it occurs only at night.

(4) **Diurnal only:** When it occurs, when the patient sleeps during day more comes in is.

(5) **Nocturnal and Diurnal:** Both.

Prevalence

In India 2.5% in the age group of 0-10 years have enuresis. The prevalence of enuresis decreases with increasing age. Increased prevalence has been reported between 4-7 years, which declines steadily. It is equally common in both sexes until 5 years of age. Boys then predominate so that by age of 11 years they are twice as likely to be wet as girls.

Etiology

1. **Family/Genetic influence:** It has been reported that nocturnal enuresis is a familial disorder. As the closeness of the genetic relationship decreases, the incidece of enuresis diminishes. It is more common in monoovular twins. In recent studies. Linkage has been found to be associated with chromosome 13q (ENUR-1), 12q (ENUR-2) and 22q (9-11), (ENUR-3).
2. **Maturational delay:** Enuresis represents a hereditary delay in development of adequate neuromuscular maturation to maintain consistent bladder control.
3. **Circadian rhythm:** Insufficient secretion of AVP is seen in night in cases of enuresis.
4. **Toilet training:**
5. **Psychological causes:** More important in elder children.
6. **Intelligence:** High incidence among mentally defectives.
7. **Sleep abnormalities:** Enuresis is found to occur in stage III and IV of sleep. Normal subjects change from Stage IV to I, when bladder volume approached full capacity, leading to awakening and conscious voiding.
8. **Infestation:** Thread worms irritating periurethral area.
9. **Society and Environment:** More common in low socioeconomic group.
10. **Neurological abnormalities and other physical defects:** Spina bifida meningomyelocele.

Diurnal Enuresis

- 3-4% if child between 4-12 year experience day-wetting.
- More common in girls are rarely after 9 years.
- 50-60% of these children have nocturnal enuresis. In contrast only 8% of children with

nocturnal enuresis have day time wetting.

- Most common cause is micturition deferral, most often in timid and shy child.

Associated Conditions

(i) Urinary tract infection: 5 times more common in girls with UTI, (ii) Urinary tract abnormalities: like residual urine and hypertrophic bladder wall, (iii) Constipation: Distended rectum leads to reduced bladder capacity and detrusor irritability and enuresis.

Complications

(1) Low self esteem (2) Social embracement and restriction (3) Intrafamilial conflicts.

Course and Prognosis

Self limited disorder that at some time will spontaneously remit, Prevalence is relatively high between 5-7 years and then begins to drop off substantially. Greatest rates of remission after age of 7 years and again after 12 years.

Assessment

(1) Medical (2) Clinical interview (3) Base line behavior recording.

INVESTIGATIONS

1. **Urinalysis:** Must always be done to rule out UTI as treatable cause of enuresis
2. **Contrast Studies:** Indicated, only if there is a significant evidence of anatomical or functional pathology clinically.

Management

If organic; refer to appropriate specialist (1) Paediatrician (2) Urologist (3) Endocrinologist (4) Allergist (5) Neurologist, (6) Psychiatrist.

If functional, three modalities – (i) Behavioral, (ii) Pharmacological, (iii) Psychotherapy.

Managed by primary physician

(1) Reassurance (2) Retention control technique (3) Star and chart method (4) Interval training (5) Awakening the child during night and voiding before retiring (6) Rewards for dry nights (7) Restriction of fluid (8) Conditioning devices – Bell and Pad Method (9) Punishment and humiliation by parents/sibilings should be discouraged (10) Pharmacotherapy.

Encopresis

"It is the fecal incontinence beyond the period when bowel control should normally have developed. It is unconscious and involuntary."

Diagnostic criteria for encopresis (DSM-IV)

1. Repeated passage of feces into inappropriate places (e.g. clothing or floor whether involuntary or international.
2. At least one such event a month for at least 3 months.
3. Chronological age is at least 4 years (or equivalent development level).
4. The behavior is not due exclusively to the directly physiological effects of a substance (e.g. Laxatives) or a general medical condition except through a mechanism involving constipation.

Classification

Encopresis can be classified in to following types:

(i) **Primary encopresis:** When the child has never achieved bowel control.

(ii) **Secondary encopresis:** develops following a period of at least 1 years of good bowel control in response to some stress.

(iii) With constipation and overflow incontinence

(iv) Without constipation and overflow incontinence

Epidemiology

Incidence 1.5% in general population: 15% of the fathers had been and encorperetic between 7 and 14 years of age; male, female ration 4:1

Etiology

(i) **Organic disorder:** Chronic constipation, Diarrohea disorders, Hirschprung disease etc.

(ii) **Non organic causes:** (i) Coercive toilet training (ii) Mother child relationship (iii) Unresolved anger at a parent (iv) Regressive wishes (v) Fecal smearing may be psychotic symptom.

Treatment

1. Essential to obtain a careful history and assess the contribution of organic factors.
2. Correcting fecal impaction.
3. Psychotherapy with the child and the parents.
4. Behavior modification in addition with psychotherapy in the form of positive reinforcement.

Drug	Mechanism	Dose	Slid Effects	Results
Imipramine (TOERALIL)	• Anticholinergic causes relaxation of detrusor muscle and contraction of bladder neck • Enhances renal water absorption	• 25 mg day, titrating up by 25 mg day every 4-7 days. • Standard maximum limit of 5 mg/kg/day with ECG monitoring above 3.5 mg/kg day • Should be discontinued every 3 months.	• Dry mouth • Nervousness, sleep disorder, mild g.i. disturbances • Constipation, convulsions, anxiety, emotional instability, syncope and collapse	• Initial success rate of 10-76% • Long term cure rate of 25-40% • Relapse rate 30%
Desmopressin (DDAVP)	• Stumulatory effect in CNS, alters sleep architecture • PGE2 has been seen to play an important role in PNE and levels have been found to be low in patients treated with DDAVP	• Rapic onset of action • 20-50ug intranasally	• Hyponatrcmia • Water intoxication • Headache • Nasal congestion • Epistaxis • Seizures	• Initial success rate 66-93% • Long term success rate 20-30% • Very high relapse rates
Oxybutynin (DIIROAN) In treatment of patients with detrusor instability and vesico ureteric rgflux	• Anticholinergic drug • Inhibits muscarinic action of acetylcholine on smooth muscle	• 10 mg/day in 2 divided doses • Can be gradually increased to 20 mg/day orally for 1 month	• Not recommended in children<5 years • Can cause heat prostration due to reduced sweating	

Eating Disorders

A. Feeding and Eating Disorders of Infancy and Early Childhood

1. Food refusal 2. Pica 3. Rumination disorder

B. Eating disorders during adolescence

1. Anorexia nervosa 2. Bulimia nervosa

Epidemiology

Age of onset 1-2 years; Male: Female = 1:1; More common in low socio economic group.

Etiology

(i) Parent child relationship: Parental neglect, poor supervision, repeated traumatic separation (ii) Oral fixation (iii) Serves as a mean of getting attention (iv) These children are often aggressive and their aggressive tendency culminates in negativism. (v) Nutritional deficiencies particularly iron and zinc deficiency can cause craving for ice and non food items. (vi) It is common in autistic and mentally retarded children.

Complications

(i) Iron and zinc deficiency (ii) Lead poisoning (due to lead based paints) (iii) Parasitic infections (iv) Intestinal obstructions (due to ingestion of hair balls, stone, gravel).

Management

1. Try to find out the cause
2. Psychotherapy of the child and the parents
3. Iron and zinc supplementations
4. Control of parasitic infection
5. Mild aversion therapy/ negative reinforcement

Rumination Disorder

"It consists of bringing of food in to the mouth without nausea, vomiting or a feeling of discomfort." The food is then either spat out or re swallowed

Diagnostic criteria for rumination disorder (DSM-IV)

1. A repeated regurgitation and re chewing of food

for a period of at least 1 month following a period of normal functioning.

2. The behavior is not due to an associated gastrointestinal or other medical illness (esophageal reflux).
3. If the symptoms occur exclusively during the course of mental retardation a pervasive developmental disorder, they are sufficiently severe to warrant independent clinical attention.

Epidemiology

Rare condition occurs more commonly in males (5:1) and usually appears between 3-14 m of age. It is potential fatal in up to one fourth of the affected children.

Types

- **Psychogenic ruminators:** These are infants with otherwise normal development, often there is a disturbed parent child relationship.
- **Self stimulating ruminators:** Seen in mentally retarded individuals of any age, often occurs in the presence of nurturing parents.

Etiology

1. Rumination generally occurs for the first time by accident and is then indulged in as pleasurable activity.
2. The disorder often occurs in families in which the mothers are immature, involved in a marital conflict, unable to give much attention to the baby.
3. Abnormality in parental care either under stimulation with neglect or over stimulation out of phase with infant needs accompanied by harsh handling.
4. Selectivity with regard to the food regurgitates.
5. One-fourth may have developmental delays attributed to mental retardation or pervasive developmental disorder.

Signs And Symptoms

Repetitive regurgitation of undigested food. The regurgitations typically described as effortless and unforced.

Symptoms can begin to manifest at any point from the ingestion of the meal to 120 minutes thereafter.

Abdominal pain (38.1%), lack of fecal production or constipation (21.1%), nausea (17.0%), diarrhea (8.2%), bloating (4.1%).

Management

1. Behavior therapy is directed towards positively reinforcing correct eating behavior and negatively reinforcing rumination.
2. Parent counseling and family therapy are often necessary.
3. Infants nutritional status should be improved.
4. Withdrawing attention from the child, whenever this behavior occurs.
5. Increase tender loving care from mother or care taker.
6. When infants are allowed to as much as they want, the rate decreses.
7. Medicines such as metoclopramide, ranitidine, haloperidol-have been found to be useful.

1. Speech Disorder

2. Stammering

"It is a condition in which the rhythm or fluency of speech is disturbed" it may include a variety of types of disruptions of the speech flows such as:

- Repetition Forcing
- Prolongation Incompletion
- Hesitation Air flow problems
- Freezing Eye contact

Chronic stuttering may be accompanied by ocular auditory or physiological manifestations such as eye movements grimances or liguistic circumlocutions to avoid certain word.

Diagnostic criteria for stammering (DSM-IV)

A. Disturbance in the normal fluency and time patterning of speech/ inappropriate for the individual age, characterized by frequent occurrence of one or more of following: (1) Sound and syllable repetitions (2) Sound prolongations (3) Interjections (4) Broken words (e.g. pauses within a word) (5) Audible or silent blocking (6) Circumlocutions (7) Words produced with an excess of physical tension (8) Monosyllabic whole-word repetitions (e.g I-I-I-I see him).

B. The disturbance in fluency interferes with academic or occupational achievement or with social communication.

C. If a speech-motor or sensory deficit is present, the speech difficulties are in excess of those usually associated with these problems.

Epidemiology

Prevalence 1% and incidence 3%; More common in children than adult; Male:Female ratio – 3:1; More common in mentally retarded children or known brain damage; More common in younger children's then older children's; more common in urban areas as compared to rural areas.

Etiology

1. Psychogenic model 2. Learning model 3. Organic model

Genetics – High concordance in monozygotic twins, 40-60% have a positive family history of stammering.

Differntial Diagnosis

1. **Non fluent speech:** It is extremely common in children, especially between the ages of 2 to 3 years. Stuttering is distinguished from normal childhood non-fluency speech by the presence of tension and struggle during speech and by the type of fluency disruptions that are produced. Normal childhood non-fluency includes whole word repetitions. Interjections, hesitation and revisions. However, frequent multiple sound repetition, broken syllables and part word repetitions, and extended prolongations are rare in normal non-fluency.

2. **Cluttering:** It is disruption of speech fluency characterized by a rapid rate of speech marked impairment of speech intelligibility, grammatical and syntactic errors, and lack of awareness of the disturbance on the part of speaker.

Course and Prognosis

Approximately 80% of stutters recover and at least 60% do so spontaneously. Recovery is more likely in girls than in boys and generally occurs before age 16.

Treatment

1. An understanding of the nature of stammering and adjustment of the personal attitude of the stammerer towards his disability.
2. Relaxation therapy.
3. Exercises which help towards the control of the stammer spasm.
4. Discussions concerning individual difficulties and speech situations with suggestions and assignments where practice in meeting these.
5. Group therapy where practice and confidence in the use of speech may be gained.
6. Psychopharmacology and psychoanalysis.

Treatment in the early stages

The advice given aims first of all to alleviate the mother's anxiety and give her some understanding of the nature of stammering in its early stages. The questions of sleeping accommodation, hours of sleep, eating, play and the relationship of the child to parents nd to other children are discussed, advice is given to maintain the general well-being of the child. The child must not be overprotected, but must be treated as other children, discipline being maintained firmly, but calmly.

Children aged five to six or seven years, who began to stammer at a latter age and are already attending school, may require group therapy in addition to wise management at home.

The part of the teacher in School

The.....can do much to encourage confidence and personal self respect by giving the child responsibility and by maintaining a calm, unhurried and understanding attitude.

Reading aloud in school may cause the stammerer to sit in a state of anxiety before the reading lesion, in anticipation of being asked to read before the class. It is often helpful if another child is asked to read in unison with the stammerer. He will then experience little or no difficulty, but other children should also read in pairs. So that the stammerer's disability is not made more obvious.

Temper Tantrums

"It is defined as uncontrolled outburst of kicking screaming and breath holding which is a dramatic physical demonstration of child's resentment."

Epidemiology

Common between 15m-3 years occurs about once a week.

Etiology

(i) Personality of the child (ii) The period of resistance and the development of ego (iii) The desire to practice new skills (iv) Imitativeness (v) Insecurity (vi) Level of intelligence (vii) Over-indulgence, over protection and dominance (viii) Parental inconsistency (ix) Ignorance of personality differences in children (x) Parental fatigue, impatience or unhappiness.

Management

1. Organic disease must be ruled out.
2. Reduce opportunities for resistance and the child should be kept occupied.
3. The best way to treat a tantrum is to ignore it.
4. Fight only those battles that wood to be won and avoid those that arouse unnecessary conflict.
5. Do not abandon a preschool child when tantrum occurs. An older child can be asked to go to him/her room.
6. Never let a child hurt him or others.
7. Attitude of the parents should be understood and must be corrected.
8. The child should not be given what he wanted after the tantrum. He can be picked and given a feeling of love and security.
9. Maintain an environment that provides positive reinforcement for desired behavior.

Breath Holding Spells

"Breath holding spells are reflexive events in which typically there is a provoking event, that causes anger, frustration and child starts crying – Stops at full expiration – child becomes apneic and cyanotic or pale (pallid). In some cases, the event continue – child may lose consciousness and muscle tone – fall to ground. Occasionally child may have seizures or asystole."

Epidemiology

Age group 1-5 years and majority begin in the first 18 months; 4-5% children in this age group; Rare before 6 months and after 5 years; Tend to disappear by 4th birth day.

Types

Two types (i) **Cynotic** – more likely due to thwarting

(ii) **Pallid (acyanotic)** – due to pain

Differential Diagnosis

Breath Holding Spells	Epilepsy
Known precipitating factor present	Rarely follows a precipitating factor
Orderly and slow sequences of events	Whole sequence of events is very fast
Convulsion follows cyanosis first	Here cyanosis follows beginning of tonic spasm
Child stark crying before the attack	No epileptic cry
EEG normal	May be abnormal
Child usually plays after the attack	Child sleeps after the attack

Clinical Picture

Cyanotic type: The child utters two or three loud cries and then holds the breath in expiration. In trivial cases the apnea lasts for 5 to 10 seconds, he becomes blue and then promptly recovers. In slight more severe cases the breath is held for additional 5-10 seconds, he becomes severely cyanosed and losses consciousness, becomes pale and limp and may fall. There is then feeble cry followed by more vigorous cry and he becomes normal again. If the apnea is prolonged for more then 30 seconds or so the child becomes rigid and has a major convulsion indistinguishable from epilepsy.

Management

1. Parental reassurance that spells will not harm the child.
2. Parents are best advised to ignore the behavior.
3. If loss of consciousness occurs the child should be place no his or her side to protect against head injury and aspiration.
4. Strong pinch on the back of the baby can terminate the spell.
5. Atropine (0.01 mg/kg) subcutaneously has been used with some benefit in spells accompanied by bradycardia or asystole.
6. Iron should be given in anemic child as anemia increase the frequency of BHS. Iron should also be given in non-anemic child because iron is found to be effective in decreasing the frequency of breath holding spells.

Colic

The word colic is derived from Greek word 'Kolikos' meaning 'pertaining to colon'. "Colic is characterized by intermittent episodes of abdominal

pain and server crying in young well fed infants who are otherwise normal and healthy". It begins in first few weeks (1-2 weeks) of life and peaks at the age of 2-3 months. Crying usually occurs in late afternoon or evening.

Clinical Appearance

The attack usually begins suddenly with a loud cry. Crying occurs continuously, paroxysms may persist for several hours, face become red and legs drawn up on the chest, abdomen becomes distended and tense, feet are often cold and hands are clenched. Attack terminates after the infant is completely exhausted or after passing of flatus or faces.

Causes

Exact cause not known. These could also be manifestation of hunger, aerophagia, cow's milk intolerance, overfeeding, too frequent feeds, congenital malformation of gastrointestinal tract, intestinal obstruction or peritoneal infections and gastroesophageal reflux.

Characteristic intrinsic to the child (temperament) and parental caring pattern may also be responsible for colic.

Management

1. The history should include the detailed account of a day including amount intensity and pattern of crying elimination and feeding.
2. Complete physical examination to be sure that the infant is thriving has no nutritional or anatomical explanation for the symptoms, no evidence of intestinal obstruction.
3. Adequate feeding techniques, including burping, stable emotional environment.
4. Parents should be educated about the developmental aspect of crying.
5. Reassurance to the parents, that the baby is healthy.
6. Baby should be kept in a quiet environment without excessive handling.
7. Rhythmic stimulations such as gentle swinging or rocking soft music or walks in scroller may be helpful.
8. Change the feeding habits.
9. Medications: Simethicone, dicylomine, Phenobarbital elixir should not be used. No role of suppositories/enema. Ranitidine HCI might be helpful if GE reflux is the cause.

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METABOLIC AND LIFESTYLE DISORDER: TREATMENT BY AYURVEDIC APPROACH

DR. ANJALI SINGH, PROF. A. K SINGH** AND PROF. K.N. DWIVEDI****

An overview of the current trends in western medicine too now shows increasing tendency of emphasis on lifestyle management in prevention and treatment of many modern diseases. It is now believed that most of the major chronic diseases such as Diabetese mellitus, Hypertension, and Ischaemic heart disease, Obesity, Psoriasis are caused because of life style related errors. These diseases are considered in Ayurveda as Santarpana Janya vikara and cause of santarpana janya vikara defined by Charak is consumption of unctuous, sweet, heavy food stuff, new cereals, alcohol etc.:

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(C.S.Su 23/3)

After consumption of rich, oily and sweet food stuff in excessive amount it will lead to several diseases like: Diabetese, urticarial patches, itching, anaemia, fever, leprosy, over-obesity etc.

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d|"BkU;ke ---- LFkkY;------------[4]AA (C.S.Su 23/5,6)

Lifestyle disorder is mainly overcome by the right 'Dincharya' (daily regimn), Ratricharya (night regimn), Ritucharya (seasonal regimn) and dietary regime mentioned in Caraka and Vagabhatta.

Ayurveda, the age old science of life, has always emphasized to maintain the health and prevent the diseases by following proper diet and lifestyle regimen rather than treatment and cure of the diseases. The basic principle followed in the Ayurvedic system of medicine is '*Swasthyasya Swasthya Rakshanam*,' which means to maintain the health of the healthy, rather than *Aturasya Vikara Prashamanancha,* means to cure the diseases of the disease[5]. For this purpose the *Dinacharya* (daily regimen) and *Ritucharya* (seasonal regimen) have been mentioned in the classics of Ayurveda[6]. Dincharya is described by Acharya Charaka and Vagabhatta as a daily regimn to follow.

LoLFkL; LokLF; j{k.k vkrqjL; fodkj ç'keu pA

Dincharya – Meaning daily regimn to follow in appropriate manner like when to wake up, when to sleep, when to eat etc. to become healthy. A person in good health should wake up in 'Brahma muhurta' but here one thing is important that one should wake up if the digestion is complete, otherwise one can lie down for some more time . But sleeping beyond sunrise is not advisable. (A.S.Su 3/2)

One should excrete urine and faeces only after getting the urge.Brushing of teeth should be done in the morning and after taking food.(A.S.Su 3/16). After brushing eyes should be sprinkled with the mouth full of water, with cold water in grishma and sharada season and other season with luke-warm water.

Ritucharya[7] – *Ritu*, the season, classified by different features expresses different effects on the body as well as the environment. *Ayurveda* has depicted various rules and regimens *(Charya)* regarding diet and behavior to acclimatize seasonal enforcement easily without altering body homeostasis. In Ayurveda twelve months are categorized into six season and these are:

Hemanta (winter), shishira (Autumn), vasanta (spring), grishma (summer), varsha (rainy), sharada (season between rainy and winter).

Hemanta (November-December) – In this one should eat foods which are unctuous, heavy, sweet, sour and salt tastes predominantly, milk products, cane sugar products, new rice and hot water, drink wine, vinegar.Person should avoid light food and cold drinks.

Shishira (January-February) – In this season all regimn prescribed for winter should be followed in increased measure.

Vasanta (March-April) – In this season one should avoid heavy, sour, fatty and sweet diet as well as day sleep and diet should be light. Physical exercise is advisible.

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Grishma (May-June) – In this season sweet, cold, liquid and fatty food and drinks are beneficial. Wine and alcohol avoid strictly. One can sleep in day time in this season.

Varsha (July-August) – Digestion is disturbed during rainy season hence moderate living is recommended in this season. In this season people should avoid cold drinks, day sleep, physical exercise and use food and drinks often mixed with honey. Diet should be predominance with sour, salted and fatty articles.

Sharad (September-October) – In this season sweet, light, cold, slightly bitter food and drinks should be taken in proper quantity with good appetite.

Other general diet regimen indicated to avoid life style disorder-

1. Intake of heavy food substances is advised as one-third or half of the saturation point and not excessive saturation even in case of light food articles in order to maintain the proper agni (digestive fire).

2. Certain food stuff which Acarya Carak had advised to take in daily diet to make our diet balance and these are:

   .....'kkyhenxk'p l/kovkeyd ;okuA

   -----i;% lfi ---- -e/k pkH;lrAA[8] (C. Su 5/12)

Shali (rice), mudga (pulses), saindhav (rock salt), amalaka (Euphorbia officinalis), milk, ghee and honey. If we see properly, these all contain carbohydrate, protein, electrolyte, Vitamin C, Calcium and Fat which is required in our daily diet to make us fit. So, we can see how much scientific knowledge they gave us in that era and now we just forgot the benefits of this and we all are wrapped badly with the effect of junk food.

3. One should take the above mentioned food articles as daily routine which maintain the health and prevent unborn diseases.

मात्रावद्धयशनमशितमनुपहत्य प्रकृतिं बलवर्णसुखायुषा योजयत्युपयोक्तारमवश्यमिति[9] ।। (C.S.Su 5/8)

So adequate amount of food elevates no. of diseases and gives strength, complexion, happiness, and responsible for longevity.

Some other regime also prescribed by Charka for Santarpana janya roga

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Use of Madhu with Haritaki (Terminalia chebula) churna and oftenly use of ruksha food stuff. Other formulations which is mentioned by Charak are Trifaladi Kwath, Mustadi Kwath.

As far as the dietary modifications are concerned, the diet would include oils, butter, and sweet food when there is aggravation of the Vata Dosha. These foods will alleviate the inherent dryness and roughness associated with the Vata Dosha. When there is *Kapha* dominance in the bio constitution of the fellow or the disease is because of the Kapha aggravation, the diet would include bitter, sour, vinegary, spicy, dry food. These foods are opposite to the Kapha Dosha. These will ignite the digestive power and improve the digestion. If *Pitta* is disturbed, the diet would include mild tasting food, grains, lentils, and moderate amounts of sweets and oils.

Besides planning for diet in this way; at certain time (especially when the digestive fire is too much diminished) the concerned fellow is advised not to eat and drink anything. It is something like that the fire is suppressed by too much of the ashes over the burning woods. When we blow the air over it the fire will again aggravate. In the same way when an Ayurveda physician advice for fast, actually he is asking to remove the toxins which are suppressing the digestive fire. By fasting we are giving a rest to the digestive system and as a result it can rebuild itself. This is the reason Ayurveda always recommends to take the meal only when the previous meal has been digested.

Along with a proper diet a healthy lifestyle is also very important to maintain health and also to enhance the effect of treatment. Ayurveda strongly recommends that everyone should have a regular sleeping schedule, about 8 hours of sleep each night, rising early in the morning; do regular exercise; and eat breakfast and engage in other dietary recommendations according to seasons.

Besides proper sleep exercise especially yoga and breathing exercises; and sunbathing are also necessary for a healthy life. It is important that some appropriate form of Yoga should be practised regularly according to one's Dosha constitution. The concept behind Yoga Asanas and Pranayama according to your Doshas is simply to re create harmony among your Doshas physically as well as psychologically. So Dietary Management and healthy lifestyle will benefit you maintaining in complete health – which is the aim of Ayurveda.

With the change in season, the change is very evident in the environment we live in. We see various changes in bio-life around us, such as flowering in spring and leaf-shedding in autumn in the plants, hibernation of many animals with the coming of winter, and so on.

As adaptations according to the changes, is the key for survival, the knowledge of *Ritucharya* (regimen for various seasons) is thus important. People do not know or ignore the suitable types of food stuffs and others regimen to be followed in particular season, this leads to derangement of homeostasis and causes various diseases, such as obesity, diabetes, hypertension, cancer, and so on in our country the situation is quite alarming due to rapid changing of disease profile.

Conclusion

This The World Health Organization has identified India as one of the nations that is going to have most of the lifestyle disorders in the near future. Nowadays, not only are lifestyle disorders becoming more common, but they are also affecting younger population. Hence, the population at risk shifts from 40+ to maybe 30+ or even younger. Already considered the diabetes capital of the world, India now appears headed toward gaining another dubious distinction of becoming the lifestyle-related disease capital as well. A study conducted jointly by the All India Institute of Medical Sciences and Max Hospital shows the incidence of hypertension, obesity, and heart disease is increasing at an alarming rate, especially in the young, urban population. According to the doctors, a sedentary lifestyle combined with an increase in the consumption of fatty food and alcohol is to blame cases of obesity, diabetes, hypertension, and so on.

Ritucharya is prominently defined in *Samhitas* of Ayurveda. Prevention of disease to maintain health is being the first and foremost aim of the holistic science of Ayurveda. In *Tasyashitya* chapter of Charaka Samhita, it is said –

rL;kf'krk|knkgkjncy ;L; r|lkRE; fofnr p"Vkgkj0;ikJ;eAA

(C.S.Su 6/3)

which means 'the strength and complexion of the person knowing the suitable diet and regimen for every season and practicing accordingly are enhanced[11]. Main theme of this chapter is to make people aware concerning the methods to live in accordance with the environment.is the way the ancient sages set up the regimen for various seasons on analytical reasoning to obtain *Swastha* (health) and prevent the diseases. The examples set by them stand as a hint to decide other dos' and don'ts' in the regimen-*Ritucharya.*

One study carried out by Jangid *et al*. on the concept of *Ritus* and their effect on *Bala* reported that the overall effect of *Hemanta Ritu* on *Bala* of healthy volunteers was maximum, effect of *Vasanta Ritu* was moderate and the effect of *Varsha Ritu* was minimum, and concluded that *Hemanta* is the *Ritu* of *Pravara Bala*, *Vasanta* is the *Ritu* of *Madhyama Bala* and *Varsha* is the *Ritu* of *Avara Bala*. Results of the study support the principles of Ayurveda.

Peoples' diet changed substantially in the second half of 20th century, generally with increased consumption of meat, dairy products, vegetable oils, fruit juice, and alcoholic beverages, and decreased consumption of starchy staple foods, such as bread, potatoes, rice, and maize flour. These observations suggest that the diets [or lifestyle] of different populations might partly determine the rates of cancer, and other lifestyle disorders, such as obesity, diabetes, cardiovascular diseases, etc[12].

It is to be known that disharmony in the *Doshas*- *Vata*, *Pitta*, and *Kapha* results in *Roga* (disease). And aim of the science of Ayurveda is to maintain the harmony. With changes in diet and lifestyle, there are changes in the state of *Tridosha*, which is bound to affect us, resulting disharmony, causing lifestyle diseases. *Ritu* acts as *Vyanjaka* or *Nimittakarana* in the aggravation and manifestation of disease.Hence after knowing certain principles of Ayurveda we can live healthy life.

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TRADITIONAL MEDICINAL PLANTS FOR TREATING IMPORTANT DISEASES

DR. BHUWAL RAM, NEELAM** AND PROF. K.N. DWIVEDI****

अनेनोपदेशेन नानौषधिभूतं जगति किंचिद्
द्रव्यमुपलभ्यते तां तां युक्तिमर्थं च तं तमभिप्रेत्य ।

(Charak Sutrasthana 26/12)

By above verse the author of Charak Samhita says that everything of the world has therapeutic value provided it is used rationally. All the plants on the earth are important for humanity as human beings are influenced in various ways by plants and their products. Existence of mankind is impossible without plant kingdom as they provide balance ecosystem, major source of nutrition, preventive aspects of medicine, and primitive aspects of disease (Kumar and Dhan, 1998). Approximately two - thirds of the world's population depends upon plant resources for their primary health care and rely on plants sources of drugs (Farnsworth et.al., 1985). The world health organization (WHO) has estimated that 80% of the people in the developing countries of the world rely on traditional medicines and 85% of the traditional medicine involve the use of plant extracts.

India has ancient history of use of plants in the Indigenous system of medicine (Ayurveda, Unani and Siddha) and it dates back over 5000 years. Ayurveda records over 8000 herbal remedies. India officially recognizes over 2500 plants as having medicinal value, and it has been estimated that over 6000 plants are used in traditional herbal medicines (Huxley 1984).

LEPROSY

Calotropis gigantia (Linn.) R. Br. ex Ait.

Family : Asclepiadaceae
Hindi : Ark, Madar
English : Bow Sting Hamp
Distribution : Throughout India

Use: The whole plant either as decoction or in powder form is used for leprosy. The bark, root and dried milky sap may be used in small doses in certain cutaneous infections, such as leprosy.[2]

जाव्यर्कनिम्बजैर्वा पत्रै …….(Charak chikitsa 7/56)

Holoptelia integrifolia (Planch.)

Family : Ulmaceae
Hindi : Papri, Chirbilva,
English : Indian elm
Distribution : Throughout India, in deciduous forests.

Use: The leaves are boiled in water and after filtration, the patients are given bath with the filtrate to cure leprosy. The bark is also useful in leprosy. [2]

dj´th--------dfed"Bi;egft rA

(Bhavaprakasha, Guducyadi Varga 124)

Hydnocarpus kurzii (King) Warb.

Family : Flacourtiaceae
Hindi : Chaulmogra
English : Chalmogra
Distribution : North-east India

Use: The oil is mainly used in the treatment of leprosy and is effective, in early cases, in decreasing the size of nodules, anesthetic patches and skin lotions. It is administered internally, the dosage being increased gradually to produced gastric irritation. [4]

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Lawsonia inermis Linn.

Family : Lythraceae
Hindi : Mehndi
English : Henna, Cypress Shrub
Distribution : Scarcely in dry deciduous forests, widely cultivated as a hedge plant.

Use: An extract made from the leaves and flowering twigs is much valued in the treatment of leprosy. Root and bark are also used in the treatment of this diseases.[4]

u|ikyh tkfyuh p|p en;Urh---
?k`r| ok ;fn ikIr| l|'kk/kukLrFkkA

(Sushrut chikitsa 2/91)

f=Qyk Rod f=dVd| l|jlk en;fUrdk-----
fl)e d|"Bkig ?k`reA

(Sushrut chikitsa 9/34)

Nelumbo nucifera Gaertn.

Family : Nymphaeaceae
Hindi : Kamal
English : Indian Lotus
Distribution : Throughout the warmer parts of India

Use: Seeds are sweet and flavoury, useful in leprosy and cutaneous diseases. The tender leaves and stem are useful in leprosy. [4]

dey---r".kknkgkL=foLQkVfo"kohIiuk'kueA

(Bhavaprakash, Puspavaraga 3)

Abies webbiana Lindl.

Family : Pinaceae
Hindi : Talispatra
English : East
Distribution : Upper Himalayan tracts.

Use: The dried leaves (Talispatra of Northern India) are useful in asthma. The powdered leaves are often given along with the juice of Adhatoda vasica and honey. [2]

rkyhli=| thoUrh opk r|j{klfer%A

(Charak chikitsa. 17/143)

Acorus calamus Linn.

Family : Araceae
Hindi : Vacha
English : Sweet Flag
Distribution : Throughout India, wild or cultivated ascending the Himalayas up to 1800 m in Sikkim in marshes.

Use: Rhizome is useful in asthma. It should be first used in large or nauseate dosage (15 to 20 grains) and then repeated every 2 or 3 hours in small doses till relieved. [2]

rkyhli=| thoUrh opk r|j{klfer|

(Charak chikitsa 17/143)

ASTHMA

Adhatoda vasica Nees

Family : Acanthaceae
Hindi : Arusha, Bakas
English : Malabae nut
Distribution : Throughout India

Use: Powdered dried leaves are made into cigarettes and are smoked in asthma. The fluid-extract prepared from the leaves is a powerful remedy in asthma especially in combination with belladonna. [8]

=;|"k.k nkf?kd| ok·fi fic}kIk?k`r| rFkkA

(Charak cikitsa. 17/146)

Alhagi camelorum (Fisch.)

Family : Papilionatae
Hindi : Jawasa,
English : Camel Thorn
Distribution : North-west India

Use: The powdered plant is smoked along with dhatura, tobacco and ajwain seeds as a remedy for asthma. [8]

rkyh'kofânhI;d pfodk ---------- dkl'okIkjkpde

(Chakradutta 11/38)

Datura metel Linn.

Family : Solanaceae
Hindi : Safed dhatura
English : Devil's Trumpet
Distribution : Western Himalayas

Use: The leaves and the roots are a good palliative in spasmodic asthma. The leaves may be made into cigarette or smoked in a pipe, with or without tobacco to relieve asthma. [16]

Euphorbia hirta Linn.

Family : Euphorbiaceae

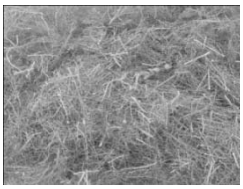
Hindi : Dudhi

English : Australian Asthma Her

Distribution : Throughout the hotter parts of India

Use: Plant decoction is used in asthma and chronic bronchial infections. Its tincture is used in chronic bronchitis and asthma. [2]

Hyoscyamus niger Linn.



Family : Solanaceae

Hindi : Khurasaniajvayan

English : Henbane

Distribution : From Kashmir to Garhwal

Use: Young leaves and fruit tops are the source of drug used in asthma. [2]

JAUNDICE

Berberis aristata DC.

Family : Berberidaceae

Hindi : Rasaut

English : Indian Barberry

Distribution : Himalayas from 2000 to 3500m.

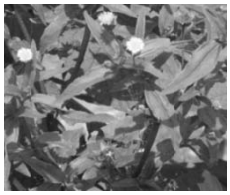
Use: Root-bark, wood and an extract made from the root-bark 'rasaut' are useful in jaundice. [13]

d"Bi nk:gfjnk----------ânkx ik.Mjrk 'kkFk----------

(Charak chikitsa 14/160)

KAMALA

Eclipta alba Hassk.



Family : Asteraceae (Compositae)

Hindi : Bhangra

Distribution : Throughout India

Use: Leaf-juice is given in one teaspoonful dose in jaundice. There are two varieties of plants- the yellow flowered and the white flowered. Yellow flowered has thicker leaves which are extensively used in jaundice[9].

Emblica officinalis Gaertn.

Family : Euphorbiaceae

Hindi : Amla

English : Indian Gooseberry.

Distribution: Throughout India, in deciduous forests and on hill slopes up to 200m, also cultivated in plains. The bark is useful in jaundice.

Use: Dried fruit in combination with iron and also fermented liquor prepared from the fruit is used in jaundice. [11]

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(Charak chikitsa. 16/58)

Phyllanthus niruri Hook.

Family : Euphorbiaceae

Hindi : Bhui-amla

Distribution : Throughout India as a weed

Use: Fresh roots are said to be an excellent remedy for jaundice. Fresh leaves are used for the treatment of jaundice. Fruit is used in the treatment of this disease. [13]

ckãh rkeydh-----dkeyk'kkfuy-----A

(Charak chikitsa. 18/42)

DIABETES

Acacia arabica Willd.

Family : Mimosaceae

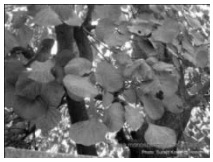
Hindi : Kikar

English : Black Babool.

Distribution : Throughout India.

Use: The gum is said to be very useful in diabetes mellitus. [10]

Butea monosperma (Lam.) Kuntze



Family : Papilionaceae; Fabaceae

Hindi : Palash, Dhak

Distribution : Throughout India.

Use: Gum known as Bengal kino is useful in diabetes[2]

प्रियङ्गुपद्मोत्पल किंशुकानाम् .....पैत्तेषु मेहेषुदश प्रदिष्टाः।

(Charak chikitsa. 6/31)

Ceiba pentandra (Linn.) Gaertn.

Family : Bombacaceae
Hindi : Safed semal
English : White silk cotton tree, True kapok tree
Distribution : Planted mainly in South Indian in areas up to 450m elevation.

Use: The juice obtained from the roots is considered a most valuable cure for diabetes. [2]

कूटशात्मलि.....भूतानाहविबन्धास्त्रमेदः शूल कफापहः।
(Bhavaprakasha, Vatadivarga 17/143)

Coccinia indica W. & A.

Family : Cucurbitaceae
Hindi : Kunduri, Bimbi,
English : Ivy Gourd
Distribution : Throughout India, cultivated as well as wild.

Use: The expressed juice of the thick tap-root is used as an adjunct to the metallic preparations prescribed in diabetes. Cooked leaves are considered very useful. The plant has a remarkable effect in reducing the amount of sugar in the urine of patients suffering from diabetes mellitus.[7]

Gymnema sylvestre R.Br.

Family : Asclepiadaceae
Hindi : Gur-mar,
English : Australian cow plant
Distribution : Central and Peninsular India

Use: Fresh leaves are used to reduce glycosuria (Madhumeha). The leaves cause hypoglycemia, which sets in soon after the administration of the drug either by mouth or by injection. The drug has no direct action on carbohydrate metabolism, and acts indirectly through stimulation of insulin secretion of the pancreas. It stimulates the heart and circulatory system and increases urine secretion. The presence of antraquinone derivates accounts for its laxative action.[2]

मेषशृङ्गफलं तिक्तं कुष्ठमेहकफप्रणुत्।
(Bhavaprakasha, Guduchayadi Varga 255)

Tinospora cordifolia (Willd.) Miers ex Hook. f. & Thoms

Family : Menispermaceae
Hindi : Giloe
Distribution : Throughout Tropical India

Use: The stem juice is useful in diabetes.[12]

iVkyfuEckey dke rkuk ----- iUk"k eg"kn'k ifn"VkA
(Charak chikitsa. 6/32)

TUMOURS

Annona squamosa Linn.

Family : Annonaceae
Hindi : Sharifa
English : Custard Apple
Distribution : Throughout India.

Use: The ripe fruit is medicinally considered a maturant, and when bruised and mixed with salt, is applied to malignant tumours to has suppuration. The leaves are used as a poultice to produce suppuration.[7]

Catheranthus roseus (L.) G. Don

Family : Apocynaceae
Hindi : Sadabahar
English : Periwinkle
Distribution : Throughout India

Use: The alkaloid 'vincristine' derived from leaves is used for treatment of acute leukaemia in children including lymphocytic leukaemia.'Vincaleukoblastine' is used for the treatment of Hodgkin's disease and 'leukocristine' employed for breast cancer and malignant lymphoma. Several combinations of different leaf alkaloids have been used in multiple drug cancer therapy with varying degree of success. [12]

संदपुष्पा कषाय.....रक्तार्बुदविनाशिनी।
(P.V. Sharma, Dravyagunavigyana Vol-2, Raktarbuda)

Ficus racemosa Linn.

Family : Moraceae.
Hindi : Gular
English : Cluster fig.
Distribution : Throughout India

Use: The milky juice in combination with sesamum oil is administered in cancer. [13]

पित्तार्बुदे .....विघृष्य चोदुम्बर शाकगोजीपत्रै मृंश.....
(Chakradutta 41/51)

Podophyllum hexandrum Royle

Family : Podophyllaceae
Hindi : Bankakri
English : Indian Podophyllum
Distribution : Temperate Himalayas

Use: The rhizomes and roots yield 'podophyllin' and 'podophyllotoxin' as the active principles. During recent years, 'podophyllin' has acquired special importance for its possible use in some forms of cancer. The limiting factor has been the severe gastro-intestinal discomfort followed by its use in high doses. The cytotoxic effect causes mitotic arrest, nuclear fragmentations and other cell damage. As a karyoplastic, it affects both dividing and non-dividing cells. 'Podophyllotoxin' and 'peltatins' have high potency in reducing damage in sarcoma, carcinoma and melanoma (Cancerous compounds).[13]

Taxus baccata Hook. F.

Family : Taxaceae
Hindi : Thuner, Birmi
English : Himalayan Yew
Distribution : Temperate Himalayas

Use: 'Taxol', obtained from the needles is reported to cure uterine and breast cancers.[13]

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SYSTEMS BIOLOGY : A PRIMER ON CONCEPTS*

PROF. B.L. PANDEY** AND ABHAY KUMAR PANDEY***

Attitudinal change of avoiding being jailed into hypothesis based on established concepts. and research pursuits by multidisciplinary approach that integrates quantitative and computational methods with experimental biology to resolve challenges of complexity – constitutes notion of systems biology. It is a biological discipline of everything. A discipline of everything can't really be named and a theory to explain everything appears to explain nothing. Fundamentally novel theory is no necessity to explore and understand complexity. It is adoption of more comprehensive and pluralistic mind set, than adopted in past, to characterize bits of scientific facts, that is called for Systems Biology aspires to analyse entirety and not so much indulgent in entireness of the analyses. It is the movement beyond analysis of individual isolated molecular parts, toward comprehending bigger picture of the components, functioning as integral parts of a whole, in question.

Research effort of Systems Biology is projected on to the 'hyperspace', spanned by molecular complexity, structural complexity, temporal complexity, abstraction and emergence and algorithmic complexity. Each such perspectives nevertheless, overlap, one another and are not mutually exclusive. Technical advances anabling multiple parallel high throughout analyses have advanced ambitious goal of a systematic, perhaps exhaustive, identification, characterization and categorization of all genes and proteins of a genome, as far as possible. Next, this is followed by studies on functional aspects of individual genes and their encoded proteins, e.g. the interaction pattern, biochemical activities, and biological role. The regulatory interactions between genes, proteins and metabolites contribute, in a combinatories and constraints manner to molecular complexity. The whole therefore, becomes more than the sum of parts. The post genomic biology aims at establishing the genome wide 'network map' of all the specific, regulatory interactions between the molecules in an organism. Systems biology is indeed a 'network biology'.

Next, there is task of studying the dynamics of the collective behaviour of the molecules in the network. Need for the computational capacity to analyse and manage the vast amount of sequence, protein structure, functional and expression profile data has brought bio-informatics to centre stage of genomics. This empowers systematic quest for missing parts of a finite jigsaw puzzle of genome, by mind set oriented to original perception of 'discovery' science, instend of the traditional 'hypothesis-driven' science. Comprehensive characterization of details in qualitative and quantitative terms is important because living systems exhibit immense heterogeneity of individual components. The combinatorial possibilities of interaction among the components (i.e. genes, peptides, cell types, organisms) to generate biological function are unending. These heterogeneous entities are organized. No physical systems possess such distinction as living systems. Future biology thus, has obligation for systematic, exhaustive analysis of individual parts, their interaction modes and quantitative parameters within molecular dimension of biological complexity. All this constitutes essential first step only in journey toward understanding a given living organisms as an entity a system.

Genes determine proteins, which organize the chemistry to assemble organelles and cells. A group of cells assembles as tissue, bearing characteristic patterns. Tissues form organs. In this organization of the living organizm the transition are smooth not abrupt in regard to features and role as seen in non-living materials of man made systems. This appears a fundamental distinction of living systems from man made machines. Such multiscale complexity in material structure is also spread to dimension of dynamic behaviour, i.e. both in space and in time. A central goal of studying generation of the temporal patterns in behaviour of a system is understanding of the finite relationship between the architecture of network on onehand.

The relationship implements various feedbacks, modulations and control schemes. On the other hand,

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particulars of the dynamics may be taken to consideration. The temporal oscillations, in very basic temporal pattern, are manifested in gene expression in cell division cycle. They occur also in various other cellular processes like change of redox states response to damage of DNA etc. High level physiological variables too display periodic dynamics e.g. the trans-membrane potentials, Systolic calcium, secretion of humeral mediators, neural activities and muscle contractions. The oscillations may also be local manifestation of large scale spatiotemporal traveling waves, like the waves of excitation in the heart or brain, animal swarms, flocks or even the nationwide outbreaks of infections. The spatiotemporal patterns at various scales of magnitudes constitute example of phenomenon of 'emergence', inhered in living systems.

Identification of messengers mediating the regional synchrony and function, such as the oscillations of calcium within single islet in pancrease, is one of the challenges for biological understanding. The systems therefore, require to be studied when they are not in equilibrium. As an example, the dynamics needs analysis in the metabolic responses of cells to chemical perturbations as to present the metabolic model. Till now the focus has been on steady state analyses of metabolic fluxes.

Many phenomena associated with complex systems are better understood in terms of general abstract principles. No reference is made to particular material constituents. An example of circadian rhythm can illustrate this. Its oscillatory nature is required as such to be studied in an abstract sense. The traditional studies in molecular biology would focus on identifying the tangible material substrate lying under observed phenomena, e.g. particular genes that are involved in the circadian rhythm. Such habitual epistemology drives the ubiquitous hunt for molecular pathways that cause particular behaviour or disease. If living organisms were machine findings in such searches could be enough. Identification of genes critical to periodicity in circadian rhythm may provide mechanistic, quantitative, working explanation as needed, but cannot suffice for understanding how the more abstract property of oscillation arises from the organization and interplay of the individual components. The physicists mathematicians and even engineers study such phenomena without being tied to underlying particulars and from a more general perspective. The cult of systems biology is paradoxically reductionist, in regard to seeing emergent systems property as a consequence of interplay of the parts. This necessarily requires simplication, abstraction, conceptualization and formalization. The philosophy is not of leaving out irrelevant details but instead, strive to build understanding with abstraction beyond. The technical and methodological issues there is a fundamental limit to modeling i.e. system is usefully described by an abstract formalism. This is like realization of limit beyond which computer files cannot be compressed. The concept of computational irreducibility comes in force. Predicting emergent behaviour in biological system is not subject to short cut of a theory and is driven by details of real world encounters.

A central feature of complexity in a living organism is that it encodes and processes information. Such feature may be comprehended in something like 'algorithmic complexity'. The term refers to measures for computational resources needed to solve a computational problem. The same may apply to complexity of the 'problems' which organism computers and the physical medium used to do that. By analogy, that applies also to complexity to the theoretical models simulating the computations by organism. A living system that computes its own development and homeostasis in response to external pertubations. The DNA sequence, with genetic code and transcriptional regulation as programming language, embodies digital kind of computing. The biochemistry and neuropsychophysiologic functions in her analog component (molecular concentrations, membrane potentials etc.) for processing information. Gene regulatory networks in cells process information by transforming a continuous development signal, encoded by a hormone concentration as the input, in to a gene expression pattern and associated cellular phenotype as the output.

Some yet to be identified aspects of organismal

complexity will not be subject to mathematical modeling and general prediction. Only way for computing such complexity with reasonable resolution would be to use knowledge of all the parts simulate every step, bit by bit. As simplification is essential to understanding, the sophistication of logic must have upper limit. Only below such limit the features of living system can be abstracted and mathematically modelled.

Novelty of systems biology lies in the anti-reductionist thought in mainstream experimental biology which emphasizes active experimentation in iteration with theory instead of relying on thinking about experimental observation reported by others. There were times when biology had theories but no data. Then molecular biology ushered an era of data but no theories. The new age of systems biology promises theories with data and vice versa.

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DIETETICS IN AYURVEDA

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Ayurveda considers *Ahara* (diet) as very crucial element for the maintenance of life and hence it has been included in the three *Upastambhas* or the three pillars for life sustenance along with sleep and abstinence. Considering its importance and keeping in view its dependence on the status of *agni* (Digestive capacity), it has been described to be decided in relation to the *Prakriti* and the health or the diseased status of the individual as well as the qualities of the food product itself. Various general principles have also been described in a scattered form in the *Ayurvedic* texts which describe about the basic rules regarding the consumption of food. Here we will discuss the main general principles regarding dietetic rules for eating the food and evaluate their scientific role.

Ashta Ahara Vidhi Vishesha Ayaytana –

Charaka[1] has described eight factors which govern the ultimate effect of food intake in the body as –

1. ***Prakriti* (Nature of the food article) –** one should consider the nature of food article being consumed in terms of its properties such as its *Rasa* (Taste), *Guna* (Properties) (also includes *Guru* (heavy) and *Laghu* (light) property of *Ahara* which pertains to its digestibility), *Veerya* (potency), *Vipaka* (transformed product after digestion), *Prabhava* (Special effect) and judge its suitability for the person consuming them. For simple example take rice – newly harvested rice is *guru* (heavy to digest) while that which is older than a year is *laghu* (light to digest). So an article should be consumed only after assessing its suitability for the person.

2. ***Karana* (Method of processing the food) –** Method of processing of the food has also been given due consideration in Ayurveda and also is present even today in the various Indian style of cooking. A single food article by the various ways of its preparation will provide different effects in the body. For example rice cooked without taking out *Manda* (the starch portion of rice obtained when rice is cooked in greater amount of water) is heavy to digest while the one with *Manda* removed is light to digest. Similarly the different other preparations of rice as *Lai (Kheel),* rice flour and *Chuda* have different properties in terms of digestion and their effect on the body. Similarly *Dahi* is *ushna* and *guru*, *abhishyandi* (obstructing) in nature, but if we in the context of processing- churn it and remove the butter portion and add *Trikatu*, *Jeera*, salt or sugar to it– its property will change each time. So we can see that the processing of food was considered a very important tool for the addition and subtraction of the desired qualities in any given food to make it wholesome for the person.

3. ***Samyoga* (Combination) –** The combination of one food to other also imparts various qualities to the resultant food which may either be the additives of the combined ones or may be entirely new ones. *Sattu* told to be taken with only salt and water is *Ruksha* (un unctuous), *Laghu* (light) and *Karshaka* (emaciating), but to that in which sugar is added turns *Snigdha* (Unctuous), *Guru* (heavy) and *Tarpaka* (nourishing). Here a person should also keep in view the compatibility of the food items being combined in terms of the principles of *Virruddha Ahara* (in-compatible diet).

4. ***Rashi* (Food quantity) –** In addition to the above properties due consideration should also be given to the quantity of the food consumed in terms of its properties as well as the *agni* and the health or diseased status of the individual.

5. ***Desha* (Habitat) –** The habitat of the food items imparts its qualities in the food article in terms of its contents, their proportions and percentage. The principle in Ayurveda states that food articles and drugs native to the place of birth and living of an individual are naturally suited to him. So a person should judge the place of origin

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of the food article to know about its suitability. For example let's consider here meats of various animals – meat of aquatic animals are very different in property and constituents from that of those living in plains or in marshy areas; thus, before consuming any food article an enquiry about the source of origin of the food should be made.

6. ***Kala* (Time) –** It refers to the time of the year. It is of two types – *Nityaga* (which expects the compatibility to *Ritu*) and *Avasthika* (which requires the wholesomeness to the status of the person either healthy or diseased) and the diet should be ascertained accordingly, by following the rules as prescribed.

7. ***Upayoga Sanstha* (Rules governing the intake of food) –** Various rules have been described in the Ayurvedic texts which should be followed for the intake of food and also for its digestion. They will be described in detail further.

8. ***Upayokta* (Wholesomeness to the individual taking it) –** Besides considering all the above stated factors a person should finally check for the suitability and wholesomeness of a given food article to his own health. For example milk is considered as the best *Jivaniya* substance, and this milk even if is having all the good properties, is suited by combination, *Desha* etc. for the people in a particular area, still it's not suitable for a *Kushthi* (person suffering from obstinate skin diseases) (*Kaphaja* especially) even of that area.

Sushrutokta *Dwadasha Ashana Pravichara* – Sushruta after describing the *Ritucharya* (Seasonal regimen) has described about *Dwadasha Ashana Pravichara*[2] stating that the *Ritucharya* should be followed keeping in mind the following *Dwadasha Ashana Pravichara*. *Pravichara* means that which should be considered before eating both by the healthy as well as the diseased person. The factors stated are -

1. ***Sheeta Anna Upayoga* (Usage of cold food substances) –** Here we can see that contrary to the Charakokta principle of *Ushnamashniyat*, here consumption of cold foods has been advised, but this advice is conditioned, only for those who are suffering from *Trishna* (thirst), *Mada* (intoxication), *Daha* (burning sensation), *Stri* (females), *Murchha* (comatose), *rakta pitta* (bleeding diathesis), *Visha* (poisons) and are *Ksheena* (weak). In such kind of people taking of warm and hot foods will not be beneficial as all these conditions are predominated by *Pitta Dosha*.

2. ***Ushna Anna Upayoga* (Usage of hot food substances) –** A person suffering from *Vataja* and *Kaphaja* disorders, one who has consumed *sneha*, *Virikta* (one who has taken the body purifying practices) and the person who doesn't have *kleda* in one's body should indulge in the consumption of hot food items. Hot food items will pacify and resolve the problems in above stated people and will be wholesome to them.

3. ***Snigdha Anna Upayoga* (Usage of unctuous food substances) –** A *Vatika Prakriti* person, one who has excessive dryness in the body, a person who has indulged in excessive physical exercise or sexual practices should habitually consume unctuous food substances.

4. ***Ruksha Anna Upayoga* (Usage of un unctuous food substances) –** Persons having excessive unctuousness in the body or excessive fatty tissue (obese), persons suffering from various *Pramehas* (urinary disorders) and having *Kapha* predominant body should indulge in the consumption of un unctuous food items.

5. ***Drava Anna Upayoga* (Usage of predominantly liquid food substances) –** People afflicted with thirst, having dry- un unctuous body and weak people should use liquid food articles predominantly.

6. ***Shushka Anna Upayoga* (Usage of dry food substances) –** people having excessive *Kleda* in the body, *Vrani* (wounded person) and those suffering from various types of *Pramehas* should use dry food substances regularly.

7. ***Eka Kala Anna Upayoga* (Usage of food substances only once) –** Food should be taken only once by those who are themselves weak or have a weak *agni* (digestive strength) for such kind of habit will increase their strength.

8. ***Dwi kala Anna Upayoga* (Usage of food substances twice) –** proper *Agni* status requires the consumption of food twice for its maintenance.

9. ***Aushadha Yukta Anna Upayoga* (Usage of food substances with medicine) –** People who don't like to take medicines should be given

medicine mixed in the food so that he may be able to take the consume the medicine which is a necessity for the person.

10. ***Matra Heena Anna Upayoga*** **(Usage of food substances in reduced amount) –** persons having reduced strength of *agni* or the digestive power should take food in decreased amount so that it may get digested properly.

11. ***Dosha prashamana Anna Upayoga*** **(Usage of food substances which ameliorate the *doshas*)–** Food according to the *Ritu* (season) is considered as the *Dosha Prashamana Ahara.*

12. ***Vrityartha Anna Upayoga*** **(Usage of food substances for nourishing the body) –** Food taken to maintain and nourish the body is considered under this heading.

Discussion

All these twelve considerations described by Sushruta are the specifications of special dietetic emphasis which should be followed by special group of people. They are in no way contraindication to the Charakokta principles. They are just stating the clear indication of the food type which is to be taken by a particular group of people in context to their digestion capacity and for bringing wholesomeness to the health of the individual.

If we interpret these aspects, in terms of researches conducted now, we see that no attention has been given to the ease and time of digestion. Their main role of focus is on the glycaemic index of foods. Some of the studies quote that the method of processing of the food may bring the possibility of improving food properties[3]. That study has also quoted that the metabolic responses to starch in cereal and legume products are greatly affected by food structure. This concept supported by their studies is much similar to our understanding of the *Samskara* or the processing of food.

Similarly the modern science also accepts that the composition of all the foods varies in terms of their carbohydrate, protein, fat, vitamin, mineral and water content and so their pace of digestion in the body will vary.

Further, it is also similarly true that our method of cooking the food also modifies their properties. Practically, we all have seen that there is difference in the digestion time of the same materials which are cooked on gas by the conventional cooking method and microwave food processed in little amount of oil; which also proves our concept of *Sanskara*.

Further our *Acharyas* were also very scientific in explaining the rules of consuming food[4] in which they have described that one should consume freshly prepared, hot, unctuous food which is good in potency, having no harmful combination, in a place which is suited to him, with all the required materials as glass, plate, spoon etc, sitting properly, in a way which is neither too fast nor too slow, without talking, laughing or focusing elsewhere, concentrating only on the food taken when the prior taken food has been digested.

Conclusion

The principles stated above are the ones which are followed even today in the rules for eating the food properly and are all scientific. All these ensure that the food taken is properly chewed and digested; it doesn't get in the respiratory tract and gives fulfillment to the individual. Importance of chewing the food has been well accepted even by the modern scientists in helping in the digestion process. Due consideration has also been given to the pace of eating the food – if a person eats too fast, the satiety centre will saturate later, hence overeating will occur; while at the other end if the person eats too slowly his satiety centre will saturate early, thus providing under nutrition. Similarly the role of psychological factors especially stress in hampering the digestion process is a well documented fact by the modern scientists. So we can very well appreciate the efficacy of "*Tanmana Bhunjeeta, Atmaanam abhisameekshya Samyak*" meaning one should eat focusing on the food only while at the same time assessing the self. This will aid digestion and prevent over and under eating and nutrition. So we can see that the principles of Ayurveda were very scientific. Some of them have been proved by science and some by our daily experiences. Only some of the aspects are awaiting acceptance by the modern world in scientific terms.

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AGEING CARE IN AYURVEDA AND BENEFITS OF BRAHMI (BACOPA MONNIERI LINN.)

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Ayurveda signifies the science of longevity. It also deals the methods by which longevity can be prolonged and its nature can be understood. While considering the significance of increasing longevity, this science targets all the factors affecting the ageing process. According to Charak the average longevity of human is 100 years. In order to maintain the complete longevity Ayurveda has prescribed a specific life style regimen, which primarily includes balanced diet and observation of health conduct. While defining the normal psychosomatic health, Sushruta has mentioned that, apart from normalcy of structure and function of the body, one must have the clarity of his I**ndriyas** (senses), **Mana** (mind) and **Atma** (soul). Main purpose of Ayurveda is not to attain full longevity, but to lead happy and healthy life. In classical literature of Ayurveda life span is divided into three parts –

1. Balyawastha (Childhood)
2. Madhyamawastha (Middle age)
3. Vridhawastha (old age)

In Sushruta samhita several physical and mental symptoms have been described as a consequence of ageing process. It includes **Dhatu kshaya** (degeneration of tissues), **Indriya kshaya** (deterioration of sense organs), **Bala – kshaya** (loss of physical strength and body immunity), **Virya kshaya** (decreased sexual power), **Utsaha kshaya** (loss of motivation), **Vali** (wrinkles), **Palitya** (graying of hair), **Khalitya** (baldness), **Kasa** and **Shwasa** (cold, cough and asthma) and **Klistha** (inability to perform mental and physical work). Sushruta has further mentioned that ageing is responsible for deterioration of dhatus resulting in emaciation. He has mentioned the word **Jara-sosha** which represents a cluster of physical and mental inabilities like **Krisha** (emaciation), **Manda buddhi** (subnormal mental health), **Manda virya** (reduced sexual power), **Manda bala** (reduced strength), **Manda indriya** (reduced ability of senses) **Kampana** (tremors), **Aruchi** (dislike), **Hata svara** (weak speech) etc.

In Ayurveda 100 years has been considered as a person's full length of life. In ancient Indian literature a detailed description is available for longevity (Yajurveda, 36:24). In Atharvaveda, (4:12) ageing is a natural process like hunger, sleep and death. According to Sushruta the ageing process is progressive and its gross effect can be observed at the age of 70 years[1]. The decline in physical strength, digestion and metabolism, graying of hair and baldness, dyspnoea, tremors, decline in cognitive function and learning abilities occurs due to ageing process[1,2] .

Types of ageing

1. **Natural ageing:** The major manifestations are reflected after the age of 60 years in spite of following prescribed specific regimen (ahar vihar) for maintenance of positive health. Though the deterioration is gradual and progressive but in order to further slow down the phenomenon of ageing process, **Rasayana** therapy is advocated.

2. **Premature ageing:** This manifests before the age of 60 years due to various etiological factors, the ageing process is rapid. The premature ageing can be prevented by adopting specific regimen of life including Rasayana therapy. Premature ageing can be prevented by the effective control of disease by launching preventive and curative measures. The therapeutic modalities include pharmacological and non pharmacological measures.

Rasayana: Rasayana therapy is one of the eight major clinical disciplines of Ayurveda. The object of this branch of knowledge is to remove the diseases and prevent ageing process. A number of Rasayana drugs have been prescribed which have the property of keeping the balance of the bodily dhatus. From the therapeutic point of view Rasayana may be of two types: **Kamya Rasayana** and **Naimittika Rasayana**. Kamya Rasayana has been advocated for normal healthy person's who desires further improvement in

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their health and vitality. Naimittika Rasayana is not a specific treatment for illness in real sense, but it is a specific restorative agent capable of bringing relief from an illness by way of its action. Charaka emphasizes the **Achara Rasayana**, and Sushruta elaborates **Ajasrika rasayana**, that is, the effort to obtain health. Rasayana effect can be obtained by a routine use of milk, ghee and other elements in the diet. Medhya Rasayana is supposed to have predominant beneficial effect on the mental functions. Charaka, Sushruta and Vagbhatta have given a comprehensive account of application of this therapy in the maintenance of psychic health.

Antiageing action of *Bacopa monnieri* Linn.

Brahmi (*Bacopa monnieri* Linn.) belongs to family scrophulariaceae, which prevents early ageing, improves the memory and intelligence, prolong life, nourish body and general health. Brahmi is one of the most popular medhya drugs (noo-tropic agent) of Indian medicine. In Hindi it is called as "Jalaneem", and in English "Indian Pennywort". It contains two alkaloids Bramhine (0.01-0.02%) and Herpestine. Harasaponin is also found in it [3].

Pharmacological properties

Guna: Laghu **Rasa:** Tikta

Vipaka: Katu **Virya:** Ushna

Prabhava: Medhya

The whole plant of this herb is advocated as a nervine and mental tonic and for the treatment of different mental and nervous disorders. Brahmi has been observed, influencing learning and memory process in different experimental evaluation. In case of depression, mental disability powder of its leaves are useful. Brahmi Ghrta is used in case of epilepsy and hysteria diseases[4].

Bacopa monnieri has shown a number of cognitive enhancing effects. It improves memory and learning, and has anti-anxiety effects. Dubey et al (1984) have shown that Brahmi have anabolic as well as tranquillising property which has major role in the improvement of mental health status. Charaka has described the use of Brahmi in Prajasthapana Mahakashaya[5]. He has also used it in Andra Rasayana[6], and Indrokta Rasayana[7]. Sushruta has explained the use of Brahmi in treating Asmari (stone)[8]. Recently, studies have reported that in old age dementia and mental deficiencies cases, the drug Brahmi has revealed its scope as safer medicinal agent arresting further memory loss along with improving the overall mental performance. Further, Brahmi has shown a significant improvement in general mental ability and behavioural pattern including cognitive function have shown Brahmi has potentiality to regulate altered level of brain biogenic amines and improve learning abilities. Cholinergic neurotransmitter declines with advancing age. Increased acetylcholine synthesis is seen after *Bacopa monnieri* supplementation which has improved memory and learning skills, elevated mood, prevent memory loss in elderly people. In a recent study, the drug Brahmi has increased whole brain acetylcholine, epinephrine, nor epinephrine, GABA, glutamate and histamine level among the rats. So Brahmi seems to be a good drug in controlling the premature ageing and improving the memory and general health.

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SOCIAL CHANGES IN SCIENCE AND SPIRITUALITY PERSPECTIVES W.S.R. TO AYURVEDA

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Every organization, or social movement begins with a dream. The dream or vision is the force that creates the future. Scientific explorations to along with spirituality is suitable for everyone. Classical Indian thought of ancient knowledge defined spirituality and Science as-

- *Para Vidya* which is knowledge of imperishable soul, self and spirit called spirituality.
- *Apara Vidya* which is knowledge of perishable, transient and materials called science.

The word 'spirit' means ''animating or vital principle in man and animals. It comes from Latin word 'spiritus' which means, soul, courage, vigour and breath. According to the Vedantic world view, a human person is said to poses a body, mind, intelligence, false ego and spirition.

Thus, the presence of this spirition or soul or atman is responsible for our spiritual nature just as W. French Anderson said, we do have religious, a spiritual aspect in our being. Over the years, spirituality has been defined in numerous ways. It has often been confused with religion. Religion is remedy to the particular unrest felt by man, even when he is fully equipped with all the best in life. Spirituality inspires a man to discover his hidden potential, makes him excited to translate his potential into capabilities which are further sharpened with specialized skills of performing his duties and responsibilities, but above all it provides a mind- set tuned to the objective of services with delight and with cheers. Indian tradition defined, Spirituality is the human desire for connection with a transcendent being or Ultimate Reality, and desire of integration of the self into a meaningful whole, a holistic mode of spirituality covers both physical and biological worlds and establishes relation with sociological, Environment and Psychological domains of society.

How science is contributing in social change and spirituality contributing. If science is giving strong base for the pillar of Technology then spirituality can be used to get the support on the top of the pillar. If one sees religion used by Hitler in massacre, then one should also see the technology used by Hitler in massacre. At present, technological developments have become a big silent killer which is more dangerous than Hitler.

Understanding of Social Change

Social change refers to an alteration in the social order of a society. It may include changes in nature, social institutions, social behaviors, or social relations. Social change may refer to the notion of social progress or sociocultural evolution, the philosophical idea that society moves forward by dialectical or evolutionary means. It may refer to a paradigmatic change in the socio-economic structure, for instance a shift away from feudalism towards capitalism. Accordingly it may also refer to social revolution, such as the Socialist revolution presented in Marxism, or to other social movements, such as Women's suffrage or the Civil rights movement. Social change may be driven by cultural, religious and economic as scientific or technological forces.

The broad definition given above comprises both what is commonly identified as social change, which refers mainly to actual behavior, and cultural change, which refers mainly to culturally meaningful symbols produced by human beings. The emphasis in this discussion will be on the interplay among the complex normative patterns of behavior that we call institutions, since it is that provide much of the rationale for social control and human activities in general.

The Importance of Social change in human life

Social change is such a prevalent and often disturbing feature of contemporary life that both the specialist and the lay man may be tempted to suppose that it is peculiarly modern. Certainly the extent and rate of change in the modern world are greater than in most past periods but the static qualities of primitive cultures or archaic civilizations are easily and commonly overstated. Change, at some level and

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degree. Is as characteristic of man's life in organized system as is orderly persistence. Paradoxically, as the rate of social change has accelerated in the real world of experience, the scientific disciplines dealing with man's actions and products have tended to emphasize orderly interdependence and static continuity. The genuine difficulties of dealing with social dynamics are in part responsible for this state of affairs. The relationship between small-scale and large-scale change and the relationship between short-term and long-term change exemplify the many analytical and factual complexities that are involved. This consideration make a formal definition of social change highly desirable, i.e.[Social change is the significant alteration of social structures that is, of patterns of social action and interaction. Including consequences and manifestations of such structures embodied in norms (code of conduct), values and cultural products and symbols.]

Social change owing to scientific development

Science is the knowledge about the structure and behavior of the natural and physical world, based on the facts that one can prove through experiments. Science is inter-relationship between the universe and the human beings to understand the universe better way. Modern science has been regarded as both a model of democratic self-governance and an activity requiring and facilitating democratic practices in its supporting social context (Popper 1950, Bronowski 1956). In this perspective, science is seen as embeded in and dependent on its supporting social context, but insulated in its practices from the influence of that context. As the reach of science and science-based technologies has extended further and further into the economy and daily life of industrialized societies, attention is paid to the governance of science. Science in the developing world differs from that in the developed world in three main ways: budgets are much smaller, research agendas are different because the socioeconomic and biophysical problems, there solutions are different, and there is a lower level of access meant and public understanding of scientific information and technology. The North-South knowledge gap is viewed by some, as the most pressing social and economical aspects of modern science. While there are number of North-South cooperative programs to support science in developing countries and improve technology transfer, much more should be done.

The current trend towards privatization in many countries is influencing the focus and practice of science. While in some instances the net result may be to increase research capacity and knowledge in selected areas, there is major concern that the trend may be undermining public-sector science, especially fundamental research and efforts to solve socially important problems of no interest to commercial enterprises. For example Patent, the protection of private intellectual property, makes the job of public research more difficult. There is also concern over the social implications of private ownership and control of technology, on broad public scientific literacy, and on options for public choice. In the past, our scientific methods and institutions have tended to emphasize the study of individual natural processes rather than systems analysis more than synthesis, and understanding nature more than predicting its behavior. While these approaches and perspectives have built up a considerable base of knowledge and led to a vast portfolio of useful technologies, especially in the 20th century. Many problems ofmankind can be solved only if we approach science more holistically. Greater effort is needed to *understand* integrated natural systems on multiple time and space scales. A major challenge for global science is to find institutional arrangements conducive to success. The proliferation of international networks and programs, the so-called "acronym jungle", reflects a rather ad hoc approach, necessitated in part by the narrowness of purposes of established scientific institutions and the lack of strategic, integrated support by national governments in areas like global change. What is needed the formation of true international partnerships that allow scientists in different disciplines and countries to fully support each other's aims and share resources and management duties to mutual advantage. Advances in science and technologies, such as global communication, satellite images of Earth, together with the popular fascination with dinosaurs etc., have irrevocably expanded the space and time scales with which people at many levels of society now view their world. Science is largely responsible for a growing public awareness that people share the planet with all other living creatures, that the environment which supports all life is subject to change, and that human activities are presently changing this environment and threaten to change it seriously. In the past two centuries, science has been used mainly as a tool for economic expansion and military power for the wealthier segments of the human race. It is now clear that the current

consumption of natural resources and increasing stresses on the regional and local environment cannot continue indefinitely without breakdown of the natural support systems that make present civilizations possible. Science, which helped to bring about this situation, now has an over-riding responsibility to help societies by making a transition from an obsession with growth to achievement of a dynamically stable and sustainable ecological and economic system. In this transition, an alliance between modern technical science and the holistic wisdom from indigenous societies and philosophers from all cultures can be very important. In the coming century, the rate of change of natural and human conditions and issues can be expected to continue to accelerate. Scientists have an increasing obligation to become involved with policy-makers and the public in finding and implementing solutions or means of adaptation to issues that are both local and world-wide, such as reconciling the present competitive profit motive with the common good; providing for contributions from and benefits to marginalized section of society and minority cultures; justifying current expenditures to prevent costs or damages to future generations; rewarding collective rather than individual efforts. The role of science in society and governance has never been more important.Science on the other hand has not only provided us with knowledge and deeper understanding of the world, but also enabled us to apply that knowledge and understanding for eliminating poverty and hunger, and the betterment of the human condition.The methods of science have allowed humanity to construct a coherent understanding of the laws and processes governing physical reality to a certain degree, the workings of society itself.

Impact of Spirituality on Individual and society

‘‘Listen to this spirituality wisdom which is of immense help for the attainment of the knowledge of soul. One should control his sense organs as well as fickle mind and keep him-self established in his own self after knowing the real nature of the soul and attaining the height of spiritual wisdom. Thus, with his know edge undisturbed in all situations, he will be able to examine all aspects. (Of the science of medicine).Even if some of the sense facilities are not working properly a wise person will be able to understand things by virtue of his spiritual wisdom. This shows that it is only the soul which is responsible for types of consciousness.’’ **Ch.Sh.3/20**

‘‘One who resorts to wholesome diet and regimens, who enters into action after proper observation, who is unattached to the pleasure drawn from the satisfaction of sensory objects, who is given to charity, impartiality, truthfulness and forgiveness and who is at service of learned people, seldom gets affected with disease. Disease don’t affect an individual who is endowed with excellence of thoughts, speech and acts which are ultimately blissful, independent thinking, clean understanding, knowledge, observance of spirituality prescriptions and love for meditation. All these factors influence the physical, mental, social and spiritual health of an individual and all kinds of individuals health affects the social health directly and indirectly both. **Ch. Sh. 2/46-47.**

After the Second World War spirituality and religion became disconnected. A new discourse developed, in which (humanistic) psychology, mystical and esoteric traditions and eastern religions are being blended, to reach the true self by self-disclosure, free expression and meditation. The distinction between the spiritual and the religious became more common in the popular mind during the late 20th century with the rise of secularism and New Age. However, if we were to analyse the spiritual experience and its behavioral manifestations among individuals, it becomes evident that there are some commonalities in the essence of spirituality that affect outward behavior. With this said, in what follows, I state why I believe it is important to examine the role of spirituality in social change. First, as hooks (2000) contend, “spiritual life is…about commitment to a way of thinking and behaving that honors principles of inter-being and interconnectedness” (p.77). The life stories of Gandhi, Martin Luther King Jr., W.E.B. Du Bois, Rosa Parks, Swami Vivekanand, Mother Teresa, and many other peace activists are examples of how the inner cultivation of personal spirituality can change the society. For example, Gandhi led India to independence as a spiritual tenant of non-violence (*ahinsa*) and through truth’s insistent call (*satyagraha)* (Dorn, 2002). Martin Luther King, Jr. led the non-violence movement with the spirit of *agape* (Radhakrishnan, 2002). And Du Bois committed his life to peace and the emancipation of African-Americans women, the poor and the people of the Third World because he felt a “sacred obligation” towards humanity (Hopkins, 1996). In addition to

these world figures, many grassroots leaders also endorse the importance of spirituality in their activities. Studying the lives of female adult educators for social change. Tisdell (2002) found that the spiritual commitments of her study's participants required that they actively work for social change. Lerner (2000) concluded that some activists required balance between outer work (i.e. working for benefiting society) and inner work (i.e. practice of meditation and the experience of mystery). And Daloz et al. (1996) reported that more than 80% of their sample of community activists indicated that spirituality. "Played an important role in the formation of commitment" to their activism (p. 141). Spirituality also includes an "active life force" or "high levels of positive life energy" that affects the state of human physiology (Harung, 1999; Owen, 2000). According to Harung (1999), shifting to higher stages of psychological development (i.e. becoming more spiritual) involves improvements in the way one's neurophysiological machinery functions. In the words, higher states of consciousness refine our nervous system. He further states that "only in this way can our full potential develop, and only with fully developed potential can one enjoy sustainable peak performance and happiness" (p.62). Stacks (2000) also contends that this positive life energy increases one's own creativity and gives rise to one's compassion toward others. In this way, positive life energy enhances one's well-being and becomes a source of action for others, further fostering for social change. To work for social change – a battle against the immoral and unethical forces – a higher self is required. Overall, the argument that for social change requires the inner cultivation of spiritual elements is best indicated by the famous passage of the constitution of the UNESCO: "Since Wars begin in the minds of men, it is in the minds of men that the defense of peace must be constructed." And, as I noted above, "human revolution" (i.e. inner change) is a key for the outer change. Thus, what we need is in future as possible who have developed a deeper sense of spirituality through achieving this higher consciousness and interconnectedness to our global society. The enterprise of building human capacity, of fostering constructive personal, community and institutional change, is increasingly being recognized as the fundamental purpose of development. Placing the generation and application of knowledge at the center of development planning and activity make it possible to study the practical implications of religious values, particularly the role that such values have in generating a unified approach toward social change at the grassroots level. Spirituality, in fact, connects the perishable man to the eternal being within him and inspires him to work for and work with divinity all the time at the work place, in the household and in the society. Such a man achieves the heights of glory and performs at the best of his ability all the time. We need an army of such people to achieve the goal of a law-abiding society, well-tuned to the objective of attaining human excellence at work as well as in all aspects of human endeavor. The practice of Swadharma prepares a man to the path of spirituality in action and thus the actions performed by such a person have a strong element of service and for the protection of the larger collective good of the society.

Conclusions

A careful study of scientific and spiritual methodologies indicates an indispensable role in social change. The continued role of Spirituality and Science truly indicates the basic feature of the reality to be incomprehensible to the human intellect. Conclusions about both the rate and the direction of social change are much affected by the choice of time intervals of observation, including the span between the initial and terminal observations. Constant surveillance of ongoing process is rare outside the laboratory and nearly impossible for long-range changes. In science, human errors are detected quickly because conclusions are put to test by other people. This way science tries to eliminate the subjectivity of a particular observer. When we come to the religious quest we are looking at ourselves and the observer is the observed. Therefore, the interaction between the observer and the observed is enormous and it becomes much more difficult to be objective. One can illustrate this by an example. If we try to observe how we go to sleep, our awareness decreases because in sleep we are not aware. So the mind cannot watch itself going to sleep. Science and Spirituality are the two dominant forces involving deep intellectual, philosophical and psychological approaches for the well-being of mankind. However, modern education with an over emphasized importance and advocacy towards the cultivation of science and technology without a spiritual dimension has caused an imbalance in the self, the society, the

nation and the world. Hence, there appears a need to increase the awareness towards the synthesis of science and spirituality to broaden intellectual perspectives, and thereby harmonize the society. Today, India has the highest income disparities in the world, while social inequalities like caste and gender prejudice are among the highest standards, they must be model of behaviour they expect of others. To effectively model the way, you must first be clear about your own guiding principles; you must clarify values by finding your voice. The scientific quest and the spiritual quest have been the two great quests of humanity but somehow a feeling has developed that science is antagonistic to spirituality. We should examine whether this is really so or it is because we give to science and spirituality rather narrow meanings. It will be worthy to mention that our traditional way of life along with science and technology can help a lot to the present day society to maintain a balance between science and spirituality because both are complementary to each other and can't be separated in true sense.

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SEPTIC ABORTION IN UN-MARRIED GIRLS : HOW IT CAN BE PREVENTED

*DR. (MAJOR) ANJALI RANI**

In India abortions are legalized but still septic abortions are important cause of maternal mortality and morbidity. They are even more troublesome before marriage.

In India it is social stigma to become pregnant before marriage. These days because of media awareness has increased about contraception but still because of illiteracy and also in rural area young girls still don't have any idea about prevention about pregnancy. In India sex education is very much lacking. Even mothers feel shy to tell their daughters about contraception. Whenever a girl becomes pregnant then initially she does not tell because of fear. She does not have idea where to go and then she take the help of untrained Dais and got so many complications. This mainly happens in uneducated girls and girls from rural area. These dais sometime put acid inside uterus and whole of uterus become gangrenous. In these type of cases hysterectomy has to be done. Now she is unable to become a mother. Some use sticks with poisonous material and can perforate uterus and intestine. These patients sometime land up in colostomy (in lay man language hole is made in the abdomen for passage of stool). That is so much embarrassing at this young age. Some patient even loose their life because of septic abortion and its complications.

MTP Act in India

Abortion is legalized in India according to MTP Act of 1971. This act has been enforced in the year April 1972 and revised in 1975. Following are the indication of abortions

1. To save the life of mother
2. Fetus is having serious congenital abnormalities
3. Social indication- Contraceptive failure, Pregnancy due to rape, mentally imbalanced women

What is abortion?

Abortion is termination of pregnancy before the period of viability (20 weeks). Uptill 12 weeks pregnancy they are called first trimester abortions. From 12 weeks to 20 weeks pregnancy they are called 2nd trimester abortions. It can be spontaneous or it can be induced.

Induced abortions are of two types:

1. Medical: These days drugs are available for abortion. MTP KIT (MIFEPRISTONE + MESOPROSTOL)
2. Surgical : dialatation and curettage.

Who can do it?

Registered medical practitioner is qualified to perform an MTP provided:

1. One has assisted in at least 25 MTP in authorised centre and having a certificate.
2. 6 month house surgeon training in obstetrics and gynaecology
3. One has got diploma or degree in obstetrics and gynaecology

Place where abortion can done

In hospitals, established or maintained by Government or places approved by government.

Complications of abortions

1. Incomplete abortion
2. Continuation of pregnancy
3. Septic abortion
4. Bowel injury
5. Bladder injury
6. Excessive bleeding
7. DEATH

Counseling of parents

Parents can play an important role in prevention of these abortions. Basically parents should deal this problem with patience. If this thing happen with there girl they should not scold her. They should be friendly with there child and ask the problem in detail. They should give their children sex education. They should also tell about the precautions they should take if they indulge in any such activity. They should also educate

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their childrens about prevention of sexually transmitted disease (AIDS, Hepatitis B).

Emergency contraceptive pills are available these days. If by mistake intercourse occurs without any precaution then she should take emergency contraceptive pills with in 72 hrs. If by chance she misses her period then abortion pill is available up till 9 weeks of pregnancy. So she should consult her gynaecologist immediately and under supervision take this pill. Sometime this pill causes excessive bleeding and hospital admission is required. In some cases the abortion is not complete and it requires surgical evacuation.

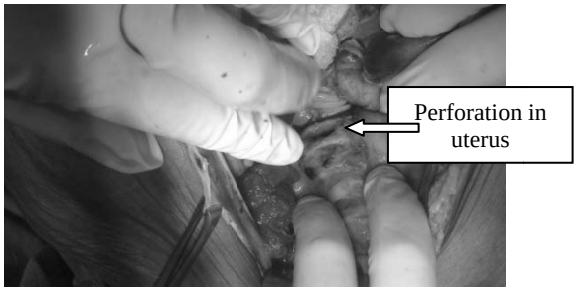

Fig. 1. Untrained dai caused perforation of uterus during abortion

Fig. 2. Medical abortion kit.

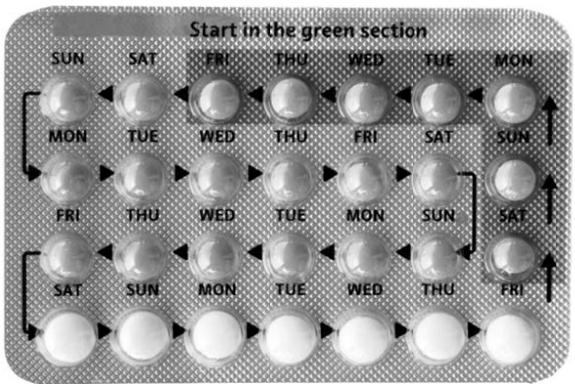

Fig 3. Oral contraceptive pills.

Some patients take inadequate dose of abortion pill which can cause trouble and lead to incomplete abortion or continuation of pregnancy. **So even if this abortion pill is available over the counter it should be taken under the supervision of gynaecologist.** Before taking abortion pill an ultrasound should be done to know the gestational age of baby and to rule out tubal pregnancy. Repeat ultrasound should be done after 14 days for knowing whether abortion is complete or not.

Important

We should catch hold untrained personnel and report to higher administrative authorities to take strict action against them.

(“**Septic Abortion can be prevented and a women can be Saved from its complications”)**

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LIFE CELL: "THE STEM CELL" -YOUR CHILD'S BIRTHRIGHT…

DR. KALPANA SINGH*

The innovative concept of stem cells which is creating a revolution in medicine brings your child the opportunity to secure their life against future ailments and provide a healthy future. Stem cells provide the opportunity to treat many critical and serious ailments in the future so that your children can approach life with more confidence.

What are stem cells?

Stem cells are the "master" cells of our body that act as building blocks to regenerate and turn into cells that form tissues ,organs and systems in the human body . Stem cells are undifferentiated "blank" cells that do not yet have a high specific function. Characteristically, stem cells have the unique ability to differentiate into a variety of cells to serve as a repair system for the body and can divide without limit to replenish other cells.

What is stem cell therapy?

Stem cell therapy is a procedure by which damaged, diseased, or malfunctioning cells anywhere in the body are replaced by introducing healthy stem cells to that area of the body. With stem cell therapy clinicians are now able to facilitate a potential treatment for all kinds of degenerative diseases because of the stem cell's regenerative abilities.

Sources of stem cells

Stem cells can be derived from various sources such as the bone marrow, embryos obtained by in-vitro fertilization, amniotic fluid, umbilical cord and menstrual blood. The umbilical cord and menstrual blood are richest sources of stem cells and they have the potential to treat many ailments through the process,

Benefits of stem cells

Stem cells, due to their huge potential and ability to generate cells and tissues can constitute different organs. Stem cells are a renewable source of replacement cells and tissues and have the potential to treat diseases such as thalassemia, leukemia, blood disorders, parkinson's and alzheimer's, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis and rheumatoid arthritis and many other ailments in the future.

Stem cell banking

The umbilical cord blood and cord tissue can be easily collected, processed and preserved through the innovative concept of stem cell banking.

a) collection- cord blood is collected from the umbilical cord immediately after the baby's birth and is drawn into the blood collection bag that comes in the kit. The mother's blood will also be collected during this time to be tested for certain infectious diseases as required by regulations. Baby's cord blood, mother's blood and umbilical cord, a specified length of 10-25 cms. Are collected within 10 mins. after the baby is born.

b) Processing- samples using utmost care adhering to international quality standards prescribed by the AABB (American association of blood banks) and cap(college of American pathologists) processed. The stem cells from cord blood are harvested using a red cell depletion method aided by a chemical called "hespan" which helps to remove most of the red blood cells. The cord tissue is washed, minced, put into tissue culture for extracting a pure mesenchymal stem cell population. A cryoprotectant (dsmo) is added to the prior to freezing .freezing is accomplished using a "controlled-rate freezer", which gradually freezes the cord blood over a period of approximately one hour.

c) Storage- lifecell uses special, compartmentalized cryo-bags to store your baby's precious cord blood stem cells. The bag includes a 20ml and 5 ml portion, and three segments for testing.

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The cord tissue stem cells are stored in 5ml cryo-vials, which has an integrated segment for testing. The stem cell bags and vials are overwrapped for added protection to avoid cross-contamination. Then the bags and vials are housed in protective cassettes and boxes and placed in liquid nitrogen storage vessels for cryogenic preservation at minus 196degree Celsius. A recent study at Indiana University demonstrated its viability after 15 years of cryogenic storage.

d) Retrieval- the client can retrieve the sample by submitting a retrieval request. HLA typing is done for the recipient. The cells are then transported in special container called “dry skipper” for shipping the frozen sample to the stem cell transplant center. The dry shipper is filled with liquid nitrogen to maintain the temperature below 150degree celcius.

‘Protect baby! Protect mom! ‘Which gives you the opportunity to secure your baby’s health and your’s too. This service is a combination of umbilical cord stem cell banking and menstrual blood stem cell banking.

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SHILAJIT : AS A UNIQUE DRUG

DR. RASHMI GUPTA, DR. GOPAL DAS GUPTA** AND DR. LAKSHMAN SINGH****

Charaka & Sushruta mention that "**There is hardly any curable disease which cannot be controlled or cured with the aid of Shilajit**". A lot of work has been done by Dr. Ghosal on the various properties of Shilajita mentioned on Ayurvedic text. Immunity enhancing property of Shilajita has been observed in my research work, so it can be used in case of immune compromised patient as like in case AIDS. As per the sentence of Charak & Sushruta it can be used to treat incurable diseases or chronic diseases. Shilajit is an exudation from rock during hot sunny days. Though it may be occurring in many parts of the world but India was the first to highlight its tremendous therapeutic value for many centuries (Caraka & Susruta). Ayurveda mentions it as wonderful medicine. The shilajit has been in extensive use in the preparations of a number of medicines.

Mythological History

In purana period the author of Brhat Rasaraja Sunder mention about Shilajita, as coated in Purana, where the Shilajita is mentioned as mineral ore substance of Mandarachala Parvata. During the time of Samudra Manthana Mandarachala and Vasuki Naga were used for churning purpose by Gods and Danaus. Due to friction some minerals were produced in Mandarachala Parvata, among these shilajit was one. In Rasarnava the origin of Shilajit is mentioned in seventh patala. Here Lord Siva narrated about the process of origin of the drug as during summer season the mountain gets heated up and as a result these mountains releases the extract of the exudates of Dhatu called as Shilajit. In Rasa Ratna Samucchaya, Basavarajeeyam, Rasa Paddhati etc. There is description regarding the origin of Shilajit, which are almost similar to each other with minor difference. Regarding the origin and description of Shilajit the authors, which followed the concept of Charaka were Chakradutta, Rasendra Chintamani, Rasajalanidhi etc. The texts which followed Susruta concept were Sarangadhara, Bhava Prakasa, Rasamrta etc. Ayurveda Prakasa, Rasendra Purana, Yoga Ratnakara etc. followed the idea of Rasarnava. According to above reference, at the time of Samudra Manthana by the Gods and Danaus, due to friction, heat was generated and as a result great amount of seat was formed. The sweat mixed with the nectar though to be divine by the gods. That divine drug was distributed in little quantities of the mountains, the same thing melted due to the sunrays and became Lac or Jatu like and hence the Shilajit got the name. All the Ayurveda lexicons believed the later part of formation of Shilajit the origin from the mountain due to the intense sun heat.

Sanskrit	:	Shilajit
English Name	:	Mineral Pitch
Hindi	:	Shilajit

Synonyms

Adreyam, Atithi, Chakram, Adrija, Girih, Saileyam, Adreyam, Girija, Shaila, Asmajam, Gaireya Silodbhava, Asmotham, Sila, Dhatu, Silabhyam, Dhatujam, Jatu, Shilajatu, Jatvasmaka, Shilaniryasa, Adrijatu, Shilasveda, Asmajatu, Shilamahe, Asmaja-tukam, Shilavyadhi, Girijatu, Shiladhatu, Shailadhatu, Shailottha, Dhatuja, Usnaja.

Availability

Shilajit is a product exuding out of rocks in the Himalayan area in summer months due to the heat of strong sun. Basically origin of Shilajit is described in Charaka Chikitsa Sthana. It is mentioned that when the mountain rocks, which are abundant in metallic elements like gold, silver, copper and iron are heated up then the Lac like exudates, which is soft like clay oozes out. In Susruta the reference of origin is found similar to that of Charaka but specifying the season as Jyestha and Asadha. Shilajatu is seen oozing out of the lime stones in the mountains near Sarayu and Ramaganga in Kumayan district of Uttar Pradesh. It is said to be available also at Gangotri and Yamunotri.

Varieties

Different types of Shilajit are mentioned in various contexts as for as number concerned, but the basic concept remains same i.e. variety depends upon the rock from where it exudes. Most of the authors

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believed that there are only four varieties of Shilajit following the concept of Charaka.

1. Swarna (Gold), 2. Rajata (Silver), 3. Tamra (Copper), 4. Loha (Iron).

This classification is based not only on the colour and consistency of Shilajit but also on the element present in the mountain from which Shilajit emerges. According to Susruta, Shilajit is of six types.

1. Swarna 2. Rajata 3. Tamra 4. Lauha 5. Naga 6. Vanga

The author of Astanga Hrdaya also followed Susruta's classification. Rasa Ratna Samucchaya described 3 types of Shilajit not mentioning about lohaja variety.

(1) Gomutra Gandhi (2) Karpura Gandhi

Gomutra Gandhi is again subdivided into two as:

(i) Sasatva, (ii) Nihsatva

In commentary of Rasendra Sara Sangraha, Shilajit was divided into two types:

(a) Girija, (b) Usaraka

Girija is again divided into 6 types based on the presence of metal in it.

(1) Kancana (2) Rajata (3) Tamra (4) Lauha (5) Vanga (6) Yasada

Usaraka is again divided into two types:

(1) Ksara or White coloured (2) Red coloured like fire

Shilajit have been mentioned as of two types in Rasarnava.

The author of Anand Kanda considered Shilajit to be of two types as that of Rasa Ratna Samucchaya but in this text the Karpura Gandhi was divided in to Sasatva and Nihsatva. The author of Ayurveda Prakasa, Rasapaddhati mentioned two variety of Shilajit.

Shilajit is placed in the different groups according to various texts. Maharasa, Uparasa Dhatu Varga, Dhatvadi Varga, Dhatupadhatu Varga, Suvarnadi Varga, Candanadi Varga, Usakadi Gana.

Sodhana

In Vidhyotani Tika the purification of Shilajit is stated. Vagbhatta followed the concept of Charaka, Susruta mentioned about the purification method with Salasaradi Gana drugs.

In Rasarnava the purification is stated, as drug should be boiled with ksara, amla varga, gomutra or with ghrta. In Rasendra Sara Sangraha and Rasa Ratna Samucchaya the purification method is similarly mentioned i.e. mixing the drug in cow milk, triphala decoction and expressed juice of Eclipta alba in an iron container successively for one day each with the above mentioned drug. Ayurveda Prakasa also followed the same procedure with little difference. Surya tapi method of purification has also been mentioned in Rasa Ratna Samucchaya and Ayurveda Prakasa. In Ayurveda Prakasa the purification of the Silajit is dealt in detail. Firstly for the external impurities, the drug has to be washed with plain water and to remove the internal impurities it should be triturated with the decoction of Neem, Guduci and Indrayava specially in the container made up of iron for 7 times with each drug. In Rasa Tarangini the author has described purification process of Shilajit in detail, which includes not only the condition in which it is purified but also the technique to extract Shilajit as per Suryatapi method, where the solvents used are hot water and Triphala decoction. The author of Rasendra Cudamani described about the purification process of Shilajit in one sloka. Swedana should be performed in swednayantra to that Shilajit which is already triturated with ksara, amla and guggulu for one hour. Basavarajiyam followed the concept of purification as above.

Test

The tests mentioned in Ayurvedic texts are only of a crude type. Genuinely of any drug is justified by the testing it as per the specification. In Samhitas and Rasarnava there is no specific description about the test of Shilajit. Rasendra Sara Samgraha, Rasa Tarangini, Rasendra Cudamani, Basavarajiyam, Rasa Paddati etc. mentioned the testing technique which are following :

1. Shilajit is put on fire it erects perpendicularly and burn without smoke.
2. If pure Shilajit is put in water through the tip of a thin erect glass it will come down slowly after spreading like fire.
3. The pure Shilajit should contain the smell of cow urine.

Colour

All the texts believed that the colour of Swarna

Shilajit is red like Japapuspa. Rajata Silajit having pale colour or white (Pandu Varna). Tamra variety possessing blue colour and lohaja type is of black colour like Guggulu.

Rasa

Majority of texts believe the rasa of Swarna Shilajit as Madhura and Tikta. Maximum authors considered Rajata Shilajit and Tamra Shilajit possessing Katu and Tikta rasa respectively. Majority of authors opinions that loha Shilajit possess Tikta and Lavana rasa whereas Astanga Hrdaya believe it to be katu rasa. Naga Shilajit possesses Tikta rasa. Vanga Shilajit is having katu rasa and Tikta rasa.

Gunas of different varieties of Shilajit

Swarna Shilajit – Sita Guna, Loha Shilajit – Sita Guna

Rajata Shilajit – Sita Guna, Naga Shilajit – Usna Mandu Guna

Tamra Shilajit – Usna Guna, Vanga Shilajit – Sandhra Guna

The Samanya guna of Shilajit is considered to be Sita by Rasa Paddhati & Ayurveda Prakasa, where as Charaka and Rasa Ratna Mala mentions it to be of Natiusna-Sita.

Pharmaceutical Properties

Organic Constituents:

	Crude Shilajit (%)	Purified Shilajit (%)
Moisture	12.54	29.03
Benzoic acid	6.82	8.58-320 mg
Hippuric acid	5.53	6.13-240 mg
Fatty acids	2.01	1.36-500 mg
Resin and waxy matter	3.28	2.44-100 mg
Gums	15.59	17.32-680 mg
Albuminoids	19.61	16.12-640 mg
Vegetable matter, sand, etc.	28.52	2.15

Mineral Constituents

	Crude Shilajit (%)	Purified Shilajit (%)
Moisture	12.54	29.03
Loss on ignition	64.58	52.63
Ash	22.88	18.34
Silica (residue insoluble in HCl)	4.60	2.69
Iron ($Fe_2 O_3$)	0.51	0.64-240 mg
Alumina ($Al_2 O_3$)	2.26	2.61-100 mg
Lime (CaO)	6.83	4.82-200 mg
Magnesia (MgO)	1.29	1.20-48 mg
Potash ($K_2 O$)	4.60	3.81-150 mg
Sulphuric Acid (SO_3)	0.64	0.97-4 mg
Chloride acid (NaCl)	0.26	0.57-2 mg
Phosphoric acid ($P_2 O_5$)	0.28	0.24-1 mg
Nitrogen	3.64	3.36-120 mg

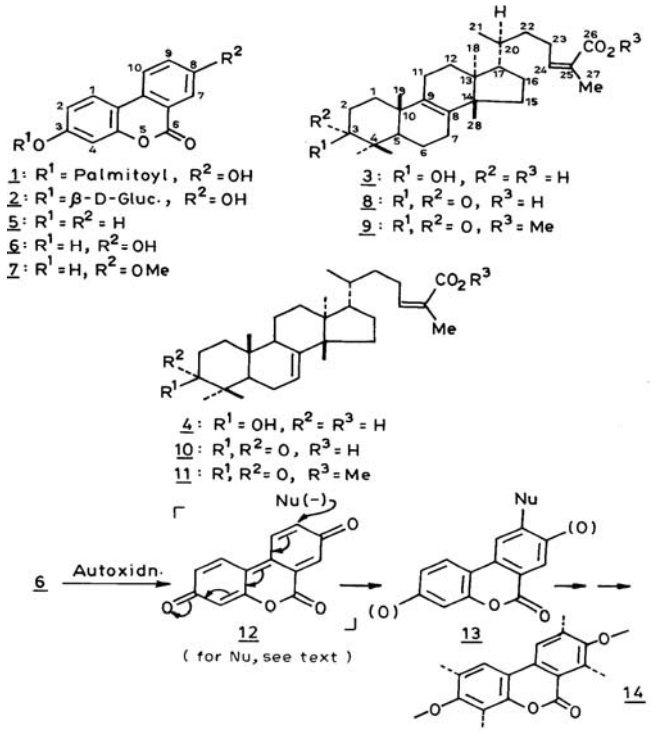

Fig. 1. Hypothetical sequence of formation of shilajit humus core.

Table: Composition of headspace volatiles of Shilajita from different natural habits:

Compound Type/Identity	Relative abundances	
	Min.	Max.
Aliphatics		
n-Undecane	3	28
n-Dodecane	6	25
n-Tridecane	2	26
1,1-Dimethoxyoctane	+	7
2,6-Dimethylnonane	+	2
4-Methyldecane	+	4
6-Methylheptanol	+	9
n-Heptanal	+	2
n-Octanal	+	3
n-Nonanal	+	7
n-Decanal	+	5
Ethylhexanoic acid	1	4
Naphthenes		
Diethylcyclopentane	+	2
Methylpropylcyclopentane	+	5
Diethylcyclohexane	1	2
Methylpropylcyclohexane	1	12
Aromatics/Phenolics		
m-Xylene	1	8
2,4-Diethyl benzene	+	1
1,2-Dimethyl-4-ethylbenzene	+	4
1-Isopropyl-3-methylbenzene	+	1
1-Isopropyl-4-methylbenzene	+	1
1-Methyl-4-propylbenzene	+	1
Naphthalene	+	6
Trans-Decalin	+	1
m-Cresol	+	2
p-Cresol	1	14
3-Ethylphenol	1	5
4-Ethylphenol	0.5	2.5
2,4-Bis(1,1-dimethylethyl) Phenol	+	1
Heterocyclics		
Benzothiazole	+	1.5
2,4-Dimethylquinone	2	10
Analysed by GC-MS, using markers (for details see Experimental section) Collected from seven different mountain ranges of the Eastern Hemisphere of the Globe Values are means of three replicates; area per cent normalized to equal a sum of 100% Min. minimum %, Max., maximum %, + ≤ 0.01%.		

Pharmacological Properties: Action

Locally antiseptic, anodyne, parasiticide and antiphlogistic. Internally alterative, tonic, slightly laxative, cholagogue, respiratory stimulant, disinfectant and expectorant, intestinal antiseptic, diuretic and lithontriptic.

Uses

Charaka says "There is hardly any curable disease which cannot be controlled or cured with the aid of Shilajit". It is used by Kavirajas and Hakims in a great variety of disease. It is specially employed in genito-urinary diseases and in diabetes; in gall stones, jaundice, enlarged spleen, fermentative dyspepsia, worms, digestive troubles, piles, adiposity, anasarca, renal stone, renal and bladder calculi, anuria etc., hysteria, neurasthenia, epilepsy and insanity, nervous diseases; amenorrhoea, dysmenrrhoea and menorrhagia; scrofula, tuberculosis, phthisis and leprosy; eczema, elephantiasis, anaemia, anorexia, biliary congestion, chronic bronchitis, asthma, fracture of bones etc., in diabetes in which it reduced the quantity of sugar and urine. But it increases the quantity of urea; therefore, it should never be given in uric acid calculus. It diminishes phospaturia and is useful in phosphatic concretions. It is also useful in ascites, ureamia, cholaemia and the like. It is valuable in cases of diabetic albuminuria, where both casts and albumin diminish; it is said to be a cure for diabetic amaurosis. "Under the influence of Shilajit, thirst, polyuria, burning sensation and exhaustion disappear quickly. It markedly helps the assimilation of sugar.[33]

Virya

All the authors considered Swarna Shilajit, Rajata Shilajit and Lauah Shilajit to be of Sita Virya. But exception in the case of Brhat Rasa Raja Sundara, who considers Rajata Shilajit as Usna Virya. Tamra, Naga and Vanga variety of Shilajit is believed to have Sita Virya. Samanya Shilajit is considered as Natiussna-Sita by Charaka, AH, RRM, RT where as the Virya of Samanya Shilajit as Usna.

Therapeutic uses explained by researches

It is powerful tonic and alternative useful in a variety of diseases. In sexual weakness it is generally administered with Asvagandha Dr. H.C. Sen concludes that Shilajit should be tried extensively in Obesity, Diabetes, Dyspepsia, Anasarca, Enlargements of liver and spleen, Bleeding piles, Asthma etc. Many Ayurvedic and modern literature are available regarding Shilajit.

Dose : According to different Ayurvedic Scholar-[34]

Charak	-	12 gm, 25 gm, 50 gm
Susruta	-	10 Tula (50kg)
Vagabhata	-	5 kg
Rasa Tarangani	-	2 Ratti
Common Practice	-	2 R-8R (250 mg-1gm)

Action on Dosasha

Swarna Shilajit	:	Vata Pitta Samaka
Rajata Shilajit	:	Kapha Pitta Samaka (exception Kapha Vata Samaka, pitta samaka, pittavata samaka)
Tamra Shilajit	:	Kapha Samaka
Lauha Shilajit	:	Tridosghna
Sadharana Shilajit	:	Kaphahara, Vatahara

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THE CONCEPT OF SCIENCE AND SPIRITUALITY IN AYURVEDA W.S.R. TO ATMA (SOUL)

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"The unreal has no existence and
the real never ceases to be,
The reality of both has been
***perceived by the seers of truth"*[1]**

There are two things. One of them is to be created (produced), while the other is to be discovered. The thing, which neither existed nor will exist, is created; while the thing, which has been existent and will also exist, is discovered. From this point of view, the thing, which is unreal (untrue), is created; while the thing, which is real (true), is discovered.[2]

This universe is formed by both consciousness-force and matter. The domain of learning and experimenting with matter constitutes material-based science are what we simply refer to as science in the modern times. The domain of realizing and understanding consciousness and the theory along with process of its enlightened evolution pertains to the deeper science of spirituality. The total, purpose, and fruitfulness of the word "science" are accomplished only in adept amalgamation of material-based science and spirituality.[3]

Both spirituality and science start their search for the same great truth from two different directions and as they gradually progress further and further, they come closer and closer to each other. Science establishes the composition of material word and its internal workings, which shows how the same can be utilized in a more and more effective manner. Spirituality the reveals mysteries of life and conscious world and eaches what is the best possible utilization of the great energies in the world towards creating peace, harmony and benefiting all living beings. To unravel the mysteries and learn proper utilization of the duality of consciousness and matter, we shall have to move ahead by parallel utilizing spirituality and science.[4]

Theory of origin of life according to science-

(1) panspermia (2) Biogenesis- life comes from preexisting life (3) Chemical theory (4) RNA world hypothesis (5) Metabolism first theory (6) Autocatalysis[5]

According to Ayurveda

The root cause of Srishti Utpatti (evolution of universe) is considered from Avyakta according to Charak and Prakriti (material entity) and Purusa (Conscious entity) according to Susrut and Samkhya Philosophy. In view of other scholars the causes of evolution of universe are considered as the following :

(1) Swabhava (nature) (2) Iswara (god) (3) Kala (time) (4) Yadrcha (incidental) (5) Niyati (invariability) (6) Parinama (transformation)[6]

Difference between Prakriti & Purusa

Prakriti (Material entity)	**Purusa (Conscious entity)**
Eka (Single)	Aneka (Numerous)
Acetana (Inanimate)	Cetana (Animate)
Triguna (Sattva Rajas and Tamas)	Aguna (Indenter mine)
Bijadharmini (Fertility)	Abijadharmi
Prasava dharmini (Productive)	Aprasavadharmi (Non productive)
Madhyastha dharma	Amadhyatha dharma **(S.Sa.1/13)**[7]

For evolution the contact between Prakriti and Purusa is essential. Purusa or soul is conscious, free from miseries, neutral, spectator, free from Sattva, Rajas and Tamas and passive. Prakriti is unconscious and active. When the both associate they reflect each other. With the reflection after contact with conscious purusa, nature (mahan or buddhi) thinks itself to be conscious, in the same way due to the association with active Prakriti, the Purusa thinks that it is the doer (karta) and enjoyer (bhokta).

The association of the two (Purusa and Prakriti) is as of a lame and a blind man, is for contemplation by the spirit of nature and for the release of the spirit. (S.K.21)[8]

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Science related to the existence of Atma

Atma as a dravya : Dravya is the substratum of property and action and is the material cause of its effect. There are two type of Dravya i.e. (a) Karandravya (causes) (b) Karyadravya (Effect). यत्राश्रिताः कर्मगुणा.....तद् द्रव्यम्। (C.Su.1/23)[9], Karandravya are nine viz, Prthivi, Ap, Tejas, Vayu, Akasa, Atma (Soul) Manas, Kala and Dik. खादीन्यात्मा..... .द्रव्यसंग्रह (C.Su.1/48)[10] Atma has got properties like respiration and other sentient symbols and the knowledge is its action. So Atma is dravya and is different from other substances and is most important for life. The Manas (psyche), Manoartha (the objects of mind), Buddhi (intellect) and Atma (soul) constitute the Adhyatmika dravya and its gunas are regarded as Adhyatmika gunas.

Abode of Atma (Soul) : In fact Ayurveda has described two forms of Atma first parmatma, which eternal mean has no origin but second Jivatma of Rasi purusa has its origin through the actions performed by virtue of Moha (attachment), Iksa (desire) and Dvesh(hated) (C.Sa1/53)[11]. The Hrdaya has been considered as seat of Atma (Soul).The Hrdaya (heart) is the seat of consciousness; हृदयं चेतनास्थानमुक्तं। (S.Sa.4/36)[12] What is the particular site of Atman (Soul) within Hrdaya? Describing the fact it has been stated that. The thumb-sized purusa (Atma/soul) is imminent in the hrdaya (Heart) of all persons. अगुष्ठमात्रः पुरुषोऽन्तरात्मा सदा जनानां हृदये संनिविष्टः। (Sveta. Upa.Ch. 3/13)[13] Same as described in Garun Puran that is Body less Atma (soul) is like a fireless flame, having the dimensions of a thumb. By injury, physical and psychic dosas are aggravated which destroy body and mind and finally soul leaves the body. इन्द्रियार्थेष्वसंप्राप्तिर्मनबुद्धिविपर्ययः। (S.Sa.6/36)[14] According to Garun Puran the soul is pulled out with pain from the body and, once reduced to the size of a thumb, it is brought into Yuma's presence.

According to modern researchers it is the weighty matters (soul). In 1907, Dr. Duncan MacDougall conducted a weird experiment which became famous as the '21 grams' experiment. By the help of six dying patients placed in specially designed beds and concluded that something, indeed, leaves the body at the moment of death. Dr Macdougall's experiments showed that something weighs about 21 grams. Dr Macdougall ensured that each especially designed bed was weighed so that any loss of fluids from urine or the bowels at the moment of death would still be weighed because the material would remain on the bed.[15]

The Soul purely believed by hindus and philosopher, Atma & Parmatma are weightless, Soul has no mass & it is not influenced by gravitational forces, so Weight of Soul is not possible at all. (Weight = Mass X Gravitational Force), Mass Value of Soul = 0, Gravitational Force = 0, so Weight of Soul has to be Zero. Science can deal with Mater only. It requires mass/volume. Otherwise science cannot accept Atma & Parmatma science has no definite answers about life/soul. If one lives according to science he is breathing. If he stops breathing he will die. Who is feeling? Brain? brain has no feeling at all. Soul is knowledge and love. We can feel, can see that as light, and cannot measure.[16]

Means of Knowledge to Atma: The soul is essentially devoid of all pathogenity. It is the cause of consciousness through the mind, senses and the specific qualities of basic elements (Sabda, Sparsa, Rupa , Rasa and Gandha). (Ch.Su.1/56)[17]. The soul can never be separated from the mind, and so, it is always endowed with consciousness. (Ch.Sa.3/18)[18] Manas is the tool by which one can perceive Sukha(happiness) or Duhkha(miseries). Adhyatma is a state which results by a neutral phase of manas. In these state manas dosen't becomes affected by Sukha or Duhkha (Brama Vaivert Puran 20/47).[19]

The Charactristic of Atma according to Ayurveda

Atman (Soul) is known as the cause of cognition or knowledge. So many properties of the same have been described in Ayurveda. Consciousness or presence of Jivatma is acknowledged by these properties. The existence of Atman is experienced due to these sign. According to Charaka Samhita the following are the Lakshana (properties) of the absolute Atma (soul).

1) Prana and Apana (Inspiration and expiration)
2) Nimeshadi movements like lid movements, locomotion etc.
3) Jeevanam (Life)
4) Manogati travelling of minds from one place to another place.
5) Indriyantra transfer of impulse from one sense organs to others.
6) Preranam initiates of impulse
7) Dhranam retention of impulse

8) Swapne deshantara gamanam travelling of mind dream state.
9) Panchatwa dispersion in to five elements after death.

Special qualities contributed by Atma

10) Ichachha- Desire of wishing
11) Dewsha-Wishing of
12) Sukham- Means pleasure is agreeable perception
13) Dukham-is disagreeable
14) Pryatna-Action or effort
15) Chetna-is Consciousness
16) Dhariti-Refers to retentive power or self control
17) Buddhi-Refers to intelligence
18) Smriti- Refers to Memory
19) Ahankara- Refers to ego.

All these are the signs of living being. These signs are not present or traced in a dead body. So they are considered to be the proof for the existence of the absolute Atma (soul). When the Atma (soul) departs, the body becomes vacant and is deprived of consciousness; only the five Mahabhutas remain so a dead body is stated to have attained the state of five Maabhutas (Ch.Sa.1/70-74).[20] Thus all the sign of life are seen when Atma attached with five mahabhutas.

Character/features derived from Atma in the living being

The features of the individual, which are derived from the Atma are taking birth in such and such wombs, life span, self realization, mind, senses, to take things into and to excrete things out of the body, stimulation and sustenance of sense organs, characteristic shape, voice and complexion of the individual, desire for happiness and sorrow, liking and disliking, consciousness, courage, intellect, memory, egoism and efforts. All these characters of all individual are derived from the Atma (soul). **(Ch.Sa.3/10)[21]**

Vedic axioms of Atma (soul)

1. Reality consists of material energy and superior spiritual energy.
2. Soul is an eternal quantum of in finite spiritual energy.
3. Soul is neither created nor destroyed.
4. Consciousness and freewill are its fundamental properties.
5. It exists in definite form.
6. Soul cannot be divided nor combined with another soul.
7. Happiness, love, kindness, gratitude, anger, etc are different states of consciousness whose pattern forms its personality.
8. Thinking, feeling, are experience while it is in this body, are also different state of consciousness of the soul experienced and expressed though body.
9. Soul's interaction with body is mediated though the subtle material elements of mind, intelligence and outside world.
10. Soul identifies with a body in a similar way we identify and operate an animated object in the video game.
11. Material body is an 'intelligent' I/O device or tool for the soul to interact with this world.
12. There is another spiritual world where it can directly interact though spiritual body (soul itself) with the world without having material body.
13. There exists a special soul, Super soul which is the basic, source of conscious and is the controller of everything else. It is qualitatively one with soul but quantitatively infinite. It exist simultaneously in three eternal aspects called Brahman (all pervading), Paramatma (localized) and Bhagavan (supreme personality).[22]

Identifying presence of Atma : It is unlikely that instruments recognize presence of soul because it is a different category of reality. For example, in order to measure the magnetic field, we need apparatus which has magnetic properties. Similarly, in order to identify the presence of a soul whose fundamental property is consciousness, instruments which are made of matter alone and thus devoid of consciousness are not sufficient. Therefore, a soul can be identified only by another soul. Where- there is pain, there is soul; there is happiness, there is soul; there hatred, there is soul; there is jealousy, there is soul; there is love, there is soul. These are all properties of soul, not body.[23]

The concept of Lokapurusa Samya and Atma

An individual is an epitome of the universe as all the material and spiritual phenomena of the universe are present in the individual and all those present in the individual are also contained in the universe. पुरुषोऽयं लोकयम्मितः। (Ch.Su.5/3)[24]. Realization of the fact that attachment leads to miseries and detachment to

happiness is that real knowledge. This knowledge can be achieved only by the virtue of the realization of the identity of the universe and man. This is the object of instructions relating to the identity of the universe and man. (Ch.Su.5/8)[25]

Each empirical soul or jivatma is trying to dissolve him which supreme soul. This condition is called Shanti (liberation), Vipapa (free from sinful acts), Viraja (free from attachments), Santa (serene), Para (absolute), Aksara (indestructible), Avyaya (immutable), Amrta (immortal), Brahman (god) and Nirvana (the state of existinction of all miseries). By this spiritual knowledge the stage of prasama (absolute tranquility or unlimited happiness) i.e. salvation is attained which is the only and ultimate goal of each jivatma. (Ch.Sa.5/23-29)[26]

According to Gita i.e. the person who wants to attain salvation, if he regards the world as true, he should practice Karmayoga (discipline of action); if he regards the self as true, he should practice Jnanayoga (discipline of knowledge) and if he regards God as true, he should practice Bhaktiyoga (discipline of devotion).[27]

Freedom of the action of the Atma : The soul is absolutely free to act as it pleases. It is also free to controls. It is also free to controls its mind and to get rid of the results of good or bad acts of its own. वशी तत् कुरुते कर्म य.....वशी सर्व निरस्यति।। (Ch.Sa.1/78)[28]

Tools of gyana (knowledge)-1) Trayodasa Karana : The instruments of knowledge are Manas, Buddhi (intellect), Buddhindriya (shrotta, ghrana, chaksu, rasan, sparsan), Karmendriya (hasta, pada, guda, upastha, vagendriya). The association of these karana (tools or instruments) along with Karta (Atma) procedure Karma (action) Vedana (perceiviance), Buddhi (intellect), Gyana (knowledge). Atma alone does neither initiate action nor enjoys the fruit of action. Combination of all these factors is responsible for manifestation of everything and without their contact there is no manifestation. **(Ch.Sa.1/56)[29]**

2) karyakaranvad: According to karyakaranvad the origin of jivatma- three types of karan/hetu described i.e. (**a) Samvayikaran**- Akash, Vayu, Agni, Jal, Prathvi, Atma (**b) Asamvayikaran**- Combination of Panchmahabhut and Atma **(c) Nimit Karan**- Ritu, Kshetra, Ambu[30]

3) According to Indian philosophy there are the many tool is used**:**

1. **Upamana** : Knowledge derived by analogy (something like something else)
2. **Arthapatti :** Knowledge derived by in inference used to account for an apparent inconsistency.
3. **Abhava :** absence (perceiving the object's absence)
4. **Sambhava :** inclusion (perceiving the object's absence)
5. **Arthya :** Tradition.
6. **Pratyaksa :** Knowledge cognizable by sense organs and the mind.
7. **Anumana** : Knowledge derived by logical inference.
8. **Shabda :** Knowledge conveyed by the words of an impartial authority.
9. **Cesta :** gesture or symbols.
10. **Anupalabdhi :** Non-perception[31].

Importance of Atma in relation to health and diseases : According to Charaka Ayu (life) is defined as- Āyus means the conjunction of body, sense organs, mind and soul is known by the synonyms dhāri, jīvita, nityaga and anubandha . शरीरेन्द्रियसत्वात्मसंयोगो ..... पय्यायैरायुरुच्यते।। (Ch.Su.1/42).[32]

Last chapter of the sutrasthana (Ch. Su.30) nityaga is replaced by Cetananuvrtti (continuance of consciousness). In fact, Cetananuvrtti is both cause and effect of Ayus. Continuance of Jivatman (soul) is cause while consciousness emanating and manifesting in body is effect.[33]

The union of sperm, ovum and the soul in the womb is designated as embryo. If there is no soul, there is no conception, no pregnancy. शुक्रशोणित जीव संयोगे तु खलु कुक्षिगते गर्भसंज्ञा भवति ।। (CH.SA.4/5).[34]

According to Cakrap Áni i.e. 'Antaratma' as pure spirit and 'Garbhatma' as the Sad-dhatuka one. अन्तरात्मोच्यते ..... व्यावर्तयति।। (Ch. Sa.3/8)[35]

Health is defined as समदोषः समाग्निश्च समाधातुमलक्रियः..... इत्यभिधीयते।। (Su.Su15/48).[36]

The features of a healthy individuals are described as - he in whom the dosas (vata, pitta, and kapha and rajas, tamas), Agni (digestive power), Dhatus (tissues), Malas (waste products) and kriyas (functions of all these) are at equilibrium state, Atma (soul), Indriyas (senses) and Manas (mind) are peaceful (calm, tranquil) is said to be healthy.

Agni (pitta), Soma (kapha), Vayu, Sattva, Rajas, Tamas, five senses and soul-these are known as Prana (life). अग्निः सोमो वायुः सत्वं रजस्तः पञ्चेन्द्रयाणि भूतात्मेति प्राणाः। (Su.Sa.4/3).[37]

In Ayurveda only living being is accepted as Purusa. The other two types of Purusa viz. Parama Purusa and Ativahika or Suksma sarira, being free from the gross body, neither do any work nor can enjoy the fruits of their actions. Their treatment is also not possible in the absence of gross physical body. So the empirical soul or Cikitsiya Purusa is accepted as the aim (subject matter) of Ayurveda. तोऽभिहितं..... स एवः कर्मपुरुषश्चिकित्साधिकृतः।। (Su. Sa.1/15/-16)[38]

Atma an important component of management of diseases

The body is the instrument for the attainment of Dharma, Artha, Kama and Moksa; so it has to be protected from diseases and the evil effects of the actions of past lives. Dosha, Dhatus and malas destroy the body when they become abnormal but protect health, strength and growth when they are equilibrium state. धर्मार्थकाममोक्ष दोषा शरीरं..... बलायोपचयाय।। (Sa. Sam.Pra.Khanda5/53-54)[39]

Dhi (intellect), dhairya (strong will) and atmadivigyana (knowledge of the soul) are the ideal therapies for the mind. धीधैर्यात्मादिविज्ञानं मनोदोषौषधं परम्।। (A.H.1/126,ChS.Su.1/58)[40]

Patient, one of the important component of treatment should have long life-span and mental strength, be curable, having sufficient means and self control, be faithful and obedient to physician. आष्युमान सत्ववान् .....उच्यते।। (S. Su.24/21)[41]

Discussion

The author of "Evolution in science and Spirituality" says "by converting energy into matter and matter into energy science has proved that forms can be converted into gross and gross forms into subtle". According to Ayurveda, the cycle in which Atma (Soul) enters the new Parthiva Sharira (material body) situated in uterus of mother to take birth in this world and leaves the old Parthiva Sharira i.e. death enter again in a new Parthiva Sharira. Again and again Jivatma takes birth by entering in Parthiva Sharira. Again and again Suskha Sharira leaves Parthiva Sharira after death. Again and again Jivatma lives in uterus of mother by entering Parthiva Sharira.

The sciences and Spirituality are two slides of the same coin and not two different objects. So we cannot live without Spirituality, just as we cannot live without food and clothing. Spirituality influences human conduct. Its principal aim is to save living being from arrogant and selfish pursuits, and so it should never be ignored. Only cooperation and coordination between Spirituality and science and nothing else, can lead the world to lasting peace, happiness and holistic progress

Conclusion

When a soul wants to enjoy this material world, forgetting its real form in the spiritual world, it takes this life of hard struggle for existence. This unnatural life of repeated birth, death, disease, and old age can be stopped when this consciousness is dovetailed with the supreme consciousness of God, So Knowledge, ingenuity, span of life, happiness and misery etc all the functions of the senses are derived from Atma (souls)and Atma gyana provides leads to Knowledge of salvation and Moksa.

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CHEMISTRY OF BHASMAS – AN APPRECIATION

PROF K.K. NARANG* AND PROF. C.B. JHA**

This is well understood that the entire Universe is composed of Matter and Energy. Man's descendance on Earth is a mystery to date. Now we know that all Matter is composed of chemicals which are energy in solidified form. Our ancient ancestors knew this. Man was considered to be made from five Basic Elements i.e. Panchamahabhuta (Akash, Vayu, Agni, Jala, and Prithvi). Eats food made of five basic elements during life time and after a span of life dies and decays mingles again with the five basic elements. This is the life cycle; (पंच भूतात्मिके देहे आहारः पंच भौतिकः).

Our ancient scholars of Ayurveda by experimenting with Nature gained experience to cure the disease and allay the pains of society using herbs. Later from experience that on exhuming the body, a very small portion of ash along with bones, which when heated at very high temperature, get powdered. The powdered ash protects the skin in cold regions. Lord Shiva and his disciples used to smear Bhasma (Bhabhuti) in cold climate of Himalayas. That ash was brought from Smashan (the cremation ground). Now we know that the burnt ash is composed of several metal oxides including calcium phosphate which is further broken down to anhydrous calcium oxide and phosphorous pentoxides. Both of which react with water producing heat which can keep the body warm.

$$Ca3\ (PO4)2 \rightarrow 3CaO + P2O5$$

$$CaO + H2O \rightarrow Ca\ (OH)2 + Heat$$

$$P2O5 + 6H2O \rightarrow 2\ H3PO4 + Heat$$

Ancient Acharyas realized the importance of ash and considerd the use of Bhasmas for treatment of diseases. Even now Bhasma or Bhabhuti is given with Honey to patients.

The purpose of this article is to appreciate the age old Ayurvedic, Traditional or Holistic approach of medication in the service of mankind vis-a- vis Modern System of Medication.

The ancient Ayurvedic Scholars used to give advice on the basis of Dashvidha Rogi Pariksha (Tenfold patient examination) and thereafter, in medieval period, by visual examination and by pulse feeling rather than dependence on instrumental data as in modern times.

The basic problem with Ayurvedic system is the language. The prescription and procedures in the ancient text are given in Sanskrit language. The word to word translation from Sanskrit to other languages does not give the natural feel hidden in Sanskrit language. Here under the authors wish to share their knowledge and experience to seek appreciations of our traditional knowledge by readers.

The practitioners of traditional system of medication were silently working for the society through all these years when they were suddenly awakened from slumber by one article published in **Journal of American Medical Association (JAMA)** in 2004 by Dr. Robert B. Saper and co-workers (Ref.-1). of Boston USA. The Ayurvedic pharmaceutical Industry approached the Ayurvedic Scholars through Government of India, discussed the issues related to Herbo metallic and Herbo mineral drugs at several national symposia. With the active participation of Govt. of India, several research workers have taken up this issue of study of Bhasmas and related aspects.

The publication in JAMA has provided an incentive to researches in the field of Ayurveda, particularly in the field of Heavy Metal Toxicity. The above authors (Ref- 1) had only analyzed the heavy metal contents of several Ayurvedic formulations but did not identify the metallic species and did not specify the reactivity of the species.

What is Bhasma?

Metallic and mineral Bhasmas used in ayurveda and siddha medicines are (a) burnt or calcined metals and minerals at high temperatures in open air.(b) dehydrated and broken up minerals by heating, (c) triturated metals with sulfur, (d) sublimed metal compounds.

Ordinarily Bhasma is a calcined product of metal / mineral in open air. Metals react with oxygen

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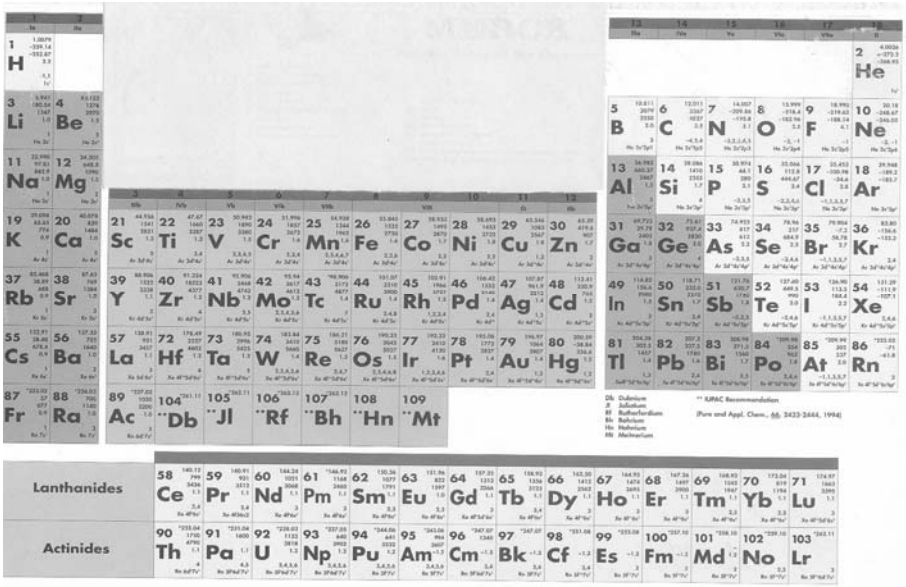

The Periodic Table

of air when heated to give metal oxide. By repeated heating and grinding the bulk metal / metal oxides are broken into finer particles. The minerals also decompose to give metal oxides.

Fe + O = FeO, Fe2O3, Fe3O4

CaCO3 = CaO + CO2

Bhasma is a compound formation or decomposition of a compound on heating in open air. Referring to all the elements arranged in the Periodic Table below:

The Periodic Table

Elements in Periodic Table are arranged according to the Atomic number.

Metals react or are made to react with non metals at room temperature or on heating to result in compounds or BHASMAS. By this definition: All compounds formation is the process of Bhasmikaran and all compounds are Bhasmas.

Mercury reacts with Sulfur even by grinding or rubbing:

Hg + S = HgS

Because it is a soft metal and Sulfur is a soft base and HgS formation is due to acid –base or redox reaction by using outer electrons of Hg and orbitals of S.

Same way, 2Ag + I2 = 2AgI

Hg + I2 = Hg I2

Not only these binary compounds, the preparation of many metal salts, metal compounds/ complexes are also akin to Bhasmikaran, because it is the compound/ complex formation involving metals. The heating of non metallic compounds in open air at high temperature leaves no residue. Thus All binary, ternary or complex compounds involving metal and metal salts are Bhasmas. HgS is a Bhasma and the process of formation of HgS is Bhasmikaran.

Standard Bhasmas

It is difficult to state what is a Standard Bhasma because of variety of procedures adopted for preparation of Bhasmas, variety of natural materials used in shodhan procedures and variety in techniques adopted in Maran procedures. Therefore, a Standard Bhasma should be the one which is prepared strictly according to the textual procedure, which may vary from one text to the other. One of the general textual procedure for Shodhan of metals and minerals involves the use of cow's urine, lemon juice and lime water, herbal extracts before final calcinations to prepare Bhasma.

Standard Bhasma, thus prepared are therefore, composed of oxides of metals and minerals as major component together with oxides of metals from cow's urine, lime or lemon water, herbal extracts used during Shodhan process, as minor components.

In classical literature certain standards are given for the characteristics of the Bhasmas.

(a) They should float on water (b) they should be

non reducible to metal (c) they should be extremely soft and fine to fix into finger furs (d) they should contain free metal and be free from the shine of the metal.

Metals and minerals have been in use, in fine powders during earlier periods, some five thousand years ago. But with the technological advancements in powdering the materials to fineness that Bhasmas have been produced in microfine powders and now it is claimed that even they are produced as nano particles. With the reduction in size of the particles of bhasmas, they are given in smaller quantities. Efficacy of Bhasmas was very well understood by the ancient scholars based on the ash content of the body when exhumed. Bhasmas are effective in smaller quantities. But then there are major and minor components as well as trace metals in Bhasmas which contribute to proper functioning of the human body.

erkfu y¨gkfu jlh ÒofUr fu?ufUr j¨xku ifj'kh fyrkfuA
vH;kl ;®xkr n<ngflf) dkofUr #x tUe tjkfouk'keAA
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Bhasmas are inorganic chemicals. These inorganic chemicals in solid state are inorganic polymers. The dehydration, calcinations, burning or incineration (bhasmikarana) leads to metal- oxo bonding in metal oxides, metal carbonates, metal sulphates, metal silicates, metal phosphates etc. which are all polymers in solid state. On dissolution or reaction of these polymers in the body fluids results in breakdown of the metal – oxo bonding by water molecules resulting in hydration of the metal ions. These hydrated metal ions then react with various functional groups in herbal materials or drugs. In general the functional groups are CO, COOH, OH, NH2, CONH2, SH etc. On reacting with these groups preferentially by the metal oxide and surrounded by larger organic moiety the complex involving metal has a greater probability of lipo solubility. The lipo soluble complex is preferentially absorbed by gastro intestinal tract and carried to the blood for further action in the Body system.

What is Shodhan?

Shodhan does not mean chemical purification. Every material is subjected to Shodhan before subjecting the materials to other processing procedures like Maran, Satvapatan, Sanskar etc. Understanding that all Natural Materials must be contaminated. It is a mandatory process. The minerals and metals procured from the market are subjected to Shodhan processing without understanding of the inherent or acquired impurities during the process. For example Hg obtained from the market is subjected to Shodhan process using cow's urine, lime and lemon water and herbal materials or fluids with their inherent chemicals reacting with the impurities in the metal.

Heavy Metals

Metals having density more than 4 gm / cc are regarded as heavy metals. The transition metals like Fe, Cu, Zn, Mo, Cr, Co, etc. are heavy metals and participate in the processes of living system. Metals and their compounds – bhasmas – become toxic if given in inappropriate or large amounts or loaded forcibly by environment on to or into the system. Great care is essential in their use and in-depth study and extensive research is required for modernization of Ayurvedic Sciences and their world wide acceptance.

All the elements available on Earth and artificially prepared have been classified in the Periodic Table. Out of 112 elements so far discovered 92 (including Tc) elements exists on the Earth and the rest being synthesized in laboratories. Some 17 elements are non metals, B, Si, As, Te, At, are metalloids and the remaining are metals. S – block metals like Na, K, Mg, Ca etc. have density less than 4gm / cc and are called lighter metals and rest are heavy metals. Some of them Fe, Co, cu, Zn, Cr, Mo participate in the processes in the living system in reasonable amounts, while other metals are non essential and are not required by the system. They interfere with the growth or functioning of the system if they force their way into the system.

All matter even in the solid state have some vapour pressure and gets absorbed or adsorbed in/on the system, participates or interferes depending on its nature / characteristics / solubility etc. Metals like Mercury are mono atomic in vapour state and therefore toxic when inhaled. In compound form, its toxicity is much dependent on the properties of the compounds.

Bhasmas are inorganic compounds, obtained by incineration of the materials after the materials being subjected to processing like shodhan and marana for breaking of bigger particles into smaller particles and making them suitable for therapeutic use. Bhasmas are then mixed with herbs and herbal extracts and finally ground to prepare Ayurvedic formulations. Due precautions are required to keep them dry and dehydrated during rainy season.

Analyses of various bhasmas recently (Ref- 2), show multiplicity of metal oxide materials. Na, K

oxides are water soluble, Ca, Mg, Zn oxides dissolve in dilute acids, while Fe, Cu, Mn, Mo, Pb, Hg oxides have variable solubilities in dilute mineral acids depending on their physical characteristics. Similarly, their chlorides, sulfates, phosphates, silicates also have variable solubilities in water, dilute mineral acids depending on the strengths of the acids.

Determination of lipo solubilities between 35-37 degrees centigrade and between pH 3.5-8.0 are essential to know if the particular bhasma will dissolve in stomach and penetrate the cell walls. Considerable research is required in this direction, since a cell is a molecular machine which thrives and replicates drawing raw materials from the environment. Bio inorganic Chemistry is now a well established branch of science (Ref -3,4).

We are required to understand the nature of material we feed to the system how it should react with the system and the fluids present in the system and how much of the fed matter goes waste. We cannot afford to provide a mixture of a dozen or two of different herbal components and half a dozen bhasmas in a particular brand of formulation, without knowing their usefulness. It certainly raises or increases the cost of drug, but its efficacy cannot be over looked. While most of the material which is unabsorbed in the body goes waste it carries the unabsorbed bhasma along with.

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AYURVEDIC MEDICINES : CURRENT PERSPECTIVES*

PROF. ANAND CHAUDHARY**

Among bests of India, worldwide Ayurveda has its own prominence in perpetuation of healthy life style and health care. In recent decades global biomedical schools are being attracted to fundamental holistic approach of Ayurveda system of medicine and consequently have engaged themselves for researches to get evidence of quality, safety and efficacy of Ayurvedic medicines on their intrinsic parameters. Publications in support of good pharmaceutics and therapeutics of Ayurveda are not rare now. Every reputed journal of health care is carrying authentic information about Ayurveda. Department of AYUSH of Government of India is taking continuous lead for academic and administrative reforms in this sector. Ten amendments in the last four years in chapter IV A of Drugs and Cosmetics Acts and relevant Rules are enough evidence about sincerity of Government for mainstreaming of Ayurvedic medicines.

But, even after all these academic, administrative and regulatory reforms there are pervasiveness of differential degree of doubts in the mind set of elites and commoners as well about Ayurvedic medicines. Quality, standards, stability, safety and in true sense therapeutic efficacy of Ayurvedic medicines are under scan of civil society more seriously at present. Hereby, we the fraternity of Ayurvedic medicines will put forward some facts before medicos of country through Institute of Medical Sciences of Banaras Hindu University to consider and reset their opinion in accordance of new particulars about Ayurvedic medicines.

Quality Control of Ayurvedic Medicines

Myth- "There is no methodology to check quality and standard of Ayurvedic Medicines so market is full of adulterated, spurious and misbranded Ayurvedic formulations."

Reality-

1. Since last 15 year, 10 volumes of Ayurvedi Pharmacopiea of India part 1 (seven volumes consisting of standards of single drug) and Part II (three volumes of compound formulations of Ayurveda) are being published continuously after strict screening by Ayurvedic Pharmacopiea Committee (APC). Here it is noteworthy that APC is a high academic authority occupied by top intelligentsia of country from the field of Pharmacology, Pharmacognosy, Geology, Chemistry along with Ayurvedists.
2. Pharmacopeial Laboratory of Indian Medicine (PLIM) and Central Council of Researches in Ayurvedic Sciences (CCRAS) have published "Protocol for Testing of ASU Medicines" establishing guideline for quality control and standard of Ayurvedic Medicines.
3. Rule 160 has been instituted in Drugs and Cosmetics Rule 1945 for quality control and standard of Ayurvedic Medicines in 2008 which ensures establishment of Drug Testing Laboratory (DTL) throughout country. It is mandatory for each manufacturer of Ayurvedic Medicines to get certificate from these laboratory about quality and stability of their product.
4. AYUSH Standard and Premium brand of Ayurvedic Medicines are available in open market with authentication seal of department of AYUSH, Government of India which ensures quality of Ayurvedic Medicines.
5. Government of India is also aware about all unethical practices going on in the field of Ayurvedic medicines and hitting hard to prevent these.

Stability Profile of Ayurvedic Medicines

Myth– "Ayurvedic Medicines don't have concept of shelf life. These are forever good" Reality :

1. Sharandghar Samita, treated with highest regard among Ayurveda community as part of laghutrayee, had clearly mentioned the concept of shelf life of Ayurvedic Medicines with the title "Saveerayata Avadhi" in chapter one of Pratham Khanda in verse number 55 in 13

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mentioned for different dosages forms of Ayurveda for example two months for Churna, one year for Avaleha and infinite period for Asav-arishta.

2. With the global demand of Ayurvedic medicines for export of these as medicines, a compulsory legal requirement was aroused in first decade of this century and Government of India notified shelf life regulation for Ayurvedic medicines first time in 2005. This notification was opposed by academia and industry both. Subsequently governments kept it in abeyance and re-notified it in 2009 with through research work from institutions like NIPER, NBRI and CIMAP etc. Now it is mandatory to print shelf life period of Ayurvedic formulations from April 01, 2010 as per norms of Government after fulfilling required criteria.

3. Progress is a continuous process. Therefore, Government of India is proposing more modifications in norms and concept of shelf life period of Ayurvedic medicines with all scientific input.

Safety Profile of Ayurvedic Medicines

Myth : "Ayurvedic medicines are not safe as these contain heavy metals."

Reality :

1. Many of the Ayurvedic medicaments are prepared using mineral/metal in combination with herbs in is natural process of manufacturing under an unique discipline of Ayurveda known as Rasa Shastra. Rasa Shastra started with a rational approach in 5^{th} AD and flourished fully in 11^{th} AD as an independent therapeutic branch of Ayurveda. Later it is accommodated in main stream of Ayurveda on the virtue of its quicker action, longer shelf life, good palatability and wide therapeutic range and continues in practice till date.

2. Ancient tests of Rasa Shastra have also defined toxic effects of improperly prepared medicines containing metals in detail with their instant effective therapeutic qualities when used in properly prepared form known as BHASMA which are very much nearer to nano-particles. Precautions about therapeutic administrations of Bhasma are well addressed in books of Rasa Shastra, namely from Rasa Prakash Sudhakar (10^{th} AD) to Rasa Tarangini (20^{th} AD) in very systematic way. These guidelines are given for different Bhasma (nano-medicines) with an individualistic approach.

3. From last two decades concern over the safety and therapeutic uses of Rasaoushadies (Bio-Metallic Preparation of Ayurveda) has been growing. Among these worthy to note are publications from Boston (2004, 2008, 2010 and 2013), as a sensational findings of metallic presence and its toxicity among Ayurvedic medicines.

4. Nevertheless, contemporary treatises of Rasa Shastra are progressively validating safety and efficacy of metallic preparations of Ayurveda on scientific parameters. These equality important findings, supporting intrinsic safety of these medicines, when prepared on classical parameters of Rasa Shastra, are in circulation from New Delhi (2012) and many more are now available on PubMed (2010, 2011 and 2013).

5. Interestingly, findings about toxic effect of these medicines as a new discovery in the west, but is not new for Ayurvedic medical practice. Instead, they are widely known to Ayurvedi practitioners for centuries. We, who are trained in Ayurvedic medicine, are well versed about the side effects of herbo-metallic medicines of Ayurveda.

6. We have proven that use of manually ground particles, known as Bhasmas in Ayurveda Rasa Shastra have similar properties as described in nano-technology. In concept of nanotechnology, it has been demonstrated that when materials are reduced to the nano scale they can exhibit different properties compared to their macroscale properties contributing to their unique and unfounded applications.

7. Because of compromised manufacturing methods toxic effects of these preparations are possible. Therefore, these should be prescribed, administered and monitored under a trained Ayurvedic practitioner only and should not be used by untrained practitioners nor be self-administered as Triphala Churna etc.

Efficacy Essential of Ayurvedic Medicines

Myth – "Ayurvedic Medicines have only placebo effect and not working effectively as medicine."

Reality

1. These medicines are serving human civilization of this sub-continent know as Greater Asia much before birth of any other system of medicines.
2. European Union Directives are permitting those medicines of traditional systems. In EU which are being practiced in EU Just since last 30 year without any reported adverse effects in those country and has a long history of safe practice in parent country.
3. World Health Organization accepted Ayurveda as system of medicine after its stringent procedure for the same and supporting this system for its global acceptance.

In this brief article we are trying to sensitize every member of public and all elite academicians, researchers of core science and bio-medical schools and administrators about all inherent paramount properties of Ayurvedic Pharmaceutics.

We are convinced that on account of all recent advancements which are augmenting in acceptance of Ayurvedic Medicines as quality, safe and efficacious medicines, we should humbly request to all stakeholder of health sector to amalgamate these medicines in national health care policies.

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AGRICULTURAL RESIDUES: POTENTIAL SOURCE OF RENEWABLE ENERGY

DEVENDRA MOHAN*, ANKUR AGRAWAL** AND Y SHIVA SHANKAR***

Biomass is a renewable energy source (RES) and its importance will increase as national energy policy and strategy focuses more heavily on renewable sources and resource-conservation-measures. The most important such energy-sources are wood and wood-related wastes, agricultural crops and their waste-byproducts, municipal solid wastes, animal wastes, waste from food processing-industries and aquatic plants and algae. Biomass energy (bio-energy) utilization has gained particular interest in recent years due to the progressive depletion of conventional fossil fuels that calls for an increased use of RES (Demirbas, 2007). Bio-energy can be an important alternative in a future and more sustainable energy supply. Growing interest in bio-energy is driven by the following facts amongst others (Karekezi et al., 2004):

- It contributes to poverty reduction in developing countries,
- It meets energy needs at all times, without expensive conversion devices,
- It can deliver energy in all forms that people need (liquid and gaseous fuels, heat and electricity),
- It is carbon dioxide (CO_2)-neutral and can even act as carbon sinks, and
- It helps to restore unproductive and degraded lands, increasing biodiversity, soil fertility and water retention.

Another important aspect of bio-energy is its potential contribution towards the solution of environmental problems caused by the use of fossil fuels. The mitigation of the greenhouse effect is possible through the sustainable use of biomass as fuel and/or the sequestration of the atmospheric carbon by the forests. This way, Kyoto's Protocol allows the emission and commercialization of carbon credits by means of implementing bio-energy projects, and more recently, by means of reforestation activities. In addition the direct replacement of fossil fuels for biomass leads to a considerable reduction in the emissions of sulfur and nitrogen oxides.

For an environmental engineer, there are two very important cycles in nature involving the growth and decay of organic matter, *i.e.*, aerobic cycle, which uses oxygen in the process of decay of organic matter, and anaerobic cycle that employs the conditions involving the absence of oxygen for decay of the biodegradable materials (Wright and Nebel, 2002). Anaerobic digestion offers the following major advantages over the aerobic process (CPHEEO, 1993):

- Anaerobic process is a net energy producer. Methane is obtained as a valuable by-product, which is an important source of clean energy.
- Application of the sludge obtained can improve the fertility and texture of soils.
- Pathogens in the sludge die off during the relatively long detention periods and adverse conditions encountered in anaerobic digestion.

The following are the major disadvantages of anaerobic digestion process (CPHEEO, 1993):

- Relatively large and closed (air-tight) digestion tanks are required, which need high capital investment.
- Strict process control and monitoring are needed due to higher sensitivity of the microorganisms to changes in environmental factors.
- Supernatant has higher oxygen demand along with more concentration of nitrogen-bearing compounds and suspended solids.

Biomass Resources

Biomass fuels are usually classified into four main categories: agriculture, forestry, municipal solid wastes (MSW) and different kinds of biomass energy crops (Table 1). Agricultural residues are wastes associated with the cereal harvest and processing, such as straws and stalk, rice-hulls; forest residues are wastes associated with the processing of forest products such as pruning, wood sawdust, bark, needles, wood chips; MSW is the residues associated with human activity such as waste rubber tyre, waste

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plastic and waste paper; other biomass resources include fast-growing energy trees, short rotation crops and some kinds of grass species. Agricultural residues are basically biomass materials that are byproducts of agriculture. This includes cotton stalks, wheat and rice straw, coconut shells, maize and jowar cobs, jute sticks, rice husks, etc. (Demirbas, 2006).

Many developing countries have a wide variety of agricultural residues in ample quantities. Large quantities of agricultural plant residues are produced annually worldwide and are vastly underutilized (Demirbas, 2001). The most common agricultural residue is the rice husk, which makes up 25% of rice by mass (Demirbas et al., 2006). Many different types of biomass can be grown for the express purpose of energy production. Crops that have been used for energy include: sugar cane, corn, sugar beets, grains, elephant grass, kelp (seaweed) and many others. There are two main factors which determine whether a crop is suitable for energy use (Bonelli et al., 2007). Good energy crops have a very high yield of dry material per unit of land (dry tons/hectare). A high yield reduces land requirements and lowers the cost of producing energy from biomass (Demirbas, 2007).

India is a tropical country blessed with abundant sunshine and rains, thus offering an ideal environment for biomass production. Further, vast agricultural produce also makes available large quantities of agricultural residues which can be used to meet energy needs (Kumar et al., 2002). With an estimated production of about 350 million tonnes of agricultural waste every year, residual biomass is capable of mitigation of GHG emissions to the extent of 300 million tonnes per year (Rajkumar, 2005). The estimated potential of biomass power (agricultural residues) in India is more than 16,000 MW (MNRE, 2007) whereas the cumulative installed capacity of grid-interactive biomass power was only 510 MW till 31 January, 2007 that is far below from their respective potential (MNRE, 2007).

The Chemical Processes Involved

Any organic waste or biomass can be expressed using an empirical chemical formula, which can always be derived taking different constituents of the waste/biomass into account (Peavy, Rowe and Tchobanoglous, 1986). When an organic compound represented by an empirical formula as $C_xH_yO_zN_aS_b$ goes through microbial decomposition, carbon dioxide is produced irrespective of the fact whether the process

Table 1: Classification of biomass and residues used as energy resource (Cuiping et al., 2004)

Source	Crop or plant	Residues that can be used as energy resource
Agriculture	Rice	Straw, chaff
	Wheat	Straw and stalks
	Barley	Straw and stalks
	Peanut	Stalks,
	Sugar cane	Bagasse
	Cotton	Stalks, torus
	Corn	Stalks, cobs
	Sesame	Stalks
	Soya Beans	Straw and stalks and leaves
	Rapes	Residue after rapeseeds harvest
Forestry	Timber stands	Wood chips, sawdust, needle leaves, bark, branches, cones.
	Protection forests	Wood chips, sawdust, bark, branches
	Firewood forests	Total train
	Economic forest	Wood chips, sawdust, bark, branches
	Forests for special uses	Wood chips, sawdust, bark, branches
	Sparse forest, shrubbery	Wood chips, sawdust, bark, branches
	Orchard forest (Apple trees, Peach trees, Pear trees, Citrus Trees, etc.)	Fruitwood, pruning coconut shell, chestnut shell, walnut shell etc
Municipal solid wastes		RDF-5, papers, plastic, rubber, etc.
Others	Fast-growing plants, Short-rotation crops	Total train
	Herbage plants, Ocean biomass	Purple medic, reed
	Peat	

Table 2: Production of different crops all over India (MOA, 2002)

State	Annual production (million tonnes)							
	Rice	**Maize**	**Arhar**	**Groundnut**	**Cotton[a]**	**Jute and Mesta**	**Mustard and Rapeseeds**	**Coconut[b]**
Andhra Pradesh	11.45	1.43	0.22	2.03	1.66	0.69	NA	10.93
Assam	4.0	NA	NA	NA	NA	0.69	0.14	1.36
Bihar	5.42	1.46	0.06	NA	NA	1.30	0.10	NA
Chhattis Garh	3.24	NA	NA	NA	NA	NA	NA	NA
Goa	NA	NA	NA	NA	NA	NA	NA	1.25
Gujarat	1.01	0.62	0.11	0.69	1.16	NA	0.23	NA
Haryana	2.68	NA	NA	NA	1.38	NA	0.55	NA
Himachal Pradesh	0.68	NA	NA	NA	NA	NA	NA	NA
Jammu and Kashmir	NA	0.53	NA	NA	NA	NA	NA	NA
Jharkhand	1.64	0.11	0.03	NA	NA	NA	NA	NA
Karnataka	3.73	2.11	0.26	0.90	0.98	NA	NA	17.54
Kerala	0.75	NA	NA	NA	NA	NA	NA	54.96
Madhya Pradesh	0.96	1.20	0.23	0.24	0.24	NA	0.36	NA
Maharashtra	1.95	0.22	0.66	0.46	1.80	0.04	NA	2.44
Meghalaya	NA	NA	NA	NA	NA	0.05	NA	NA
Orissa	4.61	NA	0.08	0.06	NA	0.14	NA	1.1
Punjab	9.15	0.46	NA	NA	1.20	NA	0.07	NA
Rajasthan	NA	1.01	NA	0.18	0.81	NA	1.31	NA
Tamil Nadu	7.22	0.19	0.06	1.46	0.33	NA	NA	31.58
Uttar Pradesh	11.54	1.49	0.5	0.10	NA	NA	0.90	NA
West Bengal	12.43	0.09	NA	NA	NA	7.51	0.42	3.31
Others	3.09	0.47	0.05	0.10	0.09	0.06	0.13	1.5
Total	85.55	11.39	2.26	6.22	9.65	10.48	4.21	125.97

NA: not available [a] Millions of bales [b] Millions of nuts

Table 3: Annual potential availability of agricultural residues for energy production in different states of India (Purohit, 2009)

State	Agricultural residues (million tonnes)									
	Rice husk	**Maize cobs**	**Maize stalks**	**Arhar stalk**	**Groundnut shell**	**Cotton stalk**	**Jute and Mesta sticks**	**Mustard stalk**	**Coconut coir**	**total**
Andhra Pradesh	2.89	0.33	1.71	0.22	0.51	0.65	0.22	NA	1.67	8.20
Assam	1.01	NA	NA	NA	NA	NA	0.22	0.20	0.21	1.63
Bihar	1.37	0.34	1.74	0.06	NA	NA	0.41	0.14	NA	4.06
Chhattisgarh	0.82	NA	NA	NA	NA	NA	NA	NA	NA	0.82
Goa	NA	NA	NA	NA	NA	NA	NA	NA	0.19	0.19
Gujarat	0.25	0.14	0.74	0.11	0.17	0.45	NA	0.33	NA	2.20
Haryana	0.68	NA	NA	NA	NA	0.54	NA	0.78	NA	1.99
Himachal Pradesh	0.17	NA	NA	NA	NA	NA	NA	NA	NA	0.17
Jammu and Kashmir	NA	0.12	0.63	NA	NA	NA	NA	NA	NA	0.75
Jharkhand	0.41	0.03	0.13	0.03	NA	NA	NA	NA	NA	0.60
Karnataka	0.94	0.48	2.52	0.26	0.23	0.38	NA	NA	2.68	7.50
Kerala	0.19	NA	NA	NA	NA	NA	NA	NA	8.41	8.60
Madhya Pradesh	0.24	0.28	1.43	0.23	0.06	0.09	NA	0.51	NA	2.85
Maharashtra	0.49	0.05	0.26	0.67	0.12	0.70	0.01	NA	0.37	2.68
Meghalaya	NA	NA	NA	NA	NA	NA	0.02	NA	NA	0.02
Orissa	1.16	NA	NA	0.08	0.02	NA	0.04	NA	0.17	1.47
Punjab	2.31	0.11	0.55	NA	NA	0.47	NA	0.10	NA	3.53
Rajasthan	NA	0.23	1.21	NA	0.05	0.32	NA	1.85	NA	3.65
Tamil Nadu	1.82	0.04	0.23	0.06	0.37	0.13	NA	NA	4.83	7.48
Uttar Pradesh	2.91	0.34	1.78	0.50	0.03	NA	NA	1.27	NA	6.84
West Bengal	3.14	0.02	0.11	NA	NA	NA	2.38	0.59	051	6.75
Others	0.78	0.11	0.56	0.05	0.03	0.04	0.02	0.18	0.23	1.99
Total	21.60	2.61	13.59	2.28	1.57	3.76	3.32	5.96	19.27	73.97

is aerobic or anaerobic. If there is no intentional addition of nitrates or sulfates, the electron acceptor will be CO_2. Equation (1) as shown below, which represents the complete reaction for anaerobic process:

$$[1/(y + 4x\text{-}3a\text{-}2z\text{-}2b)]\ C_xH_yO_zN_aS_b + [(4x + 7a + 2b\text{-}2z\text{-}y)/4\ (y + 4x\text{-}3a\text{-}2z\text{-}2b)]\ H_2O \longrightarrow [(4x + 2z + 2b\text{-}5a\text{-}y)/8(y + 4x\text{-}3a\text{-}2z\text{-}2b)]\ CO_2 + (1/8)\ CH_4 + [a/(y + 4x\text{-}3a\text{-}\ 2z\text{-}2b)]\ NH_4^+ + [a/(y + 4x\text{-}3a\text{-}2z\text{-}2b)]\ HCO_3^- + [b/(y + 4x\text{-}3a\text{-}2z\text{-}2b)]\ H_2S \quad \text{---------(1)}$$

In case of partial oxidation of the substrate in anaerobic digestion, if $C_fHgO_hN_kS_m$ represents the remaining molecule, equation for the mass of methane produced may be derived using the same principles as applied for the case discussed above. The fuel gas generated may be calculated using Equation (2) as given below:

$$\text{(Mass of methane)/(Mass of } C_xH_yO_zN_aS_b) = \{[(4x + y\text{-}3a\text{-}2z\text{-}2b) - Y_{dc}\ (4f + g\text{-}3k\text{-}2h - 2m)]/8\}\ CH_4\ /\ C_xH_yO_zN_aS_b \quad \text{---------(2)}$$

Where, Y_{dc} is the cell yield under anaerobic conditions, in moles of $C_fHgO_hN_kS_m$ per mole of $C_xH_yO_zN_aS_b$, which is the electron donor.

Methane fermentation is the major process by which the wastes can be stabilized in anaerobic digestion. The similar process can be successfully used for producing fuel gas from biomass also. Increased interest in this process has been shown in recent years in face of dwindling supply of energy resources. About 70% of methane produced from complex waste/biomass results from fermentation of acetic acid, which is formed as an intermediary in anaerobic degradation of carbohydrates, proteins, fats, and other organic compounds (Jeris and McCarty, 1965).

In anaerobic digestion of carbohydrates, an external electron acceptor is not required as the organic matter itself acts as electron acceptor. Many other compounds can serve as terminal electron acceptor in biological processes. In this process, two groups of bacteria, e.g., acid formers and methane formers, work in close cooperation. Acid forming microorganisms carry the degradation to the acid stage and then, methane forming bacteria complete the conversion into methane and carbon dioxide (Sawyer, McCarty and Parkin, 1994). The products of anaerobic process are usually more obnoxious than those of aerobic process. Methane and phosphine are combustible gases, while hydrogen sulfide and other products, like mercaptans and amines, are malodorous (Barnes et al., 1981).

In the anaerobic-digestion process, the microbes involved can be divided into two big groups, i.e., the first group producing mainly acetic and propionic acids is also described as non-methanogenic and it consists of facultative and obligate anaerobes like Clostridium spp., Peptococcus anaerobus, Bifidobacterium spp., Desulphovibrio spp., Corynebacterium spp., Lactobacillus, actinomycetes, Staphylococcus and Escherichia coli. Other physiological groups present under these conditions include the microbes, which generate proteolytic, lipolytic, ureolytic or cellulytic enzymes (Higgins and Burns, 1975). Various species of Pseudomonas, Flavobacterium, Alcaligenes, Escherichia and Aerobacter contribute to the acids production in anaerobic degradation of substrates (McKinney, 1962).

The major genera of microbes, which carry out the second step of anaerobic decomposition, are similar to those present in stomachs of ruminant animals and in organic sediments gathered from lakes and rivers as already mentioned. Important of these microorganisms are in the shape of rods (Methanobacterium and Methanobacillus) and spheres (Methanococcus and Methanosarcina) (Balch et al., 1979; Jones, Nagle and Whitman, 1987; McKinney, 1962; Metcalf and Eddy, 1979). The ease in growth of the facultative bacteria give them an edge over the strict anaerobes much in the same way in which they maintain their predominance over the strict aerobes in activated sludge systems.

Methane formers are ubiquitous in nature. But, their population is very small in comparison to that of many acid-formers. This disproportion in numbers is the most important reason for the difficulties, faced in starting the units based on anaerobic treatment process, without seeding. Raw sewage sludges and industrial wastewaters have many times quite low buffering capacities, which are soon spent and free acids start accumulating, thus resulting into continual reduction in pH of the system. Fortunately, the alkalinity of the digesting sludges is naturally high because of the solubilization of CO_2 produced by the process itself, and its subsequent conversion to HCO_3^-. When digestion is proceeding satisfactorily, the alkalinity normally varies from 1000 to 5000 mg/l and volatile acids are mostly less than 250 mg/l.

At pH values below 6.5 (complete end of the methanogenic activity is observed below pH of 6.2),

methane formers are gravely inhibited, but not acid formers until pH levels fall to about 5. Under such conditions, volatile acids may accumulate up to levels ranging from 2000–6000 mg/l or sometimes even higher, depending upon the biodegradable solids content of the raw sludge. To provide buffering under such conditions, addition of neutralizing agents such as lime is required.

Two pathways are feasible for generation of methane, depending on the nature of substrate used in the beginning (Zinder, 1984). The two mechanisms may be explained with the help of following equations (3-11).

(I) Reduction of atmospheric carbon dioxide:

$$2C_2H_5OH + CO_2 \longrightarrow 2CH_3COOH + CH_4 \quad \text{------ (3)}$$

$$4H_2 + CO_2 \longrightarrow 2H_2O + CH_4 \quad \text{------ (4)}$$

(II) Reduction of carbon dioxide formed in the reaction:

$$CO+H_2O \longrightarrow CO_2 + H_2 \quad \text{------- (5)}$$

$$CO_2 + 4H_2 \longrightarrow 2H_2O + CH_4 \quad \text{------- (6)}$$

$$CO + 2H_2 \longrightarrow H_2O + CH_4 \quad \text{------- (7)}$$

$$4C_2H_5COOH+8H_2O \longrightarrow 4CH_3COOH + 4CO_2 + 24H \quad \text{----(8)}$$

$$3CO_2 + 24H \longrightarrow 6H_2O + 3CH_4 \quad \text{------ (9)}$$

$$4C_2H_5COOH+2H_2O \longrightarrow 4CH_3COOH + 3CH_4 + CO_2 \quad \text{---- (10)}$$

$$CH_3COOH + CO_2 \longrightarrow CO_2 + CH_4 \quad \text{----- (11)}$$

In addition, several other groups of bacteria like denitrifiers and desulphovibrio have been observed to be involved in the reduction processes of nitrates and sulfates under anaerobic circumstances.

Concluding Remarks

India has an economy, which is largely based on agriculture and therefore, agricultural residues are available in large quantities. This situation can offer a great opportunity for India as utilization of biomass resources will be one of the most important factors for environmental protection in the 21st century. Biomass absorbs CO_2 during growth and emits it during combustion. Therefore, biomass helps in the recycling of atmospheric CO_2 and does not contribute to the greenhouse effect as much as is done by non-renewable energy resources like coal, petroleum, etc. Biomass consumes almost the same amount of CO_2 from the atmosphere during growth as is released during combustion. In addition, overall CO_2 emissions can be reduced because biomass is nearly a CO_2 neutral fuel.

Biomass derived from agricultural residues can be considered as one of the most important options in case of a developing economy like India. It also has the largest potential, which meets requirements for environmental protection and carbon-emission and it can ensure the fuel supply in the future due to abundance. Application of appropriate technologies, capable of yielding more efficient biomass production and conversion, will be sustainable as well as highly advantageous in all agriculture-based developing countries including India.

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MY JOURNEY WITH LINEAR INDUCTION MOTOR

DR. S. N. MAHENDRA*

More than 4-decades ago R&D related to Linear Induction Motor based propulsion was started in the Department of Electrical Engineering. Initially it started as a working model for Engineering Models Exhibition. Later the activities covered a range of applications like shuttle-propulsion in power-looms to material-handling to surface/overhead/underground/people-mover transportation systems. The applications developed and the R&D activities in chronological order have been as follows:

- *Shuttle-propulsion for weaving looms* (1971-73) [1]
- *Design & analysis methodologies standardization* (1973-97)[11]
- *Surface-transport* system (1980 continuing)[3, 12]
- *Testing-methodologies & test-rigs* (1980-87)
- *Overhead-transport* systems (1983 continuing)[9]
- *Conveyor-belt/material handling* (1986 continuing)[9]
- *LIM Powered People Mover system for closed-loop circular track for Connaught Place people transport system (1986-2013[4, 5]*
- *Malaviya Center for low cost LIM metro system* (1997 continuing) [3, 9, 11]
- *Independent control of forces of propulsion & attraction* (2003 continuing) [12]
- *LIM powered sieving system for sorting ore near mines* (2003 continuing)
- *LIM based traction elevator for vehicle parking* (2012 continuing) [7]
- *Linear Switched reluctance motor* (2014 continuing)
- *Segmented linear motor based propulsion for circular looms* (2014 continuing)[4]

The present article is based on the experiences, problems-faced and developments made during the journey of the author with Linear Induction Motor (LIM).

The Journey Begins

The journey started in an interesting manner during MODEX-70. Professor S. K. Kak, former Vice Chancellor Goutam Budh Technical University, Noida, was the student Convener of the famous Engineering Models Exhibition and I was a member of his core organization team. He asked me to make and present a model in the exhibition. He was himself heading a huge team of dedicated students in making a working model of Musical Fountain (similar to the first of its type made and exhibited during EXPO-70 in Japan). When I asked him what should I make? He suggested me to make a set of U-cores with DC coils which are excited in a sequence such that a horizontal component of the attraction force is produced in the iron plates fixed to the moving member facing the cores resulting in necessary force for linear motion (similar to that in a linear stepper motor).

With detailed diagrams and design I met Professor M. Bhattacharrya in the Electrical Machines Lab for his suggestions and advice. He patiently listened to the whole idea and encouraging me (as if I was in the process of inventing something new and great) said *'why not give A.C. supply instead of D.C. supply'*. To this I said *'Sir, why not provide a 3-phase distributed winding in the core like in an induction motor and energies the three-phases with 3-phase A.C.'*. He just said *'Good. Go ahead.'* Thus unknowingly my journey with Linear Induction Motor (LIM) started. The working model was made and exhibited in room no. F-5 (Rampur Hall) near the first pillar on the left side. Objects of different shapes made of aluminum were shown moving from one end of the core to the other in a linear direction along the length of the core when the winding was energized. I was feeling great as if I have done something really great, till a visitor after seeing the exhibit said that a similar machine was made by Professor E. R. Laithwaite long back. I met Professor Bhattacharrya the next day and asked him *'Sir, do you know this fact'*. He coolly said *'Yes'*. I was pained (I do not know why) and complained *'Sir why did you not tell me this during the first meeting itself so that I would not have exhibited my ignorance and felt embarrassed'*. The words he spoke after this have inspired me and encouraged me during all the development work that I have done and narrated in this article. He said, ***"If I had told you earlier you would not have experienced in you the ability to create/invent something new. Now you have confidence that you can also think original and may be in future you may make new things".*** I can say that this is a true quality of a teacher wherein a teacher not only teaches but creates opportunity in his student to realize the inherent strengths/weaknesses in him/her. His words did come true at many occasions whenever

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a new machine was made and, for all this, I give credit to him.

Now I will take you along with this journey from 1971 till date highlighting milestones and pitfalls and also the positive effect of a good teacher.

Period 1971 to 1972

During this period I continued with development of LIM for shuttle propulsion in power looms as one of the industrialist of Varanasi showed interest and offered to support for development of handloom propelled by LIM. During implementation shortcomings were observed and three modified versions of the system were made as shown in Figs.1-3. Fig. 3 shows a novel geometry conceived and made by the author. It consists of a Single Primary Double Secondary LIM (1972). This was modified later by fitting bearings for movement and lateral guidance of an Overhead Transport System. The running-rails apart from mechanical strength to the overhead system also provided return-path for magnetic flux, thus there was an additional requirement of Aluminum Reaction Rail only (1983) and a net saving of backing iron along the length of track which would have been provided otherwise for strengthening the magnetic circuit.

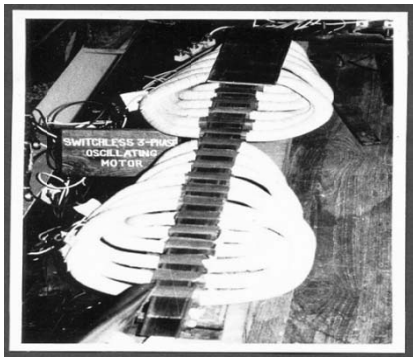


Fig.1 Back to back 3-phase LIM for automatic shuttle propulsion (1971)

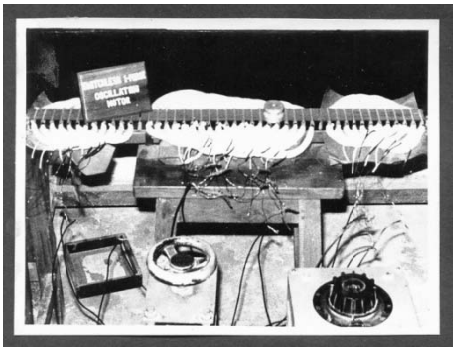


Fig.2 Single phase LIM with starting windings at the ends for producing starting force (1972)

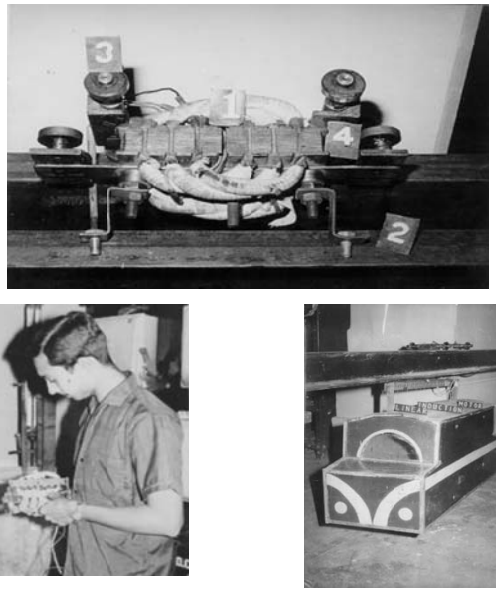


Fig.3 Single Primary Double Secondary LIM (fitted with bearings for movement and lateral guidance of OH transport system) [1972, 1983]

The small motor has carried the load of 1-adult/2-children and has application in over-head transport system.

The 1972 M. Tech. project report based on the work concluded as follows:

"The study of various types of linear oscillating induction motors made has clearly shown the possibility of developing self-oscillating/switch-oscillating linear motors operating on three-phase/single-phase supply systems. The conclusions drawn out by consideration of force/speed characteristics and mathematical analysis of respective machines clearly indicate a definite possibility of developing a method of designing of such machines. It must be realized that the perpetual oscillation of these machines and their constructional features make them one of the most complex of the electromagnetic devices and these are, therefore, not amenable to any simple analytical treatment.

Moreover, the basic shortcoming of such machines is the existence of an inherent mechanical friction and the problem of perfect alignment. The ideal arrangement will be one in which the runner moves in air under the influence of electromagnetic field developed in such machines, without touching the stationary member. The above motion must always maintain a constant 'air-gap length' through its

length of traverse. Another requirement to make an ideal machine is a long bed of traverse – preferably lying between -∞ and +∞. Although none of the above requirements are practical, they do point towards definite possibility of further development."

Period 1973 to 1978

The concluding remarks of the report were challenging hence I got registered with Professor M. Bhattacharrya in 1973 to work further on this problem. We had long sittings in the Department and in his Rajputana Hostel warden quarter. Then one day he said, *"Som now the time has come that you go out and get far better environment, facilities and exposure"*. This again exhibited the greatnesses of Professor M. Bhattacharrya because normally not many Ph.D. supervisors will tell this to their research scholars. I was bit disturbed but then the ***'Government of India's National Scholarship for Study Abroad'*** award letter was received indicating that with this scholarship I could go to any part of the world to work in the field of LIM. I was excited and contacted the giants in this subject at that time - **Professor E. R. Laithwaite** at Imperial College of Science & Technology, London, and through him **Professor A. J. Ellision**, Head of Electrical Engineering Department, The City University, London, **Professor Sakae Yammamura** of Tokyo University, Japan, and **Professor S. A. Nasar** of University of Kentucky, USA. I got encouragement and positive response from all three of them.

Now came the problem of choosing a country from these three countries for which I got the guidance from Professor R. J. Galgali, Department of Chemistry, BHU – a God gifted person who helped so many in so many ways during his stay in BHU. Based on his analysis and intuition he said *'you go to London, the UK - a country which has the roots of the subject and Professor E. R. Laithwaite is known as the father of Linear Induction Motors'*.

My correspondences with Professor E.R. Laithwaite, Professor S. A. Nasar, Professor Sakae Yammaura and Professor A. J. Ellision for seeking possibility of doing research under them have been a memorable part of my journey with LIM. It is memorable because these correspondences reflect the nature and seriousness which these professors had for the prospective research scholars – and this is essential even now. Excerpts from the letters of Professor E. R. Laithwaite are given below to show how helpful and considerate he has been in his correspondence.

"….All these things are indicative of toils and troubles of a professor at Imperial College. If you were to register for Ph. D. you will be supervised by me, as Dr. Eastham is leaving, and I have already so little time for casual visitors, it would not be fair to ask you to work with me at this time."

April 4, 1973

"….May I first offer you my sincere congratulations on being awarded the National Scholarship for Study Abroad. What I said earlier is still true. It would be unfair for someone like yourself to be under my direct supervision, as my outside commitments are so heavy that it could well be that we will talk to each other only twice a year.

However, we have very close ties with City University…..there my personal friend Professor A. J. Ellison is working on linear motors……would be willing to accept you…..and it would mean that you still have access to me, probably for longer than if you worked in my department……..

I hope you will do this and I will have the pleasure of meeting you before the end of this year." ***May 17, 1973***

The net outcome of the correspondence was that I joined The City University (TCU), London, and after meeting my guide Professor A. J. Ellision I visited Imperial College of Science & Technology, London, to report to Professor E. R. Laithwaite and take his advice and direction for my research in TCU. The few hours meeting was a memorable one as every word of his within a short time had enchanted me with the greatness of linear induction motors as experienced by him. He demonstrated so many working systems he had made to understand *'what is induction motor'* (as he had often repeated during his class lectures that he has not been able to understand what induction is). He also demonstrated his famous transverse flux linear induction motor. I was asked to hold a small 'vehicle' (with secondary aluminum plate underneath) from one end of the transverse flux linear induction motor primary member and leave it when he tells me. To my surprise the vehicle left by me on the track 'flew' over the entire length of transverse flux linear induction motor primary member without touching the track or falling sideways due to the presence of electromagnetic forces of levitation and lateral guidance produced in what he called the *'magnetic-river'* created by him. The vehicle was caught by him at the other end. During this meeting Professor Laithwaite also told me not to rush for a quick degree

but do a good work. He also told me that it took him seven years to obtain his Ph.D. degree. Perhaps he observed some reaction on my face and reacted immediately, 'It's not that I did not do much during this period. It got delayed because I did not have time to put all my work in a thesis form.' After this I met him many times without any problem, attended his inspiring lectures and watched his BBC Christmas Special Lectures. I remember each and every bit of it.

My Stay at the City University, London

My guide Professor A. J. Ellision right from day one had been very kind to me and gave me time whenever I wanted to discuss my research progress and take his advice. By nature he was also very friendly and kind to everyone and this quality of his benefitted me a lot as whenever (while meeting a person from universities and industries in and around London) I told that I am working with Professor A. J. Ellision he/she would offer to help me in my research work in whatever way it was possible for him/her. I was thus able to effectively integrate the rich academic and industrial exposure which I received in the UK and also in European cities which I visited with IEE and IEEE Students Travel Scholarships.

During one of the initial meetings when I told him that I understand the inputs and outputs of an electromagnetic system but not what is happening in the electromagnetic system. He said, *"Do you want to go inside this black-box? Do you have the courage?"* My reply was *'yes'* as I wanted to explore the links between the electrical input and mechanical output of an electromagnetic system. I knew that till I do not understand this I will never be able to effectively design these electromagnetic systems by providing a balance between all the five basic circuits of electromagnetic device viz. electrical, magnetic, mechanical, thermal and dielectric circuits of an electromagnetic system. He gave me green signal.

In yet another meeting after about six months when I approached him with a proposal to make circular transverse flux induction motor so that one can test transverse flux induction motor under dynamic conditions (as the set-up at Imperial College of Science & Technology, London, was good for standstill tests only). I had located U-shaped stampings in the Department store and had drawn a diagram also. He patiently listened to me and said 'OK you play with this till we finalize your research plan'. This resulted in development of ***Basic transverse Flux Circular Motor.*** When it was shown to the professors of Imperial College of Science & Technology, London, one of them Professor Freeman remarked ***'Oh God this is a missing link between all the electric motors made so far'***. Later BTFCM was placed as an exhibit during IEEE INTERMAG-75 at Imperial College of Science & Technology, London, - the only exhibit from a research scholar as all other exhibits were of senior professors.

Through research a link between the electrical inputs and mechanical outputs via magnetic circuit was thoroughly analyzed using the Maxwell's equations and Maxwell's Second Stress Tensor. The predicted 3-components of flux densities, forces and the performance closely matched with the experimental results obtained from BTFCM under dynamic conditions. The work was appreciated by IEE (UK) through "IEE Student Premium Award'.

Back in BHU 1978 onwards – activities & milestones

On return I had planned to integrate the knowledge gathered in London to remove the weaknesses of the working system developed before going to London. In achieving this objective the encouragement and support received from Professor G. Rajsekar needs special mention. He, after looking at my thesis, asked me *'Can you translate your research into working systems to demonstrate the principle?'* My reply was in affirmative. I told him that the main difficulty was in the laying of track along which the system has to move. He took this as a challenge and in his own dynamic way persuaded his friend Mr. K. P. Jairam, the then General Manger, DLW, Varanasi, to extend support for making the working system. I am grateful to DLW, its Officers and workers who whole heartedly extended help to make the whole system as it was unconventional in many ways. The 1:15 scale LIM based BHU-DLW surface transport model moving along 33-m oval track was later exhibited number of times in the Railway Pavelion of India International Fairs at Pragati Maidan, New Delhi. Being the only working system of its type in the country, it attracted attention of the visitors including the then Prime Minister of India Shri Rajeev Gandhi who remarked to Shri Madhao Rao Scindia, the then Railway minister that ***'this could be the future transport system for India'***.

Since then a large number of LIM based working systems including a full-scale system carrying

about 20-adults moving along 65-m meter-gauge track has been made with the help of UG/PG students and financial support from organizations like AICTE.

To cut the long story short I will narrate my journey through photographs and brief description of some of the working systems developed along with their usefulness.

(a) 1:15 scale LIM based BHU-DLW Surface Transport working System moving along 33m oval track [1981, 2001]

Fig.4 Shri Digvijay Singh, Min of State for Railways, Professor YC Simadhari, VC-BHU & Shri O. P. Gupta, GM, DLW, inspecting 15:1 BHU-DLW LIM Surface Transport System [2001]

The trolley safely moves along very sharp curves (with about 6-m diameter even at 16 kmph) due to the presence of force of attraction between the moving primary iron & the secondary reaction rail. A unique feature of LIM based system in contrast to any other conventional wheel-rail/road systems wherein (with increase in speed) the wheel-rail/road grip becomes poor leading to accidents.

The working system effectively bridges the gap between the technology & decision makers as it explains the principle of operation and the inherent advantages easily.

(b) LIM based surface transport system for underground metro moving along 65-m meter-gauge track at Malaviya Center for Development of LIM Propelled Rail Metro System: [1997, 1998, 2001]

Working system was primarily made to verify the developed design methodology. It also demonstrated the indigenous capabilities developed in the design/fabrication of LIM based systems as per specifications.

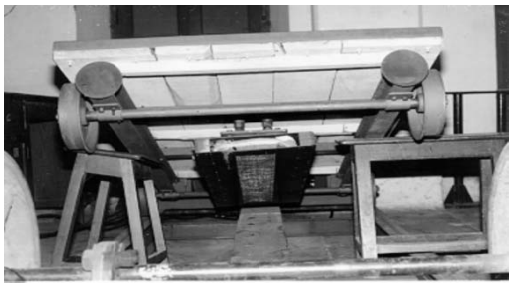


Fig 5 Trolley with LIM Primary lifted-up to show the underside arrangement

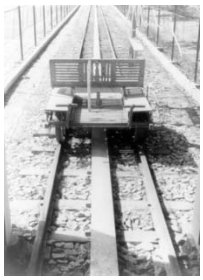


Fig 6 Trolley fitted with LIM Primary operating on 65m meter-gauge track & Shri. S.K.Khanna, MEL, IR Board, Shri O. P. Gupta, GM, DLW, & Shri J. Upadhyay, Ex- MEL, IR Board doing foot-plate inspection of the LIM Propelled Rail Metro System

Fig 7 Shri Digvijay Singh, Min of State for Railways, Professor Y.C. Simadhari, VC-BHU & Prof. P. C. Upadhyay, Registrar BHU, doing *foot-plate inspection [2001]*

The working system attracted attention of decision makers like the then Minister of State for Railways, and the present/former Indian Railway Board Members (Elect.).

The system also attracted attention of press & TV media. The R&D activities have been widely reported by many TV channels including 'Imaging Sciences' programme of national DD TV.

The working system has acted as an effective bridge between the technology and prototype stage for adoption of the knowhow to solve urban transportation problem in the cities.

(c) LIM Powered People Mover system for closed-loop circular track *for Connaught Place people transport system. (The moving platform at 5-10 kmph can complete one circle in 15-30 min)* [1986, 2013]

Fig 8 LIM Powered People Mover system for closed-loop circular track *for Connaught Place people transport system*

The model demonstrates feasibility of integration between metro terminals and other public transport modes as well as the shopping points in city-centers like Connaught Place. The cost analysis has been done and the proposal has been recently presented in two international conferences. International reactions are being received since then.

(d) LIM based ropeways in which the rope is stationery [2010, 2011]

Made primarily to demonstrate the principle of ropeways in which the rope is stationery and the trolley moves due to linear force produced by LIM mounted on the trolley.

Since moving parts are only the wheels on bearings (with no drum/gears connecting to the electric motor or the moving-ropes) the maintenance will be bare minimum. It has provision for remote monitoring and control.

The proposal can be implemented in regions where other modes of transport are neither feasible nor economical and the ropeways are the only choice.

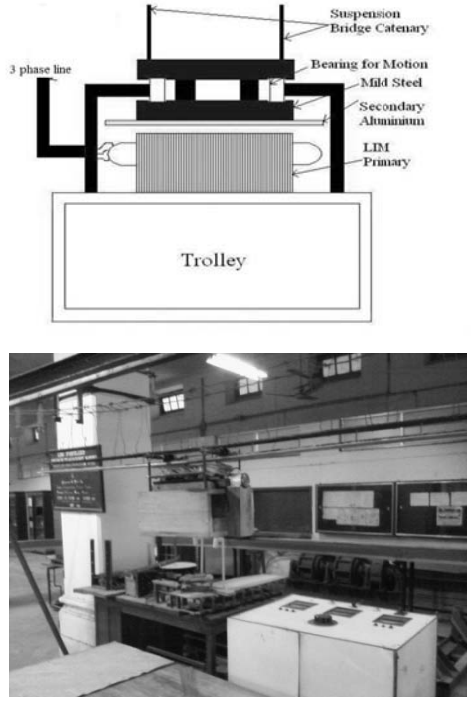


Fig 9 LIM based ropeways in which the rope is stationery

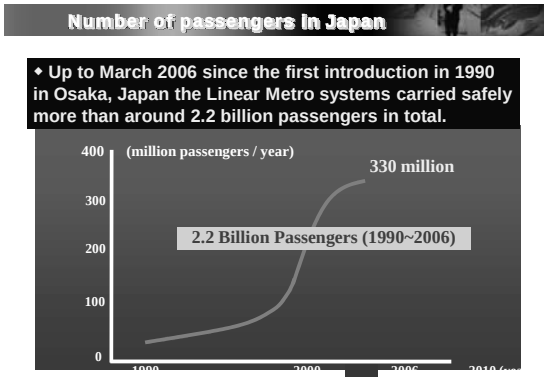
Concluding remarks & suggestion for further work

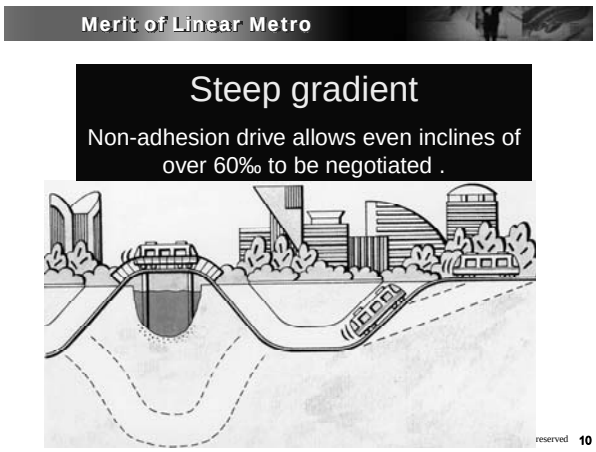
One important point brought out in this article needs special mention again. The role of teachers (like Professor M. Bhattacharrya, Professor G. Rajsekar, Professor E. R. Laithwaite, Professor A. J. Ellison) who coolly played their role in effectively shaping me and my work on LIM. This needs to be appreciated for the fact that the role of a good teacher is the most essential factor in shaping the 'future-components' of the society viz. the Man. The technological developments and modern teaching aids may assist a teacher but these shall never be able to become a substitute for the qualities of a good teacher.

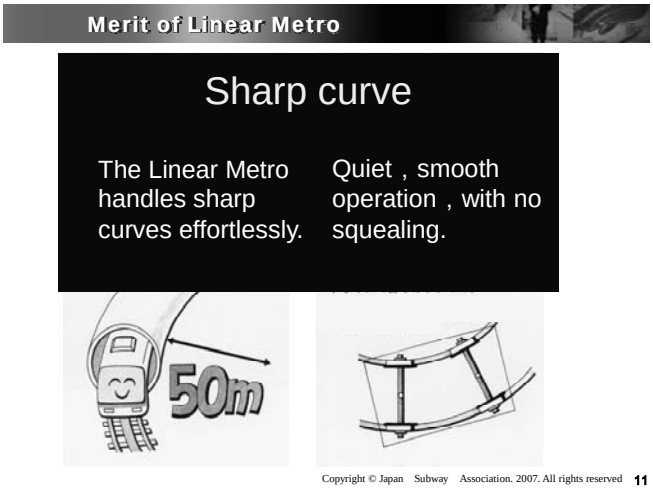
Another point which I would like to highlight here is the international interest shown in LIM activities at BHU by countries like Japan. In February 2007 ***Mr. Masahiro Ando, P.E.*** Professional Engineer as Authorized by the Japanese Government ***& Dr. Vijay Kumar Jatiya*** Funakawa Information & Environment Technology Co. Ltd., Tokyo, and Manager dealing in Business Planning & International Business Operations, visited for discussions for providing an effective solution to the ever-growing

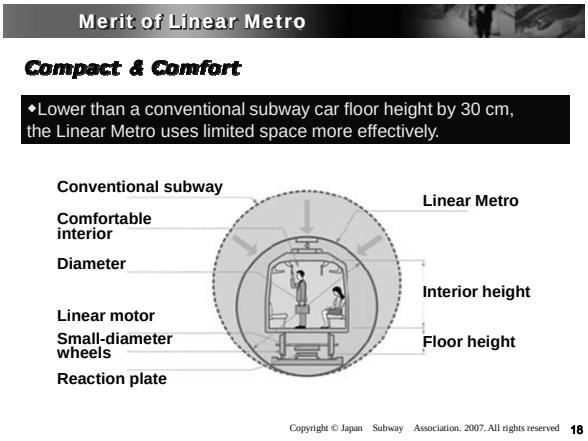
urban transportation problem in the Indian cities.

In Japan the technology has been adopted through a consortium (Japanese Subway Association) approach which included people from Academics/Associations, Subway-Operators, Development-Components and Administration (supportive organizations). Figures [13] below show the usage up to 2006 and also distinct advantages and merits as observed by JSA.









On the basis of experiences gathered from linear metros operating in Japan the Japanese have taken a blanket decision to make all future metros in the country Linear Motor based only. Two typical metros in operation in Japan are shown below.

My presentation in February 2007 was followed by that of Mr. Ando [13] and the two presentations received lot of interest followed by discussion from the audience in the lecture hall as well from the media.

Prof. G Rajsekhar, former Dean Faculty of

Engineering and Technology and Professor Department Electrical Engineering IT–BHU, traced the history of LIM R&D activities in the Department. He wondered that if the country had implemented the Departmental proposal made in early 80's, India would have been leaders in this field by now. He was hopeful that ***now the visit of Mr. Ando and Dr. Jatiya will lead to an effective integration of the 'rich experience of Japanese Subway Association (JSA) in the implementation of Linear Metro in Japan' with the 'fundamental LIM based R&D achievements of IT–BHU'.*** He was optimistic and confident that jointly the two organizations can provide a solution for the urban transportation problem in India and all over the world.

Mr. Ando who is ***'father of linear metro in Japan'*** appreciated the R&D in BHU and felt a need for exploring the possibility of solving the urban transportation problem in Indian cities through linear metro. There was a general consensus that ***the Government of India and the Government of Japan may be requested to initiate steps for joint ventures/participation in making Linear Metro based joint project proposals for Indian cities.*** To start with ***the first Linear Metro may be made operational in Varanasi*** *as it would be a* ***fitting tribute to Mahamana Pandit Madan Mohan Malaviyaji*** – the founder of Banaras Hindu University. The other reasons being that:

- Due to Sarnath many Japanese visit Varanasi and this will help them in moving around comfortably
- Any activity in Varanasi catches attention the world-over, and
- The R&D at BHU can be easily integrated.

Since then efforts were made at many levels to initiate the activity between Japan and Varanasi but with no success so far. It is expected that with renewed efforts being made with the new ministry at the center, wherein Varanasi happens to be the Prime Minister's constituency, the proposal may come through.

During the years a large number of technologies/working-systems have been developed and are ready for adoption by the user industries. These are :

a. LIM powered systems for:
(i) Overhead/Underground/Surface transportation,
(ii) Material Handling,
(iii) Ropeways in which the rope does not move,
(iv) Vertical elevators for vehicle parking,
(v) People mover system for Connaught Place

b. Control strategies for energy saving in LIM based systems including independent control of propulsion & attraction forces produced

c. Handloom for visually handicapped.

Journey with a subject never ends. People/researchers may change but so far as the R&D in the subject is concerned, it continues and I have all hope that this will happen in our Department too. In this regard it is worthwhile now *to explore the possibility of industry/academic-institution participation for further development and effective absorption of Linear Induction Motor (LIM) based systems which have been developed & tested in the Department*.

Acknowledgement

Following individuals & Agencies support is gratefully acknowledged:

MHRD/AICTE 1994-2000: For R&D Grants to develop LIM propelled transport system operating with 15-adult load on a 65-m meter-gauge track for demonstrating the technical feasibility

Prof. Hari Gautam 1996 *(the then VC BHU & later Chairman UGC)***:** For supporting creation of **Malaviya Centre for "Development and Evaluation of Low Cost LIM Propelled Rail Metro System"** in IT-BHU.

Shri Jagdish Upadhyay 1994-2000 *(Former Member Electrical Railway Board, Visiting Professor & Advisor AICTE project entitled LIM Propelled Rail Metro System)***:** For giving a practical shape to LIM traction R&D activities and projecting it for its adoption in India.

Professor M. Bhattacharrya (since 1973) for starting my journey with LIM and **Professor G. Rajsekar** (since 1977) for providing the necessary thrust in the making of BHU-DLW model which has effectively helped in bridging the gap between the technology and the decision makers.

'Government of India's National Scholarship for Study Abroad' (1973-77) that helped in acquiring advanced knowledge related to LIM technology from abroad.

Graduate, Post-graduate & Research Scholars 1977 till date: For the assistance in fabricating LIM powered working models of various applications to demonstrate the principle of LIM propulsion.

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DESIGN ASPECTS AND RELIABILITY EVALUATION OF MICRO HYDRO POWER PLANT DEVELOPED AT BROCHA SEWAGE STATION BHU VARANASI (UP) INDIA

DR. R.K. SAKET*

MICRO HYDRO power generation system (MHPGS) is one of the popular renewable energy sources in the developing countries. MHPGS has obtained increasing interests in the 21st century due to their ecological irreproachability and acceptable prices for generating electrical power without producing harmful pollution and green house gases. MHPGS based on municipal waste water (MWW) is considered as environmentally friend renewable energy source since this can be sized and designed to limit the interference with river flow and canal flow. Most of the MHPGS's operate in isolated mode for rural electrification of remote villages where the population is very small and extension of the distributed grid system is not geographically and financially feasible due to high cost investment in power transmission system. Small hydroelectric power generation systems (SHPGS's) are relatively small power sources that are appropriate in many cases for individual users or groups of users who are independent of the electricity supply grid. Although this technology is not new, its wide application to small waterfalls and other potential sites like MWW based system are new[1]. SHPGS's are the application of hydroelectric power on a commercial scale serving a small community and is classified by power and size of waterfall. Small hydro power plants (SHPP) can be divided into mini hydro (less than 1,000 kW capacity), and micro hydro power system (MHPS) which has less than 100kW capacity. Hydroelectric power is the technology of generating electric power from the movement of water through rivers, streams, and tides. Water is fed via a channel to a turbine where it strikes the turbine blades and causes the shaft to rotate. To generate electricity the rotating shaft is connected to a generator which converts the motion of the shaft into electrical energy[2].

Generally, in an autonomous MHPS, the small hydro power generators (SHPG) are the main constituents of the system and are designed to operate in parallel with local power grids. The main reasons are to obtain economic benefit of no fuel consumption by micro hydro turbines, enhancement of power capacity to meet the increasing demand, to maintain the continuity of supply in the system, etc. Small / micro hydro is highly fluctuating in nature and will affect the quality of supply considerably and even may damage the system in the absence of proper control mechanism. Main parameters to be controlled are the system frequency and voltage, which determine the stability and quality of the supply. In a MHPGS, frequency deviations are mainly due to real power mismatch between generation and demand. Reactive power balance in the hybrid system can be obtained by making use of variable reactive power device e.g. static VAR compensator[3]. Comparisons of various penstock materials have been presented considering friction, weight, cost, corrosion, joining and pressure for reliable operation of the MHPG system. Hybrid power systems are the most attractive option for the electrification of the remote locations. These include high cost because of the system complexity, site specific design requirements and the lack of available control system flexibility. Many countries have targets and aspirations for growth in renewable energy. If a new alternative generation technology is introduced that makes a relatively low contribution to the reliability of meeting peak demand then additional capacity may be needed to provide system margin and a cost is improved on the rest of the system. Quantification of the system costs of additional renewable in 2020 has been presented[4].

MHPP using MWW neither requires a large dam nor is land flooded. Only waste water from different parts of the city is collected to generate power which has minimum environmental impact. After proper chemical treatment, water is provided to farmers for irrigation purpose. MHPGS using MWW of sewage plant can offer a stable, inflation-proof, reliable, economical and renewable source of electricity. This alternative technology has been appropriately designed, developed and practically implemented in the campus of the Indian Institute of Technology,

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Banaras Hindu University, Varanasi (India). Reuse of MWW can be a stable, inflation proof, economical, reliable and renewable energy source of electricity in the power scenario of the 21st century[5].

This paper is organized as follows: Section-I presents an overview on MHPGS based on MWW. Selection criteria and brief descriptions on basic components for designed and developed MHPGS at BHU campus is described in section-II. Selection criteria of penstock pipe materials, water turbines and various generators for different head are explained in this section. Annual, monthly and daily flow-duration curve (AFDC, MFDC and DFDC) have been obtained for design and development of MHPP based on MWW by recording water flow rates in this section. Generation reliability of constructed MHPP has evaluated using Gaussian distribution approach, peak load considerations, safety factor concept and Simpson 1/3rd rule in section-IV. Results and analytical discussions are presented in section-V. Section-VI concludes this project work as an energy scenario of the 21st century.

1. Descriptions on Basic Components of Developed MHPS: An Overview

The principal components of the MWW based MHPGS are waste water tank, penstock pipe, water turbine and induction generator. MWW and SEIG based MHPGS has been designed developed and constructed at Brocha sewage station of the Banaras Hindu University, Varanasi (Uttar Pradesh) India during the session: 2007-2008[1]. Prototype MHPGS has been designed; installed and tested using farmland irrigation water flowing in canals at Taiwan. The designed MHP unit consists of a water wheel containing 16 blades, a mechanical shaft, two bearings, a gear box and a permanent magnet generator (PMG) and inverters. The low rotational speed of the water wheel can be speeded up to required rotational speed of the PMG through the designed gear box[6]. The following principal components of the developed MWW based MHPGS have been designed for reliable operation of the system.

1.1 Selection of penstock pipe

The penstock is most expensive item in this project which may cost up to 40% of total project cost. Several factors should be considered when deciding which material to use for a particular penstock design pressure, i.e. the roughness of the pipe's interior surface, method of joining, weight; ease of installation, accessibility to the site, design life, maintenance, weather conditions, availability, relative cost and likelihood of structural damage[1]. The most commonly used materials for a penstock are mild steel, high density poly ethylene (HDPE) and un-plasticized polyvinyl chloride (uPVC), because of their suitability, availability and approvability. The uPVC exhibits excellent performance over mild steel and HDPE in terms of least friction losses, weight, corrosion, and cost, etc. Comparison of the penstock materials considering friction, weight, corrosion, cost, joining and pressure have been explained[4]. uPVC material has been selected and used for design of the penstock for development of this project.

1.2 Selection of turbines

The choice of water turbine depends mainly on the head and MWW flow rate for installation of the MWW and SEIG based MHPP. The selection also depends on the desired running speed of the generator. To adjust for variations in stream flow, water flow to these turbines is easily controlled by changing nozzle sizes or by using adjustable nozzles. Turbines used in the hydro system can be classified as Impulse (Pelton, Turgo and Cross flow), Reaction (Francis, Propeller, and Kaplan) and water wheels (under-short, breast-shot and overshot). Groups of the water turbine for various head available have been proposed for sewage system based MHPP[5]. The reliability and performance of the MHPGS based on MWW and SEIG are depends on the turbines / water wheels efficiency. Kaplan turbine is used for reliable performance, installation and establishment of this project.

1.3 Selection of generator

Induction and synchronous generators are used in power plants and both are available in three phase or single phase systems. Induction generators are generally appropriate for MHPGS[1]. Induction generator offers many advantages over a conventional synchronous generator as a source of isolated power supply. Reduced unit cost, ruggedness, brush less (in squirrel cage construction), reduced size, absence of separate DC source and ease of maintenance, self-protection against severe overloads and short circuits, are the main advantages[2]. Capacitors are used for excitation and are popular for smaller systems that generate less than 10 to 15 kW. Use of induction generator is increasingly becoming more popular in MHP application because of its simpler excitation system, lower fault level, lower capital cost and less

maintenance requirement. However, one of its major drawbacks is that it cannot generate the reactive power as demanded by the load. Most of the early stages MHPP are equipped with synchronous generators[2]. SEIG is used at installed MHPGS. Generation voltage of SEIG depends on the shaft speed, residual magnetism, reduced permeability at low magnetization and value of the capacitor connected to the machine. Reliability of the self excitation must be very high at generation time. It is achieved either by increasing the speed or increasing the capacitor value or both. Residual magnetism and permeability of the rotor iron core cannot be changed during operating condition of the SEIG. However, capacitor value and shaft speed can be changed[7]. Terminal voltage of the SEIG is directly proportional to the shaft speed. If shaft speed of the SEIG is decreased below the particular value of the speed, then generation will stop. This particular value of shaft speed is called the minimum value of speed or threshold speed. Similarly, if the shaft speed of the generator is below the minimum value of the threshold speed, then SEIG will not generate any voltage. Many times generation failure noticed due to lower shaft speeds from the threshold speed of the SEIG. So evaluation of the Success and failure probabilities of the MWW based MHPGS is required[7].

2. Development of Flow – Duration Curve of SWW Based MHPS in BHU Campus

In this paper, annual, monthly and daily flow duration curves (FDC) have obtained for development and installation of the MHPP by recording water flows from maximum to minimum values. Annual flow duration curve (AFDC) and daily flow duration curve (DLDC) of the developed system have obtained for performance and reliability evaluation of the MHPGS. The AFDC and DFDC are used to assess the expected availability of water flow, flow variations and power capability to select the type of the turbine and generator[4]. According to FDC there is a difference in waste water flow (WWF) between summer (March - June) and winter (November - February) cycles and this can affect the power output produced by installed MHPP. These variations have considered for estimation of the total expected energy generation. Peak load demand has considered for evaluation of reliability of the MHPGS at different generation capacity, load demand and atmospheres variations. Output power has been estimated at different flow rate and head available in sewage system of the Banaras Hindu University, Varanasi, India. Reuse of MWW of the city can be a stable, inflation proof, economical, reliable and renewable energy source in the power scenario of the 21st century[2].

According to the above discussion, if SEIG parameter, torque, water head, capacitor value etc are constant, then the generation depends only on the shaft speed. SEIG shaft speed depends on the MWW flow rate. It means if the shaft speed is below the threshold speed then the generation will stop. The threshold speed of the MWW and SEIG based MHPG system has been calculated from the experimental results. The value of threshold speed of MWW is 3.5m^3/sec for this particular case. Thus, shaft speed of the SEIG due to MWW flow rate lower than the 3.5m^3/s, generation will stop. So, reliability of the generation failure due to lower speed from the threshold speed is examined successfully. For reliability evaluation of the MHPP, ADFDC of each month have been drawn to get idea of the failure and success generation at particular time. Generation time, repair time and number of times when generation fails for each month have discussed successfully for reliability evaluation of the system[8].

2.1 DFDC and AFDC of Developed MHPP

In this paragraph, average daily flow duration curves (DFDC) and annual flow duration curves (AFDC) have obtained by recording the MWW flows from maximum to minimum values. For development of the DFDC of any month of the assessment year, 15th day of each month is considered for flow rate measurement 24hour duration. DFDC and AFDC of the developed plant have also obtained from the average of the three years duration (from July 2009 to June 2012) for reliability evaluation of the MHPG system as shown in Fig: 5 and 6 respectively. The educational calendar or academic session of the BHU starts from July, 01 and ends on June, 30. Plant data are collected from July, 2009 to June, 2012. Peak load demand at different working conditions of the generation capacity, load demand and atmospheres variations have considered to evaluate the reliability of the MHPG system.

2.1.1 DFDC for July, August and September months

The new academic session of the BHU starts in month of the July, which is a rainy season. Therefore, waste water flow rate mostly reaches the maximum point from July to September as shown in fig.1. During these three months the average MWW flow rate is above 5m^3/sec as shown in fig.1. The number of

failure of generation due to minimum speed and repair time is less. The operating time of the MHPGS is high due to availability of the MWW.

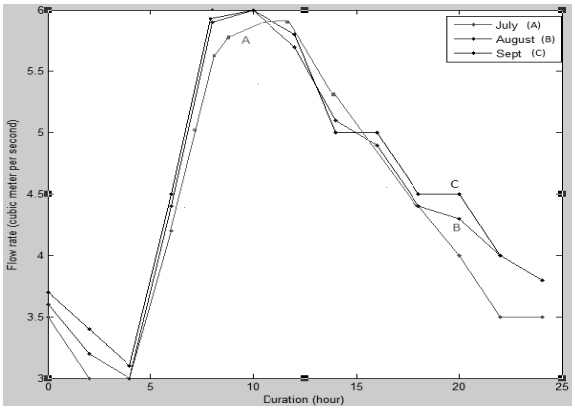

Fig: 1. DFDC for July, August and September months

2.1.2 DFDC for October, November and December months

Around October and November months, MWW flow rate decreases due to starting of the winter season. Two long holiday periods of Dashahara and Deewali festivals of India in these months decrease MWW flow rate of the sewage plant. The month of December provides semester break period as well as coldest atmospheric conditions. Therefore, MWW flow rate decreases and come down to its deep point. During these three months the average MWW flow rate decreases from $5m^3$/sec to below than the $4m^3$/sec as shown in fig. 2. In the October and November months, the number of generation failure and repair time both are higher than the July, August and September months. The operating time of the MHPGS decreases during these months. Number of failures and repair time of the developed system are high and operating time is low during December month.

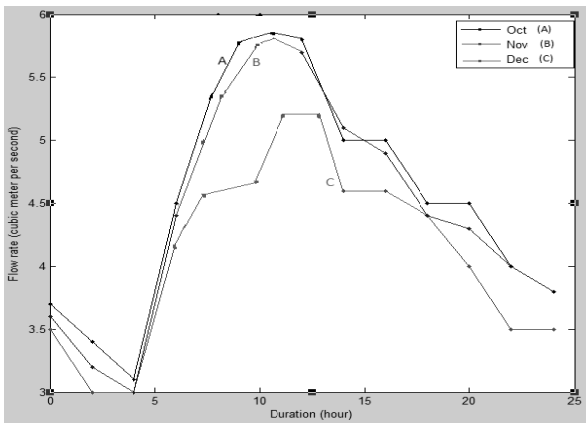

Fig: 2. DFDC for October, November and December

2.1.3 DFDC for January, February and March months

MWW flow rate increases in January due to starting of the even semester from the first week of this month. But it does not reach up to the maximum point due to winter days. Flow rate increases in February and March but do not reach up to the maximum point due to winter and holidays on Indian Holi festival in these months. The average flow rate decreases from 5 m^3/s to below than the $4m^3$/s as shown in fig.3. The number of failure of generation and repair time decreases as compared with the report of the December month. However, the operating time of the MHPGS is increases during these months.

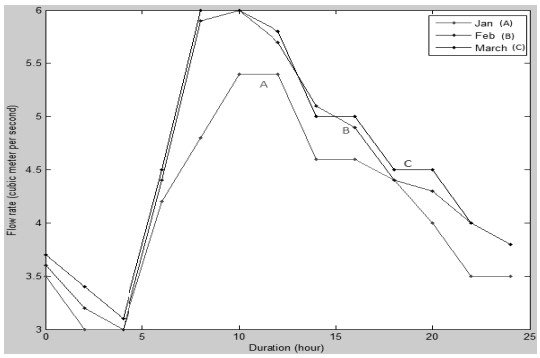

Fig: 3. DFDC for January, February and March months

2.1.4 DFDC April, May and June months

In April, MWW flow rate is standard for electricity generation. Summer vacation of the BHU starts from May to June, so MWW flow rate again decreases during these two months. The average flow rate decreases from approximately $5m^3$/s to $4m^3$/s as shown in fig.4. The number of failure of generation and repair time is approximately low in April month. However, the operating time is approximately low in the April month. Number of generation failure and repair time increases during the May and June months. However, the operating time of the MHPGS decreases due to unavailability of the MWW during the summer vacation.

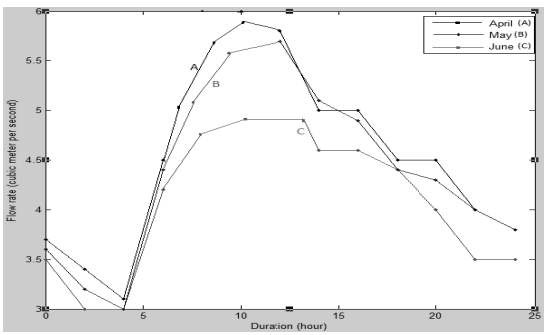

Fig: 4. DFDC for April, May and June months

Average Daily Flow-Duration Curve (ADFDC) from July 2009 to June 2012 and Average Annual Flow-Duration Curve (AAFDC) of the MWW based MHPG power plant from July 2009 to June 2012 have been presented as shown in the fig 5 and 6 respectively. According to available AFDC of the developed sewage power station, the average value of the flow rate is 4.67m^3/s. Reliability indices for the evaluated MWW flow rates have been described in the next section.

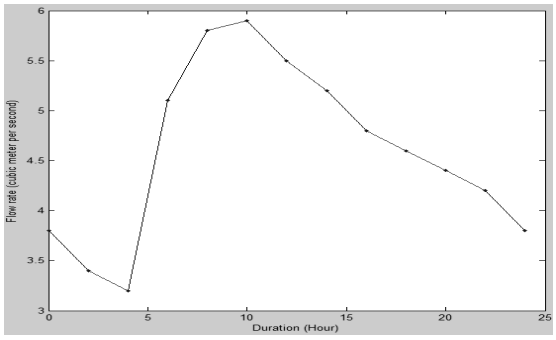

Fig: 5. ADFDC for three years (July 2009 - June 2012)

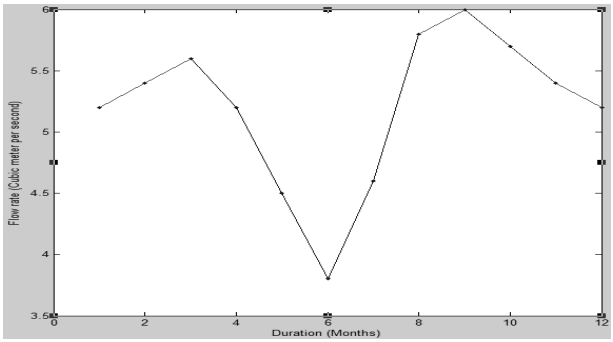

Fig: 6. AAFDC for three years (July 2009 - June 2012)

2.2. Reliability indices Evaluation Using Flow Duration Curves

Reliability indices like: failure rate (λ), repair rate (μ), Mean Time to failure (MTTF), Mean Time to Repair ((MTTR) and Mean Time between Failure (MTBF) of the system have been evaluated in this paper. Evaluation of the number of generation failure and its repair time of every month have presented in this section. These data are calculated from the sewage flow rate at IIT (BHU) campus. Total time for the average data collection is three years (July 2009 – June 2012). July, August, September, March and April have less number of generation failure and repair time. Thus, success probability of system is good during these months. December, January, May and June months are not the suitable periods for generation due to unavailability of the suitable MWW flow rates. Thus, success probability of the developed system is not good during these months.

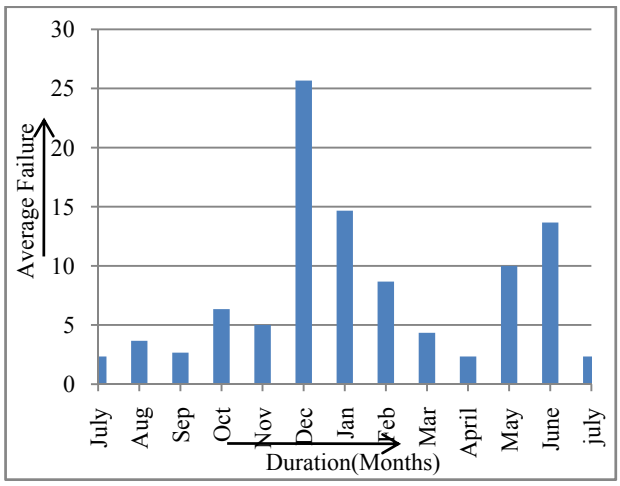

Fig: 7. Average failure Chart of MHPGS (July 2009 – June 2012)

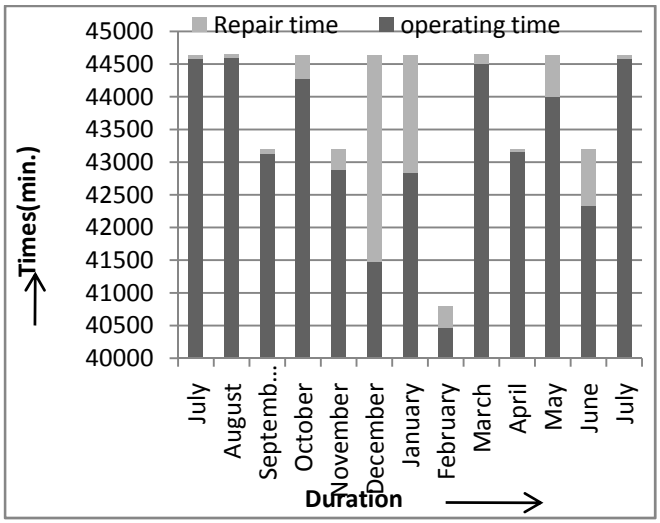

Fig: 8. Average repair and operating time of the developed system

Table I Evaluation of Reliability Indices for case: I

Reliability Indices	Session: I (2009-2010)	Session: II (2010-2011)	Session: III (2011-2012)
Failure rate (λ)	0.0115 f/hr	0.276 f/day	100.74 f/yr
Repair rate (μ)	0.765 r/hr	18.36 r/day	6701.4 r/yr
MTTF (r)	86.952 hr	3.623 days	0.0099 yr
MTTR (m)	1.306 hr	0.0544 day	0.00015 yr
MTBF (T)	88.26 hr	3.6774 days	0.0101 yr

3. Probabilistic Approaches for Reliability Evaluation of Developed MHPGS

Reliability of system is the probability of system performing its function adequately for a period of time intended under the operating conditions intended. According to this statement success probability, adequate function, time period and operating condition are the basic attributes of the system reliability. Reliability indices and success / failure probabilities have been evaluated using Gaussian distribution approach, peak load and safety factor concept and Simpson 1/3 rd rule successfully[2].

LOLP Evaluation Using Simpson 1/3rd Rule

Failure probability of MHPP has also been evaluated with more realistic model as load duration curve. Generating model adopted in this system is Normal distribution function. The reliability evaluation is based on maximum average generation capacity available. The probability of load exceeding the generation capacity is called loss of load probability (LOLP). LOLP of the developed system using stepped load duration curve (SLDC) can be written as follows:

$$\text{LOLP} = \int_0^{100} \frac{t}{100} \left[\int_{-\infty}^{P_d(t)} \frac{1}{\sqrt{2\pi}\sigma_c} e^{-0.5\left(\frac{C-\bar{C}}{\sigma_c}\right)^2} dc \right] dt \quad (1)$$

Putting, $\frac{C-\bar{C}}{\sigma_C} = Z$

The LOLP expression for 100 steps of the SLDC using equation (12) can be expressed as follows [1]-[5].

$$\text{LOLP} = \int_0^{100} \frac{t}{100} \left[\int_{-\infty}^{P_d(t)} \frac{1}{\sqrt{2\pi}\sigma_c} e^{-0.5(Z)^2} dz \right] dt$$

$$LOLP = \int_0^{100} \frac{t}{100} \varphi\left(\frac{P_d(t)-\bar{C}}{\sigma_c}\right) dt \quad (2)$$

The LOLP using SLDC of the developed system have been evaluated by Simpson's 1/3rd rule. LOLP of the system is evaluated considering LDC as SLDC with maximum 100 steps. This may be possible if daily load duration curve can be approximated as multilevel representation as in the case with Markov modeling of load in frequency and duration calculations.

4. Result and Discussions

Failure probability as explained in section 4 has been evaluated using various set of data available at developed MHPP at Broacha sewage station of the BHU campus using prababilistic approach[1, 2]. Discussions on obtained results have been described as follows.

LOLP Evaluation using Simpson 1/3rd rule

The generation capacity data for evaluation of LOLP has been obtained from installed MHPP. LDC is designed and obtained a straight line with P_{dmax} = 1000W and P_{dmin} = 300W for reliability evaluation of the system using Simpson 1/3rd rule. Various plots for different steps of the LDC have been drawn for performance analysis and reliability evaluation of system considering different conditions using equation (2).

Table II: Generation capacity for evaluation of LOLP with stepped load duration curve

Capacity (W)	σ_C = 10% of $\bar{C}$	σ_C = 15% of $\bar{C}$	σ_C = 20% of $\bar{C}$	σ_C = 25% of $\bar{C}$
500	50	75	100	125.0
550	55	82.5	110	137.5
600	60	90	120	150.0
650	65	97.5	130	162.5
700	70	105	140	175.5
800	80	120.0	160	200.0
850	85	127.5	170	212.5
900	90	135.0	180	225.0
950	95	142.5	190	237.5
1000	100	150.0	200	250.0
1050	105	157.5	210	262.5
1100	110	165.0	220	275.0
1150	115	172.5	230	287.5
1200	120	180.0	240	300.0
1250	125	187.5	250	312.5
1300	130	195.0	260	325.0
1350	135	202.5	270	337.5
1400	140	210	280	350.0

Case I: LOLP Evaluation for 5 steps of SLDC

LOLP for 5 steps of the SLDC has been evaluated in table: III for different generating capacity of the installed MHPP.

Table III: LOLP for 5 steps of the SLDC

Loss of Load Probability for 5 steps of SLDC				
Capacity C	Curve D for σ_c=25% of C	Curve C for σ_c=20% of C	Curve B for σ_c=15% of C	Curve A for σ_c=10 % of C
500	0.0940	0.0730	0.0660	0.0600
550	0.0930	0.0720	0.0650	0.0550
600	0.0920	0.0710	0.0640	0.0500
650	0.0910	0.0700	0.0630	0.0400
700	0.0905	0.0620	0.0600	0.0350
750	0.0900	0.0600	0.0550	0.0250
800	0.0840	0.0550	0.0500	0.0200
850	0.0805	0.0500	0.0400	0.0150
900	0.0800	0.0400	0.0330	0.0100
930	0.0700	0.0450	0.0300	0.0080
950	0.0600	0.0400	0.0250	0.0030
1000	0.0500	0.0300	0.0150	0.0025
1050	0.0400	0.0200	0.0080	0.0015
1110	0.0300	0.0150	0.0055	0.0010
1130	0.0250	0.0130	0.0045	0.0000
1190	0.0170	0.0080	0.0035	0.0000
1400	0.0045	0.0020	0.0021	0.0000

In figure: 9, the curves A, B, C and D show the relations of LOLP and generating capacity at σ_C = 25%, 20% 15%, and 10% of generating capacity respectively. The LOLP of the generation capacity of developed system increases with increasing values of σ_C. For same generating capacity available, if σ_C increases, the LOLP also increases.

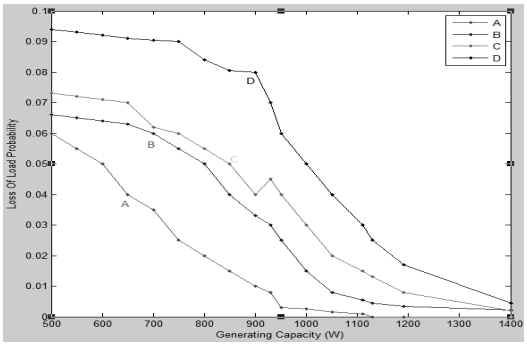

Fig 9: LOLP v/s generation capacity for 5 steps

Case II: LOLP Evaluation for 10 steps of SLDC

Fig. 10 represents the relation between LOLP and various generating capacity available in MHPGS with effects of various σ_C. The LOLP has been evaluated for 10 steps of load duration curve and included in the table IV.

Table IV: LOLP for 10 steps of the SLDC

Loss of Load Probability for 10 steps of SLDC				
Capacity C	Curve D for σ_c=25% of C	Curve C for σ_c=20% of C	Curve B for σ_c=15 % of C	Curve A for σ_c=10 % of C
500	0.0950	0.0730	0.0660	0.0600
550	0.0945	0.0720	0.0610	0.0550
600	0.0824	0.0710	0.0640	0.0560
650	0.0811	0.0700	0.0650	0.0400
700	0.0802	0.0620	0.0600	0.0350
750	0.0800	0.0600	0.0550	0.0250
800	0.0760	0.0550	0.0500	0.0210
850	0.0730	0.0520	0.0400	0.0150
900	0.0720	0.0400	0.0330	0.0130
930	0.0710	0.0450	0.0300	0.0080
950	0.0600	0.0400	0.0250	0.0030
1000	0.0530	0.0300	0.0150	0.0025
1050	0.0400	0.0200	0.0082	0.0015
1110	0.0340	0.0150	0.0055	0.0014
1130	0.0250	0.0130	0.0045	0.0000
1190	0.0170	0.008	0.0035	0.0000
1400	0.0045	0.0020	0.0021	0.0000

The curves have been plotted for 10 steps as shown in the fig.10. The LOLP of system increases with increments in σ_C due to large uncertainty involved in the generating capacity distribution factor.

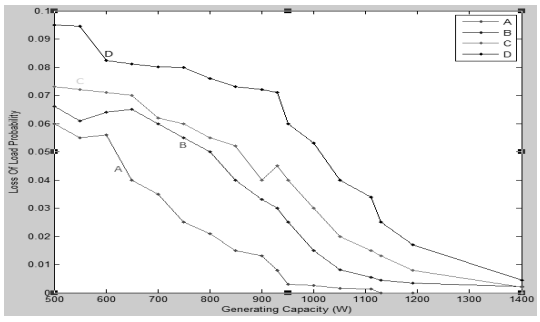

Fig 10: LOLP v/s generation capacity for 10 steps

Case III: LOLP Evaluation for 20 steps of SLDC

The plots of LOLP v/s generating capacity for SLDC for 20 steps is drown as shown in the fig 11. The curves A, B, C and D show the relation between LOLP and generating capacity for the σ_C = 25%, 20%, 15% and 10% respectively.

Table V: LOLP for 20 steps of the SLDC

Loss of Load Probability for 20 steps of SLDC				
Capacity C	Curve D for σ_c=25% of C	Curve C for σ_c=20% of C	Curve B for σ_c=15% of C	Curve A for σ_c=10% of C
500	0.0900	0.0730	0.0660	0.0600
550	0.0905	0.0720	0.0610	0.0550
600	0.0901	0.0710	0.0640	0.0560
650	0.0824	0.0700	0.0650	0.0400
700	0.0813	0.0620	0.0610	0.0350
750	0.0813	0.0600	0.0550	0.0250
800	0.0810	0.0500	0.0500	0.0210
850	0.0812	0.0520	0.0420	0.0150
900	0.0800	0.0400	0.0330	0.0130
930	0.0710	0.0450	0.0300	0.0080
950	0.0600	0.0400	0.0250	0.0030
1000	0.0530	0.0300	0.0150	0.0025
1050	0.0400	0.0200	0.0082	0.0015
1110	0.0340	0.0150	0.0055	0.0014
1130	0.0250	0.0130	0.0045	0.0000
1190	0.0170	0.0080	0.0035	0.0000
1400	0.0045	0.0020	0.0021	0.0000

It is observed from curves C and D that for the same generating capacity of the power system, the LOLP with σ_C = 15% of $\bar{C}$ is higher than σ_C = 10% of $\bar{C}$. Similarly from curves D and E it is observed that the LOLP of curve E is greater than curve D at same generating capacity. This is due to the fact that large uncertainty involved in generating capacity function.

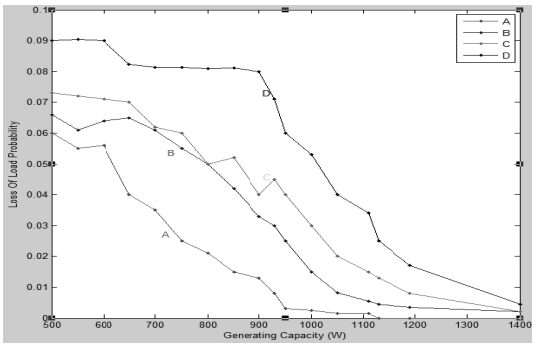

Fig 11: LOLP v/s generation capacity for 20 steps

In summary, if standard deviation of generating capacity increases, the LOLP of developed system increases at same generating capacity.

Case IV: LOLP Evaluation for Different steps of SLDC

The plots of LOLP v/s generating capacity considering different steps (curve A for 5 steps, curve B for 10 steps and curve C for 20 steps) for the SLDC have been illustrated in figures 12, 13, 14 and 15 for σ_c=10%, 15%, 20% and 25% respectively. For any value of the σ_c generation system has different LOLP for different steps of the SLDC. These graphs are also drawn from data of the tables III, IV and V for different steps of the SLDC. LOLP decreases with increasing generation capacity for all steps of the SLDC. Nature of the curves indicates that generation system has different LOLP for different steps of the SLDC. This variation is due to different loadability of the system for different steps of the SLDC.

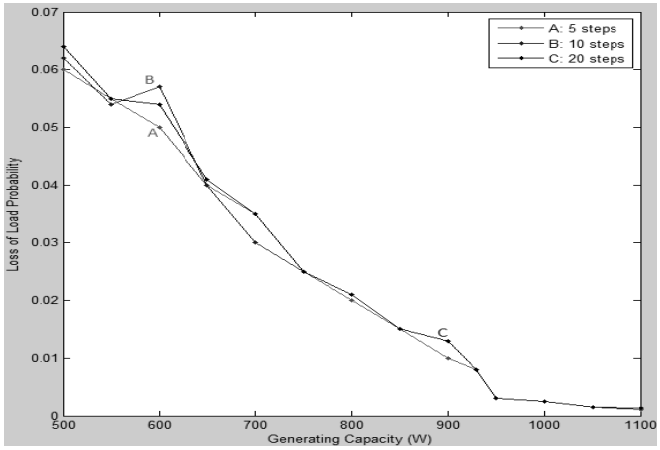

Fig 12: LOLP v/s generation capacity for σ_c=10%

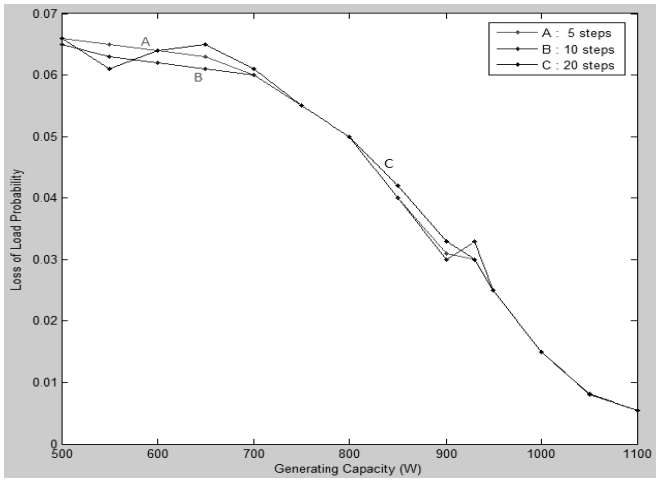

Fig 13: LOLP v/s generation capacity for σ_c=15%

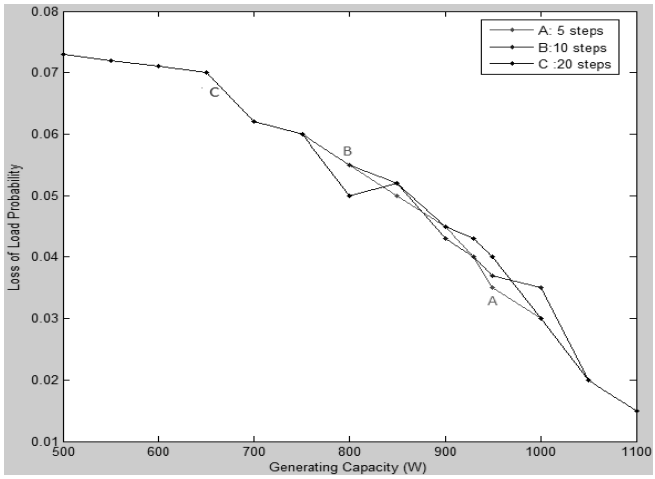

Fig 14: LOLP v/s generation capacity for σ_c=20%

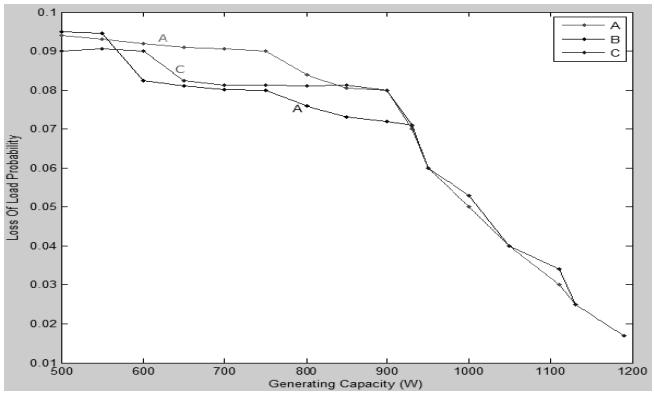

Fig 15: LOLP v/s generation capacity for σ_c=25%

5. Conclusions

Design aspects and probabilistic approach for reliability evaluation of the installed MHPGS have been described successfully in this paper. On the basis of the proposed concept and developed experimental MHPP at Banaras Hindu University campus, a number of experimental tests were performed for designing of AFDC, DFDC and SLDC. Generating capacity of installed MHPGS based on MWW at different head available at Broach sewage station of the BHU has been evaluated successfully. Turbine – generator sets has been recommended for different heads of MWW for reliable operation of the MHPP[5]. MWW flow rate and available head have been measured considering summer / winter and day / night cycles. Typical power output has been estimated and measured at different flow rate and head of sewage plant for calculation of reliability indices and reliability evaluation of generation capacity[8]. Probabilistic approach based methodologies have been introduced in this paper for generation system reliability evaluation using different load and generation capacity models. Case studies with several conditions of the configuration of the developed MHPP in University campus revealed the good performance of the proposed methodology not only in terms of failure probability evaluation but also in related to the accuracy of the reliability indices. Case study introduced in this paper has been given to demonstrate the applications of the methodologies. Further, in all cases it is confirm that LOLP increases with an increase in variance of load and generating capacity and hence, reliability of overall system decreases. Simpson 1/3rd rule has been used for reliability evaluation of the stepped load duration curve of the developed power plant. LOLP v/s generation capacity curves for different steps of the SLDC have also justified the reliability conditions of the generation system. Future research work in this area is proposed for mini and micro hydro power generation from irrigation canals. Power engineers can also plan for pico and nano hydro power generation from overhead water tanks of the buildings to charge small chargeable batteries. Simpson 3/8th rule is proposed for better approximation and future research work.

Acknowledgement

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IMPACT OF ENVIRONMENTAL CONDITIONS ON LIBRARY DOCUMENTS: A REVIEW

DR. NAVIN UPADHYAY*

"The surest way to preserve your books in health is to treat them as you would your own children, who are sure to sicken if confined in an atmosphere, which is impure, too hot, too cold, too damp or too dry."

"William Blades, The Enemies of Books, London, 1880."

The above-mentioned advice of William Blades is as valid today as when it was written. This is also still applicable with other library documents which are the product of IT revolution. The life expectancy of library documents is significantly affected by the environmental conditions in which they are stored. Environmental problems in the library buildings can cause significant damage to the documents. Generally, the library administration ignore, building up slowly over time until they reach crisis point. The damage of some documents is as similar as the damage of human kidney, which is detected – until it is too late. It has been observed that in many cases Poor environmental conditions can lead to damage to hundreds or even thousands of items at one time, each of which may need expensive individual repair. The damage documents can often be repair by the conservators, but this is rarely a cheap process and there are many other negative consequences. Therefore, the best solution is to know the factors that affect library documents and make necessary arrangements so that the documents may not be damaged due to the environmental factors.

The materials of which library collections are composed, namely paper, palm leaves, leather and adhesives used in bookbinding, optical media (CD ROM, DVDs etc.) are susceptible to two main forms of deterioration. One is biological deterioration caused by insect attack and/or fungal growth, and the other form of deterioration is caused by adverse environmental conditions such as extremes of dampness or wide fluctuations in relative humidity associated with large variations in day and night temperatures, light and atmospheric pollutants. These two forms of deterioration are interconnected because humid conditions favour the growth of fungi and accumulations of dust and dirt will attract insects.

The knowledge of environmental conditions in a library or archive is essential for the librarians to planning the best strategy for the preservation of collections and for targeting resources effectively. Apart from this, the librarians should be aware of impact that the environment conditions and environment pollution can have on library documents so that they may plan to preserve documents as long as possible. Although, there is a long list that may reduce the life of library documents, only environmental factors have been discussed in this article.

Effect of Temperature and Relative Humidity on Printed and Optical Media

Temperature and humidity have a significant and lasting effect on library documents. As relative humidity is dependent upon temperature, these two factors should be considered together. Control of temperature and relative humidity is critical in the preservation of library and archive collections because an unacceptable level of either contributes significantly to the breakdown of materials. Data are available showing the conditions of temperature and humidity under which damage to materials can occur (Nicholas 1973). One such kind of damage is from mould, which may grow where the relative humidity at the surface is around 80% or above. Moulds can be harmful to humans, so staff and users need to be protected if they handle affected collections (www.bl.uk/blpac/pdf/mould.pdf). Excessive levels of both can cause mould or mildew to grow on the books and it may also cause paper and binding to swell and contact, which they so at different rates. Its result came out as warping in the structure of the book. For example, storing books above air conditioning units or heat vents can damage books due to serve temperature and humidity changes that occur. If you see tiny, almost invisible insects inside the books as you are reading it, this indicates the presence of microscopic mildew particles. The little bugs live on mildew and eat it out of the books.

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Fig 1. Effect of changes in temperature and humidity (Leather bound book warped and suffering from “Red Rot”). (Source: http://dlis.dos.state.fl.us/archives/preservation/books/index.cfm)

It is a fact that heat accelerates deterioration. The rate of most chemical reactions is proximately doubles with each increase in temperature of 10°C (Walker, Alison, 2013). High temperatures also affect the acids inherent in old, brittle documents. The higher the heat, the faster the acids will work to make the paper brown and crunchy. The high relative humidity condition provides the moisture necessary to promote harmful chemical reactions in materials. Extremely low relative humidity, which can occur in winter in centrally heated buildings or in very dry climates, may lead to desiccation and embrittlement of some materials.

Apart from the printed materials, the libraries have developed other type of reading and storage materials (optical media), which can last long in comparison to the printed materials. However, it also needs proper care because the environmental conditions can reduce its life. CDs and DVDs can be reliable for many decades with proper handling. As with all other types of media, degradation is inevitable over time, but steps can be taken to help prevent it from occurring prematurely.

The polycarbonate substrate, or the plastic composition, that makes up most of the disc is a polymer material that is vulnerable to moisture. Optical discs will perform well within a wide range of temperature and relative humidity conditions. In the case of exposure to high temperatures, heat buildup speeds the degradation process by breaking down the recording layers of discs that employ organic dye compounds. Discs kept in a cooler, less-humid environment and not subjected to extreme environmental changes would last longer. High moisture content that can seep into disc cracks or scratches and foster the growth of bacteria or mold that can affect the readability of the disc by a drive's laser. Discs used frequently should be stored at a temperature similar to that of the environment in which they are to be used. This minimizes stress from frequent temperature change.

Effect of Light on Printed Materials and Optical Media

Light can damage books, especially by fading the bindings. It also adds to the "red rot" of leather covers as the ultraviolet rays break down the leather fibers as shown in the fig.1. Apart from this, exposure to light causes fading of dyes, inks and pigments, and can contribute to the ageing and embrittlement of paper, cloth and leather.The best obvious example of this is the way in which a newspaper left in daylight or artificial light will turn yellow within days, while a similar paper kept out of the light will not. All kinds of light are harmful, but ultraviolet radiation is particularly damaging.

Rapid and serious deterioration of paper is caused by the oxidation of cellulose brought about by the ultraviolet rays in sunlight and fluorescent light. There are two effects of light on paper materials that result in its ultimate embrittlement and deterioration. First, it has a bleaching action that causes some whitening of paper and fading of colored papers and certain inks. Second, it causes any lignin, which may be present in the paper, to react with other compounds and turns it yellow or brownish. This reaction results in newspapers' turning yellow on exposure to light can be witnessed anywhere. Certain invisible changes also occur at the same time when these visible effects of light are taking place. Fibers in the paper are broken into smaller and smaller units until they are so short they can no longer maintain the bonds necessary to hold the paper together. Some woods bleach under the action of light; some turn "yellow" and some darken. Unfortunately, the reactions initiated by light continue after the source of the damage has been removed.

Although all wavelengths of light are damaging, ultraviolet (UV) radiation is especially harmful to library documents because of its high level of energy. The standard limit for UV is 75 µW/l. The sun and tungsten-halogen or quartz lamps, mercury or metal halide high intensity discharge lamps, and fluorescent lamps are some of the most damaging sources of light because of the high amounts of UV energy they emit. Consistent contact with UV (ultraviolet) rays may reduce the life of optical media. The sunlight's ultraviolet photons have enough energy to produce a photochemical reaction, altering the optical properties

of the dye (recording layer) molecules. The broad spectrum of unfiltered sunlight, infrared to ultraviolet, can impart heat to the disc. The increased temperature generated by sunlight will accelerate the degradation or breakdown of the dye layer (recording layer) of the disc. The combination of high temperature and high relative humidity will further accelerate that degradation. Sunlight accelerates the aging of the disc by altering the appearance of the recording layers and therefore rendering the disc ineffective.

Effect of Pollution on Printed Materials and Optical Media

Pollutants contribute heavily to the deterioration of library documents. Particulate pollutants may enter the library from external sources such as roads, industrial sites, building works and it may be generate inside the library as products of material decay, by wooden shelving or certain types of paint. The two major types of pollutants are gases and particulates. Gaseous contaminants especially sulfur dioxide, nitrogen oxides, peroxides, and ozone catalyzes harmful chemical reactions that lead to the formation of acid in materials.The worse contaminants for this group of materials are sulfurous and sulfuric acids resulting from the combustion of fuels and from other industrial processes. Sulfur dioxide when mixed with water (humidity) turns to sulfuric acid, which is a leading cause of “red rot” in leather book covers. This creates a serious problem for paper and leather, which are particularly vulnerable to damage caused by acid. There is a close correlation between the loss of strength of paper and its acidity resulting from sulfuric acid contamination. Dust and dirt particles in the air not only carry with them the adsorbed pollutants mentioned above but may exert an abrasive action on books and paper. Another effect could be witnessed in the form of discolored & brittle paper, weak and powdery leather. Solid pollutants cause mechanical deterioration by abrasion and encourage the spread of mould and insects.

Pollution can damage the data stored on the disc and reduce the life of the optical disc. Fingerprints, smudges, dirt, or dust on the laser reading side of the disc can disrupt laserfocus on the data even more than a scratch can (Byers, 2003). Dirt or dust on the disc can block or reduce the light intensity of the laser. If severe enough, it will cause the disc drive to miss data as the disc is being read. Fingerprints, smudges, or dirt cover wide areas of data and can cause the laser beam to go out of focus or lose intensity. They can also cause widespread misreading of data along the data lines or tracks, to an extent that exceeds the error correction capability of the disc drive. Dust can also spin off into the disc drive and collect on the laser head or other internal components. Fingerprints, smudges, and dirt are easier to remove than scratches; it is simply a matter of cleaning them off. Apart from optical media, audiovisual documents are extremely sensitive against dust, which influences not only the integrity of the carriers by abrasion, but also deteriorates the retrieval of the signals in the replay process. In severe cases, a total signal breakdown can be observed. (http://webworld.unesco.org/safeguarding /en/txt_envi.htm)

How to Minimize the Damage Caused by the Environmental Factors

As mentioned in the beginning of the article the damage of some documents is as similar as the damage of human kidney, which is detected – until it is too late. Therefore, the best way to overcome this problem is to adopt all safety measures, which can minimize the effect of environmental factors. Environmental conditions and methods of storage have a great influence on the life of documents. Control of the environment and the provision of good storage conditions constitute the first of all preventive measures.

Controlled Temperature & Relative Humidity

Maintaining a consistent environment within the library is most important. Providing stable and optimal temperature and humidity is an important step in safeguarding the library documents. Library materials benefit from being stored in an environment with a low temperature and low humidity; however, temperatures should be comfortable for library users and staff as well. This fact could not ignore that the reading space and book stacks could not be separate in many cases. So first, the library should decide that what temperature and humidity setting could comfortably maintain throughout the year without affecting the library users and documents. Maintaining stable conditions is crucial. A library should choose a temperature and relative humidity within the recommended ranges that can be maintained twenty-four hours a day, 365 days a year.

Authorities disagree on the ideal temperature and relative humidity for library documents. This may vary from region to region as per their climate conditions. A frequent recommendation is a stable

temperature no higher than 70°F and a stable relative humidity between a minimum of 30% and a maximum of 50%. (http://www.nedcc.org/free-resources/preservation-leaflets/2.-the-environment/2.1-temperature-relative-humidity,-light,-and-air-quality-basic-guidelines-for-preservation). Research indicates that relative humidities at the lower end of this range are preferable since deterioration then progresses at a slower rate. Keep in mind, however, that standards for temperature as well as for relative humidity are based on conditions in temperate climates and may be unattainable in very dry and humid tropical areas. PD 5454:2012 recommends temperature 13 C to 20 C and relative humidity 35% to 60% for the storage of library and archive collection. (Guide for the storage and exhibition of archival materials, 2012).

HVAC (Heating, Ventilating and Air Cooling) systems can regulate humidity and temperature and suppress mold growth, performing these tasks consistently throughout storage areas. Libraries have found that the best conditions are maintained by constant-volume, all-air HVAC systems whose filtration, dehumidification and humidification, maintenance, and monitoring tasks are handled by central (rather than distributed) stations. Now days, computerized Building Management Systems (BMS) are available to monitor climate conditions and control HVAC equipment in large buildings or groups of buildings. There are two types of instruments available to measure temperature and RH independently of a BMS. ”Snapshot" measurements which record of conditions at a specific moment and provide a rough picture of environment and are dependent on human participation; and those that provide a continuous record of climate conditions. The “Snapshot” recording instruments which can be used to monitor the temperature and humidity are thermometers (to measure accurate temperature), humidity indicator strips or colour cards (showing approximate reading), Battery –operated Psychrometer, Electronic Tempratute Humidity Meter (±3-5% accuracy), Min/max Digital Hygrothermographs etc. Data loggers, Recording Hygrothermographs are continuous monitoring devices that provide continuous record of climate conditions.

If temperature does not control because of inadequate mechanical systems, other preservation measures (passive climate control) can be taken.

Some Passive climate control, which can be adopted, is:

1. Reduce heat gain by covering windows to the east and west with screens or curtains to control direct sunlight and use of surrounding vegetation, such as shade trees.
2. Increase air circulation by taking advantage of breezes, keeping windows open but screened to prevent the entry of insects and birds. Open any vents or small windows close to the ceiling to stimulate the circulation of air through open windows closer to floor level.
3. Reduce heat intake by using reflective colors on roof surfaces, installing false ceiling to reduce heat from the roof.
4. Reduce extreme humidity with dehumidifiers.

Light

Any exposure to light, even for a brief time, is damaging for library documents, and the damage is cumulative and irreversible. Light accelerate deterioration of library and archival materials. Although all wavelengths of light are damaging, ultraviolet (UV) radiation is especially harmful to library and archival materials because of its high level of energy. Skylights that allow direct sunlight to shine on collections should be covered to block the sun or should be painted with titanium dioxide or zinc white pigments because this reflects light and absorb UV radiation. Ultraviolet-filtering plastic films or UV-filtering Plexiglas can be used for windows to lower the amount of UV radiation passing through them. Therefore, the library materials should not be display where the sun shines directly on them, even if for only a short time and even if the windows are covered with an ultraviolet-filtering plastic.

When materials are being used by the library users, light should be from an incandescent source. However, it should be in mind that incandescent bulbs generate heat so it should be place at a distance from materials. Light levels should be as low as possible, and exposure should be for the shortest time that is feasible. The standard limit for UV is 75 µW/l. The sun and tungsten-halogen or quartz lamps, mercury or metal halide high intensity discharge lamps, and fluorescent lamps are some of the most damaging sources of light because of the high amounts of UV energy they emit. Light accelerates deterioration of library and archival materials.

Pollution

Air pollution contains sulphur dioxide, oxides of

nitrogen, ozone, and carbon dioxide, all of which may be absorbed into book materials and produce sulfuric acid and other acids. Cigarette smoke also contains gases harmful to books. Ventilation is a requirement for any area where people work or study. The Health and Safety Executive requires that workplaces are 'adequately ventilated' with 'fresh, clean air' that is 'uncontaminated' and is 'circulated through workrooms' (HSE, 2003).

Open windows may admit industrial air pollution, but if the outside air is clean, they will promote good air circulation. Make sure windows have screens to keep out dust and insects. Dust not only abrades bindings and obscures text, it also contains mould spores. Periodically vacuuming or dusting your books will help prevent a mold outbreak. Because mould spores are extremely small, it is best to use a vacuum with a HEPA (high efficiency particulate air) filtration system with a brush attachment to vacuum bindings gently.

Controlling air quality inside the library is difficult and complex and depends upon several inter-related factors. There are a number of standards for air quality. However, the most reasonable recommendation is that the amount of pollutants in the air be reduced as much as practicable. Gaseous contaminants can be removed by chemical filters, wet scrubbers, or a combination of both. Particulate matter can be mechanically filtered. Electrostatic precipitators should not be used because they produce ozone. Equipment varies in size and complexity from individual filters attached to vents, furnaces, or air conditioners to building-wide systems.

HEPA filters can remove at least 99.97 percent of airborne particles that are 0.3 micrometers in diameter. Pollen Mould spores range in size from 1-200 micrometers in diameter. It is important that your vacuum cleaner have an enclosed system so that all of the expelled air passes through the HEPA filter. If you do not have a vacuum with a HEPA system, you can wipe dust off your books using "magnetic" wiping cloths that hold dust using an electrostatic surface charge. (Swiffer cloths are one commercial brand.) Do not wipe your books with any cloth treated with wax, liquid, or perfumes; chemical additives may harm your books.

Conclusion

The action needed to achieve a good environment can be seen as a series of steps that should be reviewed as part of a regular cycle. First, the library administration should establish which environmental factors are to be monitored and in which location; after that establish targets for environmental conditions; then purchase and install equipments, collect and organize data, analyze this, present and act on results, and after some time review it. It should be noted that Specialists should do the air pollution and biological contamination, whereas the former can be done by library staff provided certain instructions are followed.

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MATHEMATICAL ANALYSIS FOR STABILITY BASED ROUTING IN AD-HOC NETWORKS

SACHIN KUMAR GUPTA, MANOJ YADAV** AND DR. R.K. SAKET****

The ad-hoc networks are often multi hop networks. Some neighboring mobile nodes that are in communication range of each other can directly communicate, while others needs to use one or more intermediate router nodes to communicate with far nodes. So, a reliable routing functionality is fundamental in these networks.

Nodes and links can appear and disappear spontaneously due to the behaviour of users (who may turn off/on a node), the depletion of battery power, etc. As nodes are free to move arbitrarily and may disappear, such networks can be characterized by a dynamic, often rapidly-changing, random and multi hop topology. This ad hoc topology may also change when the nodes adjust their transmission and reception parameters (Corson & Macker, 1999)[1]. The continuous presence of these phenomenons implies a very dynamic and randomly evolving topology in both time and space.

Since wireless ad-hoc networks with mobile nodes have not stable topology, the classical network functions such as the routing are difficult to realize. The router nodes and the links between them are not stable and can appear and disappear randomly. So, classic routing algorithms cannot be used successfully. Many special reactive, proactive and hybrid routing algorithms have been proposed to solve the data transmission in multi hop ad hoc networks. However, new approaches should be used which deals with these dynamic changes. In the case of reactive routing, the proposed route to satisfy a new request can be volatile and so, the communication concerned by it may be frequently interrupted and new routes may be computed. As an example, we can cite AODV, which is a well known reactive on-demand routing protocol proposed in (Perkins & Royer, 1999)[2]. The dynamic source routing (DSR) also proposes the dynamic allocation of routes (Johnson & Maltz, 1996)[3]. Trivially, the establishment of the new routes involves additional latency and intensive communication for control purposes. When a proactive routing algorithm is applied, the topology changes must be broadcasted in the whole network. The topology information is first monitored then periodically distributed and stored in routers. A typical example is the protocol DSDV (Perkins & Bhagwat, 1994)[4] and an optimized control flooding based solution can be found in OLSR (Jacquet et al., 2001)[5]. The update of the topology information in proactive case is not immediate and cannot be executed permanently. The broadcasted control messages pass through the randomly congested network and achieve the different nodes with different random delays. In the case of both the reactive and proactive routing, the route information may be outworn and may not correspond to the routing objectives. So, the routing is based on uncertain and not necessary adequate information. In both cases, this information can be obsolete at the moment of its utilization. A wrong routing implies packet losses or additional delay. A route breaking issue from expired information initiates expensive mechanisms to find a new route. Moreover, topology and/or route maintenance involves important control message overhead.

Stability Based Routing in Ad-hoc Networks

Generally classic proactive and reactive routing protocols apply a simple additive cost metric (often the hop count) to compute shortest paths towards destinations. Often, shortest paths are not reliable when the network topology changes dynamically. To illustrate, let us imagine a shortest path with minimum number of hops. Such a path corresponds to links (hops) that rely far nodes in the space. This kind of links may be very unstable due to the mobility of the extremities.

A. Observations on link stability

Several simple approaches aiming with the improvement of the routing decision can be found in the literature. Some works established that choosing routes based on additional information such as the position of the nodes, their battery level and the mobility pattern permits to design routing algorithms which is best suitable for dynamic nature of multi hop ad-hoc networks.

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Most of stability oriented works on routing consider the link stability in the ad hoc networks fundamental. Effectively, the stability of a path depends on the stability of its composing links. Several methods for stability based routing use a classification of the network links. In (Dube et al., 1997)[6] authors use the strength of the received signal of neighboring nodes to determine whether the associated link is either weakly connected or strongly connected. Routing is then performed through paths maximizing the received signal strength. The signal strength is used as central metric to establish a route with long life time in (Agarwal et al.2000)[7]. In their routing method, the authors suggest a routing protocol called Route-Lifetime Assessment Based Routing protocol (RABR) wherein the route selection is done using an intelligent residual-route-lifetime prediction on the basis of affinity appraisal of the candidate routes. Affinity is an estimate of the time after which a neighbor will move out of the threshold signal boundary of a mobile host, and hence is a measure of link availability. A similar, cross-layer information based solution is proposed in (Trivino-Cabrera et al., 2006)[8] to find long-live paths in ad-hoc networks. Since a path is broken if one of the used links is broken, the authors propose the minimal received signal strength along the candidate path as indirect measurement of the path lifetime. Targn and al. also approach the link stability by considering the radio propagation effect on signal strength in (Targn et al., 2007)[9]. A stochastic radio propagation model is proposed to compute received signal strength between adjacent nodes and to predict path loss. The authors consider that the link stability is equal to the probability of the receiving signal strength exceeding a predefined threshold. So, the estimation of link stability is derived from the prediction of signal strength. Considering the stability of a route, they state that the least stable link within a route would be the bottleneck for the route. The life spans of multi-hop routes decrease by increasing the route length. To model the effect of route length on estimating route stability, the authors consider the route stability as the product of link stabilities. With awareness of link and route stabilities, then an Ad-hoc On-demand Stability Vector (AOSV) routing protocol is proposed to reactively discover and maintain stable routes adapted to radio channels. Similarly, the authors in (Chen & Nahrstedt, 1999)[10] also propose the classification of network links from the point of view of their stability. Their objective is to find a path with sufficient resources to satisfy a given delay or bandwidth requirement in a dynamic multi hop mobile environment with the help of a distributed QoS routing algorithm. In their classification, links between stationary or slowly moving nodes are considered as *stationary links*. In contrast to this, links which exist only for a short period of time are handled as *transient links*. Newly formed links are also considered to be transient as they are more likely to break down. Routing should use then stationary links whenever this is possible.

B. Probability based route computations.

Uncertain and unstable environment of highly dynamic ad-hoc networks focus on intensive research activities to find new and efficient models. The random behavior of ad hoc networks has been analyzed with the help of random graphs where the existence of an edge is characterized by a probability (Jacquet & Laouiti, 1999)[11]. Traditional random graph cannot model the dynamic behavior of the ad hoc networks.

Firstly analyses of the uncertainties were related to wire networks. In (Gu´erin & Orda, 1999)[12] the network state is modeled with the help of random variables. In (Kuipers et al., 2005)[13] the authors analyze the stability of paths in Internet like networks. They establish that monitoring any change along the Internet is not possible and they distinguish two kinds of changes: frequent changes and changes which occur infrequently. The infrequent changes can be broadcasted efficiently in the network; the convergence is fast compared to the change frequency. In the case of slight changes, it is not necessary to update the network with useless information. Since a constant update procedure of the network state information is very expensive (even not possible), the available network state information for routing is inherently inaccurate and the established paths can be broken at any time.

Link and path availability is described in paper (Mcdonald & Znati, 1999b)[14]. According to authors availability $A\ i, j\ (t)$ of a link (i, j) is defined as the (conditional) probability that the link is active between two nodes i and j at time $(t0 + t)$ given that it was active at time $t0$. Similarly, the directed path availability $\Pi k\ m,n(t)$ is defined as the probability of the existence of a given path k between the source m and the destination n at time $(t0 + t)$, supposing the existence of this same path at ime $t0$. If the independence of link failures is assumed, the path availability is given by the link availabilities that composed it: $\Pi k\ m,n(t) = \Pi(i,j)\in k\ Ai,j(t)$.

Probabilistic Routing Procedure

The information used to select a path in highly dynamic ad hoc networks, when a route request arrives in a router is more or less imprecise. We now specify the major causes of uncertainties in routing information.

A. Uncertainties of routing information

- ***In the case of reactive routing protocols*:** route request are broadcast without any a previous knowledge of network state. The request corresponds to a new communication or to the restoration of a broken route. Generally, the source broadcasts a request and the destination answers using a route selected on the base of the received state information on the components of the route. Then the route is configured in the routers and used until its break. The state information can be volatile. The framework for reactive routing protocol is shown in Figure 1 (a). The figure illustrates the use of the state information on an intermediate element *X* of the selected route. The source sent the request at time ($t0 - Z$) which is treated at time ($t0 - Y$) by an intermediate element. The state information on *X* arrives to the destination at time $t0$. The destination selects the route on the base of received overall information at time *t*. The route reply containing the decision arrives at the source at *t* and the communication can begin. If the component *X* does not exist when the route reply reaches the configuration of *X*, then the route is considered as broken. Because the state of the element *X* can change rapidly after the configuration of the selected route.
- ***In the case of proactive routing protocol*:** state information on the network component is broadcasted regularly and each router maintains a database on the network state. If a route request is presented, the router decides which route should be used toward the given destination. The decision is based on the local network state database. The typical use of the state information on an element *X by* a router *R* is illustrated in Figure 1 (b). The state information of *X* is sent to *R* at time ($t0 - Y$) and received at $t0$. This information will be used at time *t* for routing until the end of the routing period if all right.

In both cases state information for routing can be non-correct because of rapid and unpredictable changes in the network and because of random propagation delay of information.

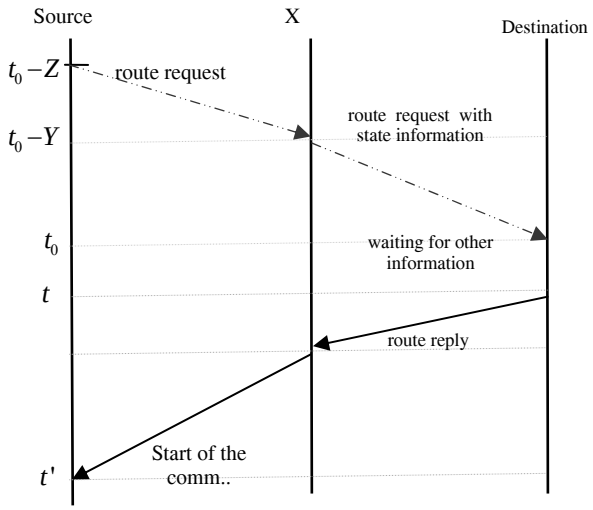

Fig. 1 (a) Probabilistic framework of reactive routing protocol

B. Network model

The aim is to model the availability of the network elements in dynamic ad hoc networks. There are two kinds of elements in consideration:

- *Nodes (mobile device):* manage their presence in the network autonomously.
- *Edges (potential communication capabilities between node pairs):* In this model, two nodes are capable to communicate if they are in the communication range of each other, independently of their operational state.

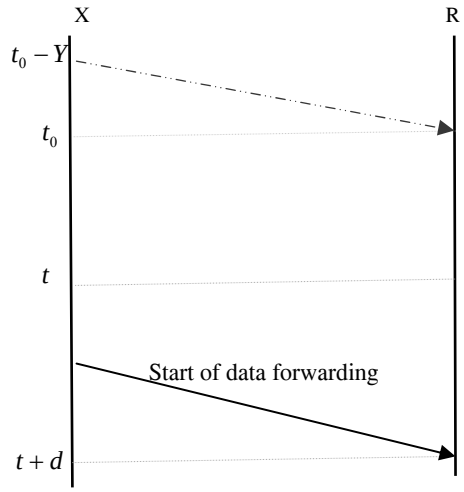

Fig. 1 (b) Probabilistic framework of proactive routing protocol.

This model (which was basically proposed in (Marie et al., 2007)[16] contains also nodes representing the network nodes and edges corresponding to the potential communication capabilities (which are binary relations). At a given time, each element can be in the state UP (U) or in the state of DOWN (D)[17]. The whole network model corresponds to a complete graph with n nodes and n $(n-1)/2$ edges representing the communication capability relations.

C. The existence probability of a path

Let us assume that consecutive links $\{L_1, L_2, \ldots\ldots L_m\}$ are in the path and the adjacent nodes $\{n_1, n_2, \ldots\ldots n_m\}$ which are also in the path. Let us consider the link L_i between two consecutive nodes n_{i-1} and n_i on the path. Let $R(n_{i-1}, n_i)$ be the binary random variable which indicates the potential communication capability between them. $R(n_{i-1}, n_i) = 1$ when they are in the range of each other (corresponding to the state UP) and $R(n_{i-1}, n_i) = 0$ (in the state DOWN). Let us consider probability $P(x = 1) = P(x)$, indicate the probability that the element x is available. Mainly, we are interested to find the availability of the elements on the time interval $[t, t + \Delta]$ without interruption.

The link L_i exists between nodes n_{i-1} and n_i, if and only if both nodes are in state UP and are also in communication range of each other. Naturally the link does not exist if one of the nodes shuts down or if $R(n_{i-1}, n_i)$ is in the state OWN. Then the probability of the presence of link between nodes will be given as

$$P(L_i) = P(n_i, n_{i-1}, R(n_{i-1}, n_i)) \quad \ldots\ldots\ldots \quad (1)$$

Generally, the existence of a node is independent from the existence of each other and from the location of the nodes. The potential communication capability $R(n_{i-1}, n_i)$ between the nodes depends only on the distance between them, and also their communication ranges. This potential communication capability is completely independent from the activity state of the nodes. Due to the independence, the probability of the existence of a link in the ad-hoc networks can be given as:

$$P(L_i) = P(n_i).P(n_{i-1}).P(R(n_{i-1}, n_i)) \quad \ldots \quad (2)$$

The mathematical computation can be generalized easily to express the probability of the existence of a complete path. Let us consider that a communication potential path $(s, d) = \{s, n_1, \ldots, d\}$ such that $n_0 = s$ and $n_m = d$. This path exists if and only if all the nodes on the path are in UP states and if each successive pair of nodes on the path can communicate (i.e. $R(n_{i-1}, n_i) = 1$).

$$P(s, d) = P(n_0, \ldots, n_m, R(n_0, n_1), \ldots R(n_{m-1}, n_m)) \quad \ldots(3)$$

Our assumption is that the existences of the nodes are always and completely independent from the other facts. So, the nodes do not appear and disappear in a correlated manner. As it is indicated in (Zhang & Dong, 2007)[15], generally, the neighbor links are not independent in ad-hoc networks because of the uncertain presence of the common nodes and their mobility. The presence of a node n_i is separately represented in this model and its probability corresponds to P (n_i). In reference to the communication capabilities, the discussion on path stability given in (Zhang & Dong, 2007) [15] is important consideration. In this model, an end-to-end communication capability of a path is expressed by $R(n_0, n_1), \ldots\ldots\ldots, R(n_{m-1}, n_m)$. Since the communication capabilities which do not share any common endpoint are independent, the probability of the end-to-end communication capability is equal to:

$$P(R_{s,d}) = P\left(\bigcap_{i=1}^{m} R(n_{i-1}, n_i)\right)$$

$$P(R_{s,d}) = \left(P(\bigcap_{i=1}^{m-1} R(n_{i-1}, n_i)).P(R(n_{m-1}, n_m) \mid \bigcap_{k=1}^{m-1} R(n_{k-1}, n_k))\right)$$

$$P(R_{s,d}) = P(R(n_0, n_1))\prod_{j=2}^{m} P(R(n_{j-1}, n_j) \mid \bigcap_{k=1}^{j-1} R(n_{k-1}, n_k)) \ldots\ldots \quad (4)$$

But, since the communication capabilities which do not share any common endpoint are independent,

$$P(R_{s,d}) = P(R(n_0, n_1))\prod_{j=2}^{m} P(R(n_{j-1}, n_j) \mid R(n_{j-2}, n_{j-1})).....(5)$$

or

$$P(R_{s,d}) = P(R(n_0, n_1))\prod_{j=2}^{m} \frac{P(R(n_{j-1}, n_j), R(n_{j-2}, n_{j-1}))}{P(R(n_{j-2}, n_{j-1}))}.....(6)$$

If we assume that the different potential communication capabilities are independent, that is, we suppose that the nodes approach one to the others in an uncorrelated way as it has been made in (Yu et al.,

2003), then the probability of the common event can be computed as the product of the probabilities of elementary events:

$$P(R_{s,d}) = \prod_{i=0}^{m} P(n_i).\prod_{i=1}^{m} P(R(n_{i-1}, n_i))....(7)$$

Let us examine that the source $n_0 = s$ and the destination $n_m = d$ belong insignificantly to each path from *s* to *d*. So, the existence probability of both nodes does not affect the path selection for any routing algorithm. Moreover, in actual cases, the path is wanted to ensure the connection between two existing nodes *s* and *d*. The simplified conditional probability of the path existence is the following:

$$P(R_{s,d|sd}) = \prod_{i=1}^{m-1} P(n_i).\prod_{i=1}^{m} P(R(n_{i-1}, n_i))....(8)$$

D. Path with maximal probability of existence

Here the path will be used between the source and the destination from the route request at time *t* until the end of the routing period, so we are more interested in path which should be stable in the time interval $[t, t + \Delta]$. The optimal path corresponds to the path with the higher existence probability in this interval. Let $T_{s,d}$ be the set of paths between the nodes *s* and *d*. The most stable path T_{opt} can be found as:

$$T_{opt} = \arg \max_{T \in T_{s,d}} P(T)....(9)$$

Since the logarithm function is a monotone increasing function:

$$T_{opt} = \arg \max_{T \in T_{s,d}} (\ln P(T))....(10)$$

or

$$T_{opt} = \arg \min_{T \in T_{s,d}} (-\ln P(T))....(11)$$

Taking into account the development of the existence probability of the paths:

$$T_{opt} = \arg \min_{T \in T_{s,d}} \left(\sum_{i=1}^{m-1} -\ln P(n_i) + \sum_{i=1}^{m} -\ln P(R(n_i, n_{i-1})) \right)....(12)$$

Conclusion

The complete review paper somehow deals with the probabilistic nature of path establishment and its possible stability for a desired time. Routing procedure is based on link stability and probability based route determinations**.** Here we observe that owing to its highly dynamic nature of ad-hoc networks, routes may frequently break. This leads to the topology and route maintenance issues. Hence it is necessary to determine the algorithms that must work in a dynamic and unstable environment. An important issue is the selection of stable routes which can reduce the control traffic and the packet losses. The topology information in the routers can be inaccurate at the moment of its utilization. The main objective of this review paper is to describe the most important heuristic and probability based ideas in order to obtain routes as stable as possible. Described mathematical procedure can be used to estimate the uncertainties due to unexpected changes and to random propagation delay of network state information. The routing algorithm finding the more stable path for a given time interval corresponds to finding a shortest path among various possible routes.

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GLOBAL ISSUES OF GMO FOOD CROPS, PRODUCTS RECEPTION AND DENUNCIATION WITH CURRENT STATUS OF INDIA

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It is essential to first define the genetically modified crops before going more in profundity regarding the pros and cons of Genetically Modified Corps (GMCs)/ Genetically Modified Products (GMPs)/ Genetically Modified Foods (GMFs). GMCs are crops, the genetic material of which has been modified by using genetic engineering techniques rather than traditional breeding techniques. The use of genetic engineering is a most recent and modern scientific alteration technique using foreign genes of specific character to produce new variety of crops with comparatively higher vigour, yield, resistant to cold, pests or insects, herbicides, drought and containing pharmaceutical significant traits. GMPs are products of GMCs such as crops leaves, branches, husks, whole plants other than grains and fruits etc., while GMFs are the grains and fruits produced from GMCs e.g. wheat, rice, pulses, tomatoes etc.

Process of producing GMCs

It begins with the "genetic mapping" of those crops that would be possibly used to mix up their genetic material to exchange or insert the genetic property or properties with defined trait or traits. Genetic mapping is defined as the total number of genes present in a crop(s) with recorded details of their sequences. The gene of choice with known sequence and function of particular crop is then identified using molecular biological lab techniques. It is cloned into a vector and then introduced into the desired crop(s) at embryonic level to enable to get incorporated into the main genome to produce GMCs. The modified seeds are obtained from GMCs and then seeded under the controlled condition such as green houses or any other traditional conditions.

Advantages of GMCs

GMCs have prime role in the augmentation of produced food taste and overall food quality. A little or no chemical pesticide is required in the GMCs due to insect pest resistant nature of the plants in comparison to the non-GMCs where chemical pesticide is required to control the pests. Since pesticide are not used from outside, pest resistant GMCs are more eco-friendly as it does not go into the air, natural soil and fresh water supplies thus causing no or very little addition of environmental hazards due to very less or almost negligible production of hazards. The non-use of pesticides decrease the growing and farming cost too including higher crop yields. Higher crop yields could be correlated to the increase in the daily income of peasants due to growth of better enhanced quality of GMPs and GMFs.

Higher yield of GMCs also result in the lowering of the food prices helping in reducing poverty and malnutrition in the developing third world countries with augmentation of living status. As people in poor countries spend more than half of their income on food alone, lower food prices mean an automatic reduction of poverty. The use of GMCs could be beneficial with decrease in the illness and sickness among the consumers due to its enhanced nutritious values. The GMFs could be a source of vitamins and minerals to the undernourished people of secluded areas of the developing countries [1] and to the poorest people of the poor countries of the third world. This required rigorous bio-safety testing of GMFs and GMPs with proper labeling before released into the market. If there is any chance of health hazard, GMCs should not be allowed to sown into the field by the farmers and also should not be allowed to be released into the markets.

Since GMCs are stress resistant, drought resistant and harboring other properties thus grow in odd environment without any extra machinery and extra energy [2, 3, 4, 5, 6, 7, 8, 9]. Moreover, there are possibilities that GMCs could be used to produce bio-insecticides and bio-pesticides to control the insects or pests on non-GMCs comparatively more environment friendly than the chemical insecticides and pesticides.

However, there is pressing need that customers should be well informed about the beneficial effects and harmful effects of GMFs and GMPs so they can evaluate the GMCs in stare with food value, nutrients contents, and impact on other agricultural crops in

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health. Farmers and consumers must be taught that less or no chemical pesticides are required to remove the pests or insects from the GMCs harbouring genes of pests resistant hence having less hazardous environmental effects [10]. Eventually, there are some drawbacks too. Such pest-resistant crops might be cause of origin and spread of novel and comparatively more resistant "super weeds" and "super pests" [10]. But this disadvantage is insignificant than the benefits as farmers must be earning more income than the traditional crops cultivation and thus should be spending more money on their children education, also in living high standard life. Cultivation of more and more fields with GMCs by developing countries could be bringing them in the competition of trading countries who earn more money from the cultivation and trading of GMFs or GMPs by generating taut competition and conflicts. Such scientific farming of GMCs could be beneficial to stop unwanted deforestation occurring due to growing population's need. On the other hand this could be slowing down global warming by diminishing the carbon dioxide load from the atmosphere. Increasing competition among the countries of various regions those are growing GMOs, may lead to the genesis of new consensus culminating into new trade, tariff and quota policies.

Recently, it has been observed that most of the countries belonging to European Union were opposing the cultivation of GMCs, firstly because they feel that these crops are advantageous to human health and environment, and secondly there is notion that since USA is a largest producer of GMCs, and exports GMPs in the other developing nations, and to those nations which are in verse to gain the status of developed countries, might have been provoking further anti-American feelings, due to "Americanization" at global level. There might be other reasons to such as inconsistency in the rule and regulation of FDA and other USA agencies. As the other GMCs growing countries are concerned to the human health, animal's safety and hazardous effects to the environment due to addition of GMPs. Thus these countries are conducting rigorous testing of produced GMPs and GMFs for safer use and release into the environment to avoid possible harm. However, supremacy greediness of GMFs manufacturing firms can't be ignored since they are trying to extract maximum monetary benefits. This is followed by the non-standard and unsynchronized bio-safety tests all around the world particularly in GMFs manufacturing countries, making difficult to believe the safety concern of GMPs. The authentic rule and regulation that all the GMPs should be sold into the market after strict bio-safety tests is still not followed [11]. The notion that, if there is least possibility of hazardous health effect, GMPs should not be allowed to go through the markets. The GMFs have to pass through stringent and multifaceted standards of testing to fully meet the criteria to be get accepted by the consumers. Measures should be able to boost up the confidence of consumer because only methodically understood GMCs due to their scrupulous testing are released into the market. Due to use of genetic engineering techniques there was scientific expansion of agriculture in the area of pharmaceutical sciences because of improved perceptiveness of GMPs leading to the development of food commodities associated with new medicines [12]. Resultant is creation of new genetic foods and beverage weapons. On the other hand revolution in scientific agriculture has given concept of "Super foods" [12, 13], that are comparatively economical to produce and grow quicker in large quantities with high nutritious value. High production of foods by one companies with a fewer competitors could be able to generate risk of oligopolies with increase prices of food commodities via widening gap between giants and smaller corporate. Moreover, generating more political power to mega companies that could be influencing safety concern with compromise to health hazardous effects due leniency in the rule regulation, standards and requirement to be followed for GMPs testing. For this extra efforts are required to label the GMFs and GMPs confirming which one are genetically modified and which one are not, depicting safety details. Proper labelling could be increasing the costs of GMFs and GMPs but is essential to win the people's trust.

Disadvantages of GMCs

Although the GMFs and GMPs have many advantages but they are not free form disadvantages as they can harm other organisms which are not harmful to the natural crops. For an example monarch butterfly is killed in large scale by the GMO corns [14, 15]. The GMCs might be good in taste but could not be as good as an original as the taste of natural crop's products flavor.

Sometime it's intricate to distinguish genetically modified plants from the natural traditional cross pollinated plants since genetically modified contains foreign gene/genes inserted through using genetic

engineering techniques as distance foreign gene/genes are transferred into the naturally produced hybrid crops by cross pollination. Insertion of new foreign genes in the offspring produced from the traditional natural crops which are also designated as organic crops makes complicated issues to distinguish them from produced or shown crop's fields are GMCs. This could be creating confusions in the proper labeling to distinguish between GMFs and non-GMFs [11].

This problem is followed by the spread of novel variety of additional resistant "super weeds" leading to the genesis of provocation of geopolitical conflicts which is also due to the selfishness of developed countries to grab maximum benefit from the produced GMCs. Additionally activists and critics those are against the production of GMCs feel that these crops are not to remove poverty and feel the need of consumers of down trodden countries rather produced by developed countries to earn money from the underdeveloped countries without considering the unforeseen dangers and health risks such as genesis of more intense allergies types that could be dangerous to the life. Such fears prompted the activists to boycott the GMFs and GMPs in the food market, retailing shops and in the general shops.

Genesis of new GMCs

Application of genetic engineering technique has given way for the development of new variety of crops with an ability to grow in extreme climates even in the deserts or in freezing temperature. For an example tomato GMCs has been developed with an ability to grow in salty soil. The most popular example of GMC is the exploitation of B.t. (*Bacillus thuringiensis*) genes in corn and other crops [2]. B.t gene is naturally present in bacterium and produces crystal proteins which are lethal to insect larvae. B.t. genes have been transferred into corn using genetic engineering technique, enabling the corn to produce bio-pesticides against European corn borer insects. As B.t. gene incorporated corn can facilitate to eliminate the further use of chemical pesticides thus reducing the cost of crop that arrives to market [2, 3]. Ringspot virus resistance papayas called Hawaiian papaya are grown and consumed at large scale in the USA. Golden rice created by the Swiss Federal Institute of Technology Institute for Plant Sciences which contains beta-carotene a vitamin-A precursor [16] funded by a non-profit organization the Rockefeller Foundation [17], preferred over normal white rice. Golden rice can be used to curb the blindness due to vitamin-A deficiency which is a most frequent problem in the developing countries[1]. A farmer grows soybean crops developed by Monsanto [3, 5, 17] that require one time application of weed-killer instead of multiple applications, reducing production cost and threat to environment of produced agricultural waste overflow. Researchers are working to develop golden rice with comparatively high iron content. However, due to funding shortage and forceful anti-GM food protesting in the key European union countries creation of these two nutritionally-enhanced rice strains has not been renewed that will prevent to come into the market [18].

Most of vegetable oil producing crops are grown at large scale and used to produce cooking oil. The vegetable oil producing GM crops are soybeans, canola and corn. These genetically-engineered crops are resistant to herbicide (weed killer) to prevent spoiling of environment by tumbling the amount of excess chemical herbicides. Canola contains herbicides (glyphosate or glufosinat) resistance genes[10]. Plant pathologists and biotechnologists' are working day and night to create GMO plants to curb and control plant disease caused by viruses, fungi and bacteria by using genetically-engineered disease resistance genes [4, 5, 6, 7, 8, 9]. Cold or unexpected frost resistant potato and tobacco plants have been developed using antifreeze gene from cold water fish to tolerate freezing temperature that kills seedlings of these plants [8]. Edible vaccines in tomatoes and potatoes have been developed by the researchers [12, 13] which can be easily shipped, stored and administered than traditional vaccines that are normally injected into the body.

Due to shrinkage of agriculture lands farmers are looking alternative to grow or cultivate crops in highly saline and drought affected area. By generating salinity and drought resistant plants that can endure in high salt concentration containing soil or long drought periods farmers can grow plants in such hostile places [7, 8]. Increasing soil and groundwater pollution has become shocking problem for clean environment in all parts of the world. Chemical treatment to curb such pollution has not been very successful. The most potent alternative is phytoremediation using genetically engineered plants. Researchers have developed genetically engineered popular trees to remove heavy metal pollutants from dirtied soil [19].

Overall it seems that in last few years the acceptance of genetically modified crops products at commercial level has been documented at global level.

For the first time in 1994 genetically modified tomato called as Flavr Savr which has slow rate of ripening was marketed. Transgenic sugar beet with glyphosate-resistance gene was adopted at larger scale in USA and this herbicide resistant sugar beet crops are accepted also in Australia, Canada, Japan, Korea, New Zealand, Russian federation and European Union [18, 20]. The transgenic sugar beets are used to produce sugar, molasses and pulp. Sugars are consumed by human beings while pulps are used to feed animals.

As more GMCs (plants) can be cultivated covering more places, this helps in decreasing global warming through the increase in the production of oxygen in the environment with decrease in the carbon dioxide load in comparison to earlier. British economists has observed and reported that GMCs can reduce greenhouse gas secretion greater than 10 million tonnes which is equivalent to removing five million cars from the road every year [21].

The adverse effects of GM-corn pollen on monarch butterfly caterpillars [14, 15] have immense splash in the media and brought the issue of genetic engineering to the forefront of the public consciousness in the USA and other GMFs producing countries due to intense protest by European environmental organizations and public interest group [18]. This public inflammation has obeisanced FDA (Food and Drug Administration) of USA to conduct three meetings at Chicago, Washington, DC in 1999, and Oakland, California to formulate new regulatory procedure taking public opinion to approve for the acceptance of GM foods [11, 22, 23, 24, 25, 26].

FDA and the United States Department of Agriculture (USDA) [21] have given green signal to over 40 plant varieties for commercialization and marketing. (http://vm.cfsan.fda.gov/%7Elrd/biocon). Those plants are modified food ripening characteristics plants such as tomatoes and cantaloupes, herbicide resistant plants of soybeans and sugar beets, and insects' resistant plants of corn1 and cotton. Some of these food products or their ingredients are commercially available in U.S. grocery stores for daily use as vegetable oils or cereals for breakfast. Such ingredients pooled from different sources by stream processing contains very less amount of genetically-modified harmful contamination if any, hence are safe for use [25, 26].

Due to restricted trials in India approximately 200 GMCs varieties of 12-different crops namely cotton, brinjal, castor, groundnut, mustard, papaya, potato, rice, rubber, sugarcane, wheat and tomato by the scientists working in various universities and research institutions. These plants are resistant to insect, fungi, drought, and viruses. The mangrove gene encoded rice varieties able to grow in high salty water soil. Tomato varieties with shelf life of over 50 days have been developed. Bt cotton is the single GM crop which got government nod for commercial production [27] and can be tested by using modern molecular biology techniques such as multiplex PCR and ELISA [28, 29, 30].

In USA in the year 2000, out of all GM crops 82% of grown GM crops were of Soybeans and corn, followed by canola and potatoes with lesser percentage. These crops were herbicide tolerance (74%), pesticide resistance (19%) and both herbicide and pest tolerance (7%). The global cultivation land for GMO crops has increased many folds as only in USA and Argentina more than 99 million acres land is used for the cultivation of GM crops. It should be noted that in 2000, more than 54% of GM soybeans, 61% GM cotton, 25% GM corn are cultivated in comparison to respective non-GM crops cultivation [31].

Along with other social and religious activists, the Vatican and the Prince of Wales [32] have opined their views against the GM foods mainly due to environmental hazards, risks to human health, and economic conflict. Environmental hazards include the harmful effect of GM crops and products to other organisms, for example pollens of B.t. corn to monarch butterfly caterpillars other insect larvae due to toxic effects [14, 15]. Another problem is the development of resistant varieties of pests to bio-pesticides. Similarly transfer of herbicide genes from crops by cross breed to weeds generating super-weeds [32, 33] that can tolerate bio-herbicide. Similarly transfer of genes from GM crops to the non-GM crops can't be avoided. Proper reliable techniques are required to test the cross contamination. However there is need to produce male sterile (pollen less) GM plants or GM plants in which pollen does not carry introduced genes to new crops and hence more research is required to be done to know how to avoid transfer of genes from GM crops to the non-GM crops [33, 2] creating buffer zones more than width of 6 to 30 meters surrounding the GM crops by planting non-GM crops which will not be harvested, is another possible solution to this problem [34]. It has been

noted that Brazilian nuts gene can't be transferred to soybeans due to its allergic reactions [35, 36]. Many researches are producing research data which flawed and lack proper scientific analysis [37, 38] to prove that GM foods have adverse effects on human health. Such data should be avoided. Some of GM crops producing companies are GM crops with suicide gene [39], so such GM plants can be grown for single time and can't be grow for the second time. The production of suicide gene containing GM plants has been abandon immediately by the Monsanto [17, 39] to avoid disaster to third world countries.

Common regulatory rules

At the Global level all those countries who are trying to promote the production of GMO crops are operating to institute a common regulatory rule to improve the varieties of GMO crops without destroying the environmental balance and compromising human health. Based on the political, scientific, economic and social activists' involvement within various regions of country, the concerned governments are retorting in different ways.

The Ministry of Health and Welfare of Japan has announced that testing of GMO products will be obligatory as of April 2001 [40] at the place of voluntary testing. Right now in Japan customers are showing maximum interest for un-modified GMO products at the place of GMO products such as vegetables and fruits. Although Indian government is very compassionate of GMO crops research to meet the challenges of exploding population and eradicate poverty as well as starvation but due to certain constringency unable to formulate and announce a common policy [41]. A few GMO products are commercially available in the market but due to health hazardous risk customers are not showing much more interest.

In Brazil, the Brazilian Institute for the Defense of Consumers collaborated with Greenpeace taken stern action to ban GMO crops and products in certain states and also filed suit to thwart the introduction of GMO products [42]. However, farmers have smuggled GMO Soybean seed into the country by illegal means to compete the global market against grain exporting countries. While in Europe due to occurrence of mad cow disease in Great Britain and dioxin-contaminated foods originating from the Belgium, the food consumers and citizens got scared leading to the down fall of confidence in GMO foods. This has prompted European Commission to bring back the confidence of public by establishing a 1% threshold for tainting of non-GMO foods 20. At the place of one agencies USA has established three regulatory bodies to monitor the GMO foods. EPA tests environmental safety, USDA tests whether plant is safe to grow or not and FDA tests the products to human safety point of view whether it is safe to eat or not. However, as per current rule of USA, FDA is not concern about the whole foods and hence does not furnish eating approval to GMO foods. This has given grate flaw in the approval certification by FDA because it can certify box of cornflakes but not to GMO corn. Such ambiguity need to be shorted out from human health safety point of view. Such ambiguity is not with European Union regulatory as they issue license and letter to growers as for example to grow B.t. corn farmers are allowed to grow 20% unmodified corn and 50% unmodified corn with cotton cultivated regions [43, 44] to avoid growth of B.t. pesticides resistance insects and shelter to Monarch butterflies.

The FDA policy of 1992 (Federal Register Docket No. 92N-0139) says that companies producing new GM foods do not need FDA approval and even not bound to follow the FDA's commendation [45].

Labelling of GM foods

Currently GMO foods as per FDA regulations are not supposed to be labelled as they are equivalent to the non-GMO foods. On the other hand various activists are demanding to label such products and foods so consumer can know what they are eating. This concern should be resolved by the new rule and regulation by the interference of Government to restore the confidence of consumer. Recently, India has taken initiative to propose competent toxicity detection, labelling of GMPs and GMFs by using modern tools and techniques to meet the standard of International labelling policies [43]. Proper test and labelling is essential because it is not well known that whether farmers have taken enough precautions to avoid the mixing of GM crops with non-GM crops during plantation. Cross contamination cannot be avoided, although European countries have permitted for 1% acceptable limit for cross contamination. The assurance of companies such as Gerber baby foods [44] and Frito-Lay [45] that they have not mixed any GMO foods must be tested and certified [46, 47]. So far technology is not so advance yet to do such testing.

As per international trade agreement of January 2000, labelling regulation for GM foods has been

established [48], and new techniques have been tried to develop to identify allergenic foods and products [49]. USA a largest producer of GM foods along with other 130 GM foods producing countries have signed the agreement which says that all exporters must label GM foods. The current policy may impel the U.S. government to short out the food labelling dilemma more swiftly.

Summary

Bio-safety concern still main hindrance in the world wide acceptance of genetically modified crops (GMCs). GMCs appear essential to meet the need of global population that has aced 6 billion people and which is supposed to double in the coming 50 years. To guarantee a sufficient amount of quality food supply to the deafening population, it is going to be foremost challenges in the coming years need to develop, novel scientific development, new treaties and testing protocol for proper labelling. It is going to make pressing needs for the GMCs and food products, in all the developing countries including developed countries to denounce undernourishment problems. For this consensus international rule, regulation and policy along with advancement in the safety testing and labelling of harmlessness of genetic modified foods (GMF) and genetic modified products (GMP) that could be added in the environment is compulsory, to differentiate them from the non-GMP and, to quench the concern of social activists working globally against GMP. The world wide people must be educated about GMCs technological development, reliability and gargantuan potential benefits for future needs.

Conclusion

By adopting common rule and regulation and global level for testing and labelling of GMC, GMP, and GMF confidence in the consumers could be restored and farmers at global level can be promoted to cultivate GMCs at maximum cultivation lands without fear and foe. This could be also satisfying the queries raised time to time on the safety issue on consumers and environment hazardous effects on other organisms, by various social organisations at global level.

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WATER MANAGEMENT IN ARID AREAS: HYDRAULIC ENGINEERING OF THE HARAPPANS

DR. G. K. LAMA*

The Indus civilization was spread over a vast area, bigger than the contemporary civilizations of Mesopotamia and Egypt. In the 3rd millennium BCE, it thrived on the rich alluvium of the Indus and the Hakra basins. Though devoid of the macabre splendour of the graves of the Mesopotamians and the Egyptians, the Indus civilization was marked by an advanced technological virtuosity. The Harappans were the first to invent an advanced system of drains and canals to take away effluents under well-covered drains, a complex system of water harvesting and reservoirs, and a developed water proofing technology as shown by the Great Bath at Mohenjo-daro. There is much to learn from them about water management in arid areas.

Hydraulic Engineering

In the 3rd millennium BCE the region of Indus Valley had plenty of fertile land, watered by the Indus and the Saraswati and with sufficient rainfall. Agriculture was practiced in the riverine valleys, having vast tracts of rich alluvium, brought by the snow fed rivers emanating from the Himalayas. The archaeological studies carried out on the grain samples found during the excavations of the Harappan levels of the eastern zone show a variety of crops which throw considerable light on the food habits of the people. Wheat and barley were the principal cereals consumed by the people, though millet, *ragi, kodon, jawar,* were also eaten. Sesame and mustard were used as a cooking medium and for lighting the lamps. Cotton was widely grown and was also exported. Tilling was done with a wooden plough having a copper capping at the head of the ploughshare. It could be of a type which is available in the terracotta models of Mohenjo-daro, Banawali and Kalibangan. The evidence of the ploughed field found in the Early Harappan levels at Kalibangan gives convincing evidence of two sets of furrows crossing each other at right angles in a grid pattern having 30 cm inter-furrow space between the east-west furrows and 1.20 m between the north-south ones. Extrapolating from the modern analogy, it appears that the Harappans practiced a system of double crops as is done in Rajasthan today where mustard is grown in wider furrows and horse-gram in the narrower ones (Fig.1).

Fig. 1. Furrow marks in a ploughed field, Period I, Kalibangan

Explaining the significance of the double furrows, Lal says that the mustard plants are quite tall and thus cast long shadows, whereas the horse-gram plants are relatively smaller and so are their shadows. Thus by sowing the mustard plants in the north-south rows, care is taken that their shadows fall more on one another rather than on the horse-gram plants. Had the mustard plants been sown in the east-west rows, their shadows would have completely covered the horse-gram plants, depriving the latter of the nourishing sun's rays and consequently hampering their growth (Lal 2002: 98-100).

The Harappans mostly depended on the alluvial soil and probably canal water for their agriculture. Monsoon has been an uncertain factor in the Indo-Pakistan subcontinent since time immemorial and because of this factor, the Harappans were perhaps forced

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to dig canals to ensure permanent water supply which could be utilized for a large area of agricultural activity both for single and double cropping. Francfort discovered a canal in the Haryana region and stratigraphically, it belonged to the Harappan period. Evidence of a 'V' shaped channel for 40 m has been found at Baror in Rajasthan. The digging of a moat around the Harappan settlement at Banawali and the canal connecting the river *Bhogavo* with the dockyard at Lothal are other examples. The evidence from Allahdino suggests that the Harappans were acquainted with well irrigation. No wonder, Fairservis called the Harappans 'master hydraulic engineers'.

Wells

Probably water wells are available both in residential and citadel areas at Mohenjo-daro, Harappa, Lothal, Kalibangan, Dholavira and Banawali. These wells are not very large and could be operated by one or two persons. Dholavira has provided evidence of damming of *nalas,* water reservoirs, rock-cut and structural tanks, and regular long drains for drainage of water. The well at Dholavira is the biggest which could be operated by more than two persons. Its trough also bears rope marks suggesting the lifting of water probably in leather bags with the help of a horizontal bar on the side wooden pillars, using a pulley and throwing it in the drain which carried the water into adjacent reservoirs in the castle area (Fig.2-3).

Fig. 2. A. Well, Dholavira

Fig. 3. The Reservoirs, Dholavira

Terracotta pulleys of various sizes have been found at Kalibangan. Wooden pulleys used in wells have been found perished. There are two types of wells, which were used by the Harappans:

1. Public wells including *piau* where two or more pots are kept by the side of the wall, and
2. Room wells.

It appears that well water was used for drinking and river water was used for all other purposes, or if the house was far away from the river, the well was used for all other purposes. Compared to Mohenjo-daro, there were fewer wells at Harappa and still fewer at Lothal (Fig.4), Banawali and Kalibangan (Fig.5-6).

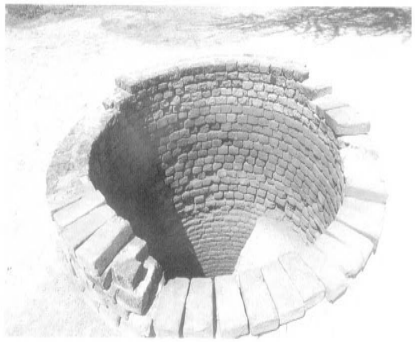


Fig. 4. A Well, Lothal

Fig. 5. A Well, Kalibangan

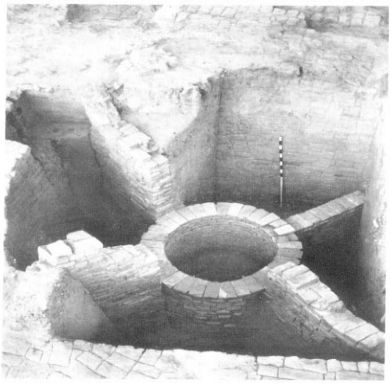


Fig.6. A Well with Radial Walls, Kalibangan

The diameter of the wells at Mohenjo-daro and Harappa ranges between 0.63 m to 2.43 m. Only one or two persons used wells with a small diameter. At Mohenjo-daro in SD area, a room well has been found in the south-eastern corner of a building with a diameter of 2.146 m x 1.479 m. It has been constructed with wedge-shaped bricks. To prevent the coping from being displaced by the rope employed in drawing water, an edging was made around it of bricks, set up right on their ends, and these were in turn kept in place. The latter was usually well- laid and shows signs of constant heavy wear and tear. Around it is the usual edging some 0.07 m high to prevent the percolation of water back into the walls. Drainage is by an open channel, which was 0.29 m wide and 0.20 m deep through the room to the south. This is one of the finest examples of a room well at Mohenjo-daro. However, this appears to be a public well, which had entrances of 2.87 m. There are two instances at Mohenjo-daro where instead of raising the steening of a well to accord with the rise in the level of the mound; a short staircase was constructed, leading to the well rooms. At Kalibangan, one well with an inner diameter of 1.25 m and outer diameter of 1.85 m having, eighteen exposed courses has been found. The ring of the well is 30 cm. It is constructed of wedge-shaped bricks and was found supported on four sides by four radial walls of a single brick course. The well has suffered heavily at the hands of brick robbers. This well catered to the needs of the people who were bathing on the bathing platforms in the citadel area. A house well is also located at the lower city area at KLB-2. At Banawali, a well has also been found. At Lothal, a well was located in the acropolis measuring 2.784 m in diameter, 7.656 m deep, and was an important source of potable water in the acropolis. It has been used in all successive phases. In the Harappan context, the largest well made of dressed stone is found at Dholavira in the south-western corner of the castle. It has a diameter of 4.45 m in the north-south direction and 4.15 m along east-west. The well has been excavated up to a depth of 13.60 m. It remained operational from stages IV to VII. The basal slab of the trough has deep rope marks. Perhaps, masonry pillars had a wooden horizontal shaft fitted with a pulley as indicated by the huge debris on both the sides. The south-western quadrangle of the citadel had a water structure, a stepped tank with a feeder channel issuing from the well. This is a remarkable well connected with a tank reservoir for collection of water with the aid of some sort of large leather bags, and pulling the water and emptying it into the reservoir could be a regular exercise. This is a very early example of pulling water from the well and keeping it in reserve for domestic purposes. Similar methods might have been used for agricultural purposes also (IAR 1996-97: 11-16**).**

The well is connected with two tanks, one larger and the other smaller lying 4.70 m apart. The larger tank's internal measurements are 4.65 m north-south, 3.15 m east-west and 4.80 m deep. The tank has six steps having a tread. In the center of the tank, there is a miniature square tank of 80 cm. The floor bears the wear marks of the jars. The smaller tank's inside measurements are 2.20 m north-south, 2.30 m east-west and 4.85 m deep. The staircase is 5.30 m long north-south, and 2.45 m wide having fourteen steps. Close to the last step, there is a limestone slab covering an aperture, which may be connected to a drain that might have been used for letting out the dirty water. The large tank appears to have been a storage tank and the other was for bathing purposes. Some of the fireplaces may be for heating water. Some cubicles may have been bathrooms (IAR 1996-97: 10-12).

Allahdino, a Harappan site in Sindh, had wells of small diameters. One well was traced up to 4.26 m and some 1.21 m into the virgin soil. The small diameter would help water to overflow in an artesian fashion. The central well was located at the highest part of the site. Any runoff from that well could be channeled wherever one wished on the slope. The surrounding area could provide for the movement of the water through stone channels. Well water irrigation was also possible for cultivation (Fairservis 1982:107-112).

Dams

The Harappan township of Dholavira is situated between the two seasonal rivers *Manhar* and *Mansar*, which empty into the Greater Rann of Kachchh. The catchment area for these two rivers lies about 10-12 km away in the hills that are about 100-150 m high on the eastern periphery of Khadir. Both the rivers have a high gradient of 3-4 m per km, and the high velocity gushing water was checked by putting across boulders, possibly wooden logs at various places. Finally three check dams nos. 1, 2, 3 near the site have been made across the river *Manhar* with rubbles and masonry stones and water was diverted to the 4 to 6 m high reservoirs in the city. On the *Mansar,* a dam has been built which fed the 1, 50,000 sq m area of the city for

agricultural purposes. The Harappans successfully dammed the river waters of the *Manhar* and the *Mansar,* the small torrents bounding the settlement on the east and the west respectively, at intervals across various points, generally where the river span was relatively narrow. This resulted in a series of check-dams which were conducive not only to diverting rain water of rivers into the city landscape, into reservoirs, but also for holding sweet water back in the river bed for sometime so that the sub-soil water table of the area rises and gets sweetened for agricultural and other habitation purposes. The ground water of the region is otherwise relatively hard and brackish, which gets worse with each passing year if rains fail.

In the immediate neighborhood of the site, one damming point on the *Mansar* and three on the *Manhar* can still easily be seen on the ground, as illustrated by the Dholavira site plan (IAR 1991-92: 29; Fig.7-8).

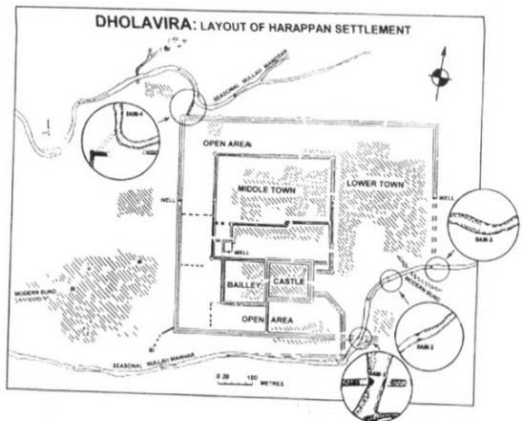


Fig.7. Check dams on the River Mansar and Manhar, Dholavira

Fig.8. Dam site on the River Mansar, Dholavira

Of these, the points on the *Manhar* appeared to be inside the eastern fortifications. Creation of check-dams at narrow openings along the river course, as it appears, was feasible with the minimum human effort. It seems that a wall of big and small stones, held in place with the help of natural features and upright wooden logs was provided at such points. Adequate measures must have been taken in creating check-dams or else the violent flow of rain water in the river, which swells in no time after the torrential rains, would sweep away any loose thing down the course of the river. It seems that the Harappans at Dholavira first settled by the side of the *Manhar* and built their citadel, the first fortified settlement of the Khadir which is close to this river water source. As the settlement grew in size and also in population, an inevitable need might have been felt by the Early and Mature Harappans to harvest more water from the other sources as well, for which they dammed another neighborhood channel called the *Mansar* that flowed almost east-west on the northern fringes of the ancient settlement. In rectangular reservoirs, rainwater was stored. Some of these reservoirs were indeed large and unique. While one of them 37 x 26.30 x 7.5 m, was built of stone blocks and was provided with a flight of steps, the other one 88.40 x 12.00 x 7.5 m was found cut out through the rock with the limited use of superb stone masonry in weak zones of the structure (Fig.9-10).

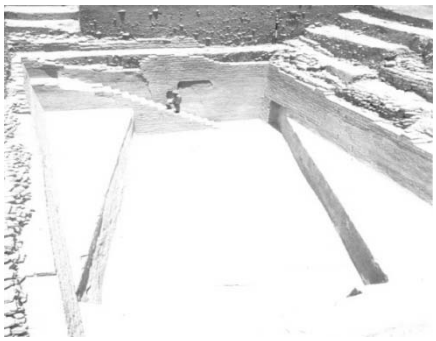


Fig.9. The rock-cut water Reservoir, Dholavira

Fig.10. Water Reservoir with flight of steps on the sides, Dholavira

Dockyard

A large water body called the 'Dockyard' is another good example of hydraulic engineering (Fig.11).

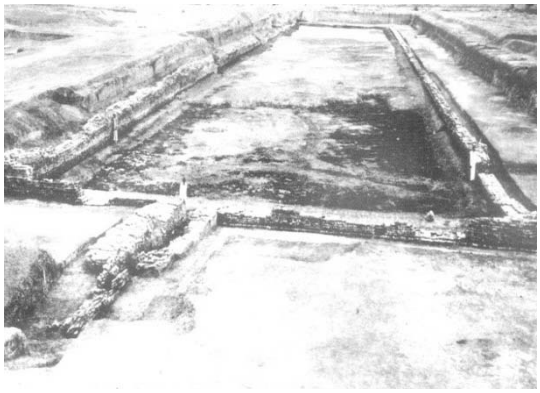


Fig.11. The Dockyard, Lothal

It measures 212-215 m in length and 35-37 m in width. The extant height is 3.03 m. The entry of boats to the dockyard at high tide was from the inlets in the northern and eastern walls measuring 12 m and 7 m respectively. The dock was connected with a *nala* and a channel to *Bhogavo* River which emptied in the Gulf of Cambay. For the exit of extra water at high tide, there was a spill channel in the eastern wall with a sluice gate. The boats returned to the sea, coinciding with a subsequent tide and with the release of extra water from the spill channel. The modern dockyard at Gogha works on the same principle. This was a great engineering feat. The discovery of marine shells from the dockyard, a few massive anchor-stones and the absence of any landing steps into the dock suggests that it was a dockyard for the berthing of boats. The terracotta models of boats from Lothal further attest to it. Rear Admiral (Retd.) Bindra, in a recent paper, has scientifically analyzed all aspects of the controversy with regard to the dockyard raised in the last four decades. He says, 'there are four specific constructional features, which distinguish this structure as a ship berthing basin from other similar structures:

1. The two inlets (northern and eastern),
2. The spill way with its dwarf walls,
3. The verticality of the inner walls with signs of a uniform level on the walls,
4. The post holes in the enclosure suggesting the tie posts for the ships.

Lothal possesses all the essential prerequisites for its identification as an ancient port. We therefore, fully support the nomenclature, "Lothal: A Harappan Port town" and further opine that no other title would have perhaps better explained the commercial and maritime functions performed by the Harappans' (Bindra 2002-2003: 1-18).As has already been pointed out earlier, of the drainage systems adopted by the Harappans at other sites, the water management at Dholavira deserves special notice. In the castle area, there is a network of drains finally joining a 120 m long covered drain. This might have been used for carrying the storm water during cloud bursts or heavy rain. Some terracotta pipes have also been found.

The Great Bath Complex at Mohenjo-daro

The tank proper of the Great Bath (Fig.12) measured 11.7 m north-south and 6.9 m east-west and was 2.4 m deep.

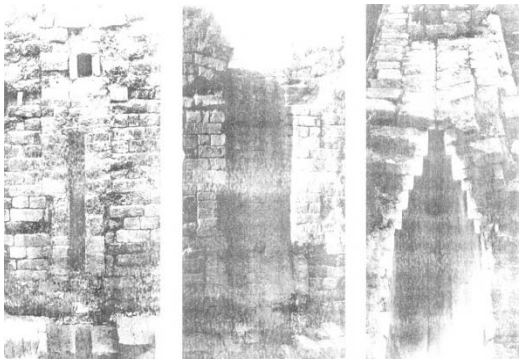
Fig.12. Plan of the Great Bath, Mohanjo-daro

The northern and southern sides had staircases leading to the floor of the tank, which had brick-on-edge paving with gypsum mortar, and also the same mortar made the sidewalls impervious. The innermost wall had a damp proof course of bitumen, followed by a second mud brick wall, and again there was a wall running all around. A corbelled drain at the south-western corner discharged the water from the tank. A courtyard surrounded the tank with a pillared corridor having a series of rooms. There were eight bathrooms and a *hammam*. Whether this was a true *hammam,* or whether the hypocaust was intended merely to keep the house adequately warm in winter, we cannot be sure, nor is the point a very material one. What is of importance is that we have evidence of a hypo caustic system of heating which goes far to corroborate the view that the building alongside the Great Bath served as a *hammam (Marshall* 1931:26).

Drains

The Harappans had a good knowledge of the drainage system, which they applied in town planning, and built various types of drains *viz.*, covered drains with gable or flat roofs and open drains with cesspits and inspection chambers. They had an excellent idea of putting the correct gradient for the floor of the drain.

The carrying capacity was kept in view with a brick floor and sides. The drains at Harappa, Mohenjo-daro and Lothal are below the streets. Successive drains of different phases are available. Drains were used both for carrying the sullage and storm water of the rains (Fig.13 a, b, c)



Figs.13 a & b. Water chutes; c-Culvert, Mohanjo-daro

It was the Harappans who gave the idea of a different type of hydraulic architecture which was a legacy of the Harappans besides other important contributions in social, economic and religious fields.

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SCIENCE FICTION AND CYBERPUNK: A CRITICAL SURVEY

DR. RAJNEESH PANDEY*

Science fiction is a well known term in modern English literature. It is a genre of fiction in which the stories or plots revolve around science and technology of the future. It is quite relevant to mention that there is always an association with the principles of science and these principles are based on partially fictitious laws or theories of science. But this association is managed within the literary glamour of genre fantasy. According to Casey Fredericks". . . false beliefs and superstitions are rejected by the critical side of the SF intellect, but on the other side SF writers and fans are attracted to magic because it presupposes as yet unknown and unpredictable changes in our reality system"(153). The plots of science fiction venture to project the situations somewhat different from the known present and known past. Science fiction texts are often set in the future, in space, on a different world, or in a different universe or dimension. Besides that, it is replete with human touch, elucidating what effect new innovations, undertakings and scientific augmentation will have on us in future.

It is very difficult to provide a satisfactory definition of science fiction for all the readers because of bewildering diversity of themes, approaches and techniques as well as the exact historic determination of the origin of science fiction. In some of its most accepted understanding, science fiction is considered a primarily twentieth-century occurrence, ingrained in a largely western practice of technological growth. Yet the origin of science fiction could be traced back to much earlier periods. More up to date confirmation for the continuation of science-fictional narratives that well predate the twentieth century can be found in Cyrano de Bergerac's seventeenth-century stories, such as *Voyage to the Moon* (1661). Italo Calvino points out that Cyrano is 'the first true forerunner of science fiction'. Calvino also highlights the poetic and philosophical qualities of Cyrano's narratives: "Cyrano extols the unity of all things, animate or inanimate, the combinatorial of elementary figures that determine the variety of living forms; and above all he conveys the sense of the precariousness of the processes behind them. That is, how nearly man missed being man, and life, life, and the world, the world"(20). Of course, there is an extensive variety of texts, observed as classics, that deal with fanciful voyages, visions, mystic explorations and metaphysical tasks which could be put under the head of science fiction. A number of narratives formed over a huge period that covers the phase from ancient Greek civilization to the nineteenth century may be said to have a potential canon of proto- science fiction including Homer's *Odyssey*, Dante's *Divina Commedia*, Ariosto's *Orlando Furioso*, Rabelais's *Gargantua and Pantagruel*, More's *Utopia*, Swift's *Gulliver's Travels*, Voltaire's *Candide*, Rousseau's *Emile* and Goethe's *Faust*.

Perhaps the best-known precursor of modern science fiction is Mary Shelley's *Frankenstein* (1818). This a classic because of its spotlight on the question of what comprises of humanity in a world where there is always a prospect for the augmentation of human powers via science and dehumanization of people through technology. Frankenstein, a student of natural philosophy, is competent to produce a simulated being with the help of technology. In spite of his generous intentions, he is heaved into a whirlpool of fear, hatred and hostility, since his creature comes to symbolize everything that humanity reckons most frightening about technology. Every challenge to nature's most fundamental laws is in the centre of *Frankenstein*. Definitely this subject will immensely captivate the succeeding science-fiction writers and film- makers. Yet it is essential to keep in mind that the novel does not merely pave the path to a wayward generation of mad scientists, sadistic doctors and self-deluded researchers. In fact, it also pioneers an issue of tremendous ideological significance for science fiction, that of monstrosity, and thus communicates a deep sense of concern surrounding anything other. The monster and the alien are used by science fiction, as by the Gothic novel, to give shape to amorphous qualms and prejudices.

Jules Verne and H.G. Wells besides Shelley are other prominent forerunners of modern science fiction in the mid and late nineteenth century. Their narratives foresee later developments in the genre by endeavouring to portray the incredible adventures as

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scientifically feasible. H.G. Wells has dexterously shown that there is an academic possibility to manage the marriage of fantasy and methodical acquaintance with scientific issues. Wells's *The Time Machine* (1895) has interwoven several themes which proved to be an outstanding hallmark in later science fiction. There is the issue of travelling through time, the prospect of world annihilation and the encounter between the human and the alien. *The War of the Worlds* (1898) also builds up the idea of alien incursion. When we go through these texts we feel that they could not be regarded as mere fantasies, because there is the categorical representation of entrenched anxieties about cultural disintegration, the bafflement of conventional confines, the enormously vicious outcome of technological advancement and, above all, the ending punch over Victorian certitudes in a waning colonial culture. Without any misgiving Wells cast a colossal impact on many subsequent British writers of science fiction, such as John Wyndham, whose *The Day of the Trifds* (1951) evolves the quandary of the last man or woman left on earth after fatal calamity, and communicates a nostalgic desire to restore the world from the existing fragments and leftovers. Evidently the science fiction is not merely concerned with a stiff, sparkly and methodically mechanized future. Rather it is a spotlight on the notion of cultural collapse and chaos that are even visible in the present.

The year 1926 is a significant juncture from the point of view of the flourishing of modern science fiction, because in this year the first issue of the American magazine *Amazing Stories*, edited by Hugo Gernsback was published. Gernsback being an occasional writer and amateur scientist, had a somewhat contradictory understanding of what a science-fiction story should consist of and accomplish. On the one hand, he expected it to be based on science and to be of topical interest to young men engaged in scientific careers. On the other, he wanted it to be a charming romance intermingled with scientific fact and prophetic vision. It was the result of Gernsback's aesthetic that we come across a series of space operas that have come to be associated with the Pulp Era of science fiction. Even Wells himself had used the term *scientific romances* for his science-fiction narratives. However, the term romance cannot be a popular fiction of today with sentimental connotations very similar to the artistic work fusing the natural and the supernatural. The tradition of the Gothic novel may be helpful in understanding of this type of romance partly derived from the tradition of the Gothic novel, where the real situations are presented as incredible and exceptional ones. According to some critics the Gothic novel is itself a significant pioneer of science fiction and its contemporary development as cyberpunk.

Despite Gernsback's contradictory approach, *Amazing Stories* cast such a captivating spell that there was a succession of other popular magazines such as *Science Wonder Stories*, *Wonder Stories* and *Astounding Stories* in the late 1920s and in the 1930s. The magazine *Astounding Stories*, founded by John W. Campbell in 1930, turned out to be a true competitor to Gernsback's *Amazing Stories*. Campbell's aesthetic too was based on a notion which viewed science fiction as a convincing account with literary proficiency about technological impact on individuals as well as cultures through refined narrative techniques and a meticulous approach to subject matter. It was the consequence of Campbell's enterprise which added a boom of science-fiction writers including Isaac Asimov, Robert A. Heinlein, Theodore Sturgeon and Arthur C. Clarke, whose works have come to be regarded by many as the Golden Age of science fiction. It was in this golden era that we see the development of some major themes of science fiction, which *Grolier* lists as: "robots, alternate worlds, faster-than-light travel, the seeding of the galaxies by human or alien cultures, the meeting of humans and aliens and its many astonishing consequences, and, in the later 1940s, the full range of possibilities presented by nuclear power"(2).

After 1950s, the impact of technology on the destiny of individual and the globe became the chief area of science fiction. This resulted in the significant development of the New Wave; a phase associated with authors such as Brian Aldiss and J.G. Ballard and with the British publication *New Worlds* (1946-70), edited by Michael Moorcock. In the nucleus of the New Wave were relevant contemporary issues such as environmental depletion, urban overcrowding and the relationship of technology, crime, drug addiction and sexuality. Thus, the New Wave determined the preface to the contents of cyberpunk which revolves all around the impact of technology on the present no less than on the future. A further glaring tint was added to the contemporary picture of Gibson and his contemporaries in the form of computer technology. The reiterated blending of reality and fantasy

emphasized by Wells, Gernsback, the Gothic, the New Wave and contemporary science fiction simply implies that speculative fiction is not an escape from cultural reality rather it is a way of polishing people's understanding of this reality by defamiliarizing it through fantasy.

The emphasis on the volatility of knowledge of technoculture in contemporary times is well exemplified by the work of J.G. Ballard through illustrative instances of the defamiliarizing effects of science fiction. Ballard concentrates the catastrophic side of science fiction to show that catastrophe is not a destiny that awaits humans but rather something that has already happened. He further points out in his introduction to *Crash*: “the future is ceasing to exist, devoured by the all-voracious present. We have annexed the future into the present, as merely one of those manifold alternatives open to us”(4). As Fred Botting observes: “The loss of human identity and the alienation of self from both itself and the social bearings in which a sense of reality is secured are presented in the threatening shapes of increasingly dehumanized environments, mechanic doubles and violent, psychotic fragmentation”(157). David Punter is also of the view: “the principal subject at issue' in Ballard's writings 'is the conflict between the individual and a dehumanized environment”(120). 'The world of assassinations and high-speed car crashes which he depicts has ceased to be amenable to interpretation in terms of natural laws, and individuals have ceased to hold them- selves together either literally or metaphorically.

Doris Lessing and Angela Carter like Ballard have put up the scenes of social decline and cultural depletion as the main motif of science-fiction. In both writers, moreover, we come across with the issues of gender and sexuality playing a vital role in the constant discussion about the future of humankind and its planet. In the science-fiction series *Canopus in Argos: Archives* (1979-83), Lessing contemplates about an evolutionary advancement of both human history and the cosmos as a whole in which intuitive powers and metaphysical propositions about the affiliation between good and evil have a more important task to perform than science. Carter’s depiction of post-catastrophe scenarios in *Heroes and Villains* (1969) and *The Passion of New Eve* (1977) is very similar to that of Ballard.

It is signified by these texts that it is always a gruelling task to provide a complete definition of science because of volatile nature of its generic boundaries. Consequently there is recurrently a fusion of scientific and technological motifs and themes and issues that are not explicitly science-fictional. Margaret Atwood's *The Handmaid's Tale* (1986) can also be put under the head of science on account of its criticism of religious fundamentalism and its so called affinity to the broad ideological issues of patriotism and political despotism. Techno science is the major means of erecting practical, prolific and methodically well-organized bodies - particularly female ones - through the organized suppression of both biological urges and cultural desires. The association between science fiction and dystopian understanding of both present and future will achieve new significance through cyberpunk.

When we are going to contextualize cyberpunk in terms of internal growth of science fiction as a genre, it should be borne in the mind that there is an obvious influence of non science-fictional authors on cyberpunk. For instance we observe a major influence of the hard-boiled detective fiction, developed in America in the late 1920s and 1930s, in the making of cyberpunk's characters and settings. In the history of crime fiction, the hard-boiled school represents a radical departure from the tradition of the Golden Age. As Ian Ousby States: “Their heroes embark on journeys through the city, taking its extremes of glamour and sleaze. Though they need to solve mysteries, they usually do so by stirring up trouble and being tough enough to handle the consequences. Hard-boiled endings, rather than returning society to order or vindicating the power of reason, affirm their heroes' ability to survive against the odds”(91).

Dashiell Hammett's *Red Harvest* (1929) is a classic of hard-boiled detective fiction where we see the anticipation of the prominent features of cyberpunk. Like Gibson's Case, Turner and Laney, there is a loner hero who has to face a nebulous world of corruption and hostility and cope with his stiffness as both a physical attribute and an intellectual faculty. The same tough and accountable character surrounded by a strange setting of urban violence, is created by Raymond Chandler in another hard-boiled classic *The Big Sleep* (1939). There is the anticipation of cyberpunk in two ways in hard boiled fiction. Firstly there is the depiction of tribulation endured by several cyberpunk heroes and heroines as we see in Gibson's *Count Zero*, *Virtual Light* and *Idoru*. Of course, there is some change where we find the

replacement of conventional dragon by another monster, in the face of insatiable corporate culture, and the conventional suffering maiden is changed by a commodified victim. Secondly, there is the appropriation of medieval motifs in its expression of a distinctly Gothic sensibility. Apart from this, cyberpunk bears many points of contact with post-modernist fiction. Indeed, cyberpunk novels and films are often taught on courses on Postmodernism. Despite many points of similarity it would not be realistic, to put cyberpunk close to all the forms of post- modernist fiction of twentieth century. Burroughs's *Naked Lunch* (1959) is perhaps a crucial influence behind cyberpunk. *Naked Lunch* concentrates on the theme of 'the junk virus' - drug addiction - as the opening point for a thrilling voyage into the territory of abjection: the state of body and mind that turns into certain objects and experiences concurrently attractive and disgusting. *Naked Lunch* is felt more perturbing than that of Thomas Pynchon's *The Crying of Lot 49* (1966) in substantial conditions. All the same, it is intensely disconcerting in its presentation of a world devoid of certitude for people to adhere. Pynchon's heroine, Oedipa Maas, is steered by insinuation, traces, and supposition through a maze of conspiracies which may not be considered as real. The novel's drastic probing of reliability has provided prolific ground for the development of cyberpunk. The major characteristic of Pynchon's work inherited by cyberpunk has been pointed out by Brian McHale as, “his paranoid vision of a world controlled by multinational corporations, who are controlled, in turn, by the self-actuating technologies upon which their power depends”(316). Another postmodernist narrative that in some ways anticipates cyberpunk is Don DeLillo's *White Noise* (1984). This novel addresses the dystopian implications of late capitalism by focussing the instability of the apparently secure and calm life of small-town North America.

The origin of cyberpunk may not be merely literary. The term 'cyber' in cyberpunk refers to science and, in particular, to the radical redefinition of the affiliation between human beings and machines brought about by the science of cybernetics. The word cybernetics was introduced by the mathematician Norbert Wiener (1894-1964) in a book titled *Cybernetics, or Control and Communication in the Animal and the Machinepn* in 1948. Cybernetics is derived from the Greek word *kibernetes*, which means 'steersman'. This term implies that control should be in form of 'steersman ship', not of 'dictatorship'. Wiener was of the view that biological bodies and mechanical bodies are autonomous systems related by the fundamental fact that both work in terms of control and communication. According to Wiener the history of machines consists of four stages: the golemic age (a pre-technological world), the age of clocks (seventeenth and eighteenth centuries), the age of steam (late eighteenth and nineteenth centuries) and the age of communication and control (the era of cybernetics).). Every stage is represented by an unlike model of the physical organism: the first stage corresponds the body as a model of a magical clay shape, the second as a clockwork mechanism, the third as a heat engine and, the fourth as an electronic system. The concept of the body as an electronic system is based on its structure as a communication network competent of processing the information through sense organs for subsequent action in accordance with information received. The entire research in the field of cybernetics corresponds to the conception of human body as a machine therefore it seeks the prospect to create machines in replication of human organism. The nervous mechanism, a sophisticated system of control governed by the brain serves as a working model for designing a *cybernetic organism*, a technological creation that simulates the human body because of existing obvious structural similarities between machines and living organisms. The virtual interchangeability of human organism and machines is a recurring theme in cyberpunk and always inherent in the depiction of cyborgs. The cyborg sums up many existing concerns about the congregation of the natural and the artificial and the thought that there is no obvious division between the non-human and the human, the technological and the biological, the original and the copy. Concurrently, Many traditional suppositions and confines are put under question by cyborg. As Gary Lee Downey, Joseph Dumit and Sarah Williams point out: “cyborg anthropology poses a serious challenge to the human-centered foundations of anthropological discourse' by 'examining the argument that human subjects and subjectivity are crucially as much a function of machines, machine relations, and information transfers as they are machine producers and operators”(343).

The term *cyborg* (cybernetic organism) was used by Manfred E. Clynes and Nathan S. Kline in 1960 to describe a self- regulating man-machine system, believed to be more flexible than the human

organism. According to M.E. Clynes and N.S. Kline cyborg is fundamentally an improved human, ideally capable of surviving in extraterrestrial worlds. It simply refers to altering man's bodily functions to meet the requirements of extraterrestrial environments which would be more logical than providing an earthly environment for him in space. Clynes and Kline's project inspired the 'Cyborg Study' conducted on behalf of NASA in 1963. This project, observes Robert Driscoll: “. . . concerns itself with the determination of man's capabilities and limitations under the unpredictable and often hostile conditions of space flight, and the theoretical possibility of incorporating artificial organs, drugs, and/or hypothermia as integral parts of the life support systems in space craft design of the future, and of redumetabolic demands and the attendant life support requirements”(76).

The term 'cyberpunk' was introduced by Bruce Bethke in a short story in the spring of 1980 and it was published in *Amazing Science Fiction Stories* in November 1983. After one year in December 1984, an article was published in the *Washington Post* and this term was employed by Gardner Dozois to illustrate the fiction of authors such as Sterling, Cadigan and, of course, Gibson, whose epoch-making *Neuromancer* appeared in the same year. According to David Porush, the foremost question which connects the concerns of different writers is: “What aspect of humanity makes us human?”(258) This question undeniably forms the nucleus of cyberpunk and establishes frequently the interaction of so-called real humans with artificial intelligences, androids, cyborgs, computer-simulated bodies, mutants and replicants with this objective to set up what exactly distinguishes the natural from the artificial. Mostly it is not easy to draw this distinction between the natural from the artificial.

As mentioned above, the 'cyber' component in the term cyberpunk refers to the fact that this branch of science fiction originates from cybernetics rather than spaceships and robots. The 'punk' constituent of the term suggests the impudent approach of urban street culture. The characters of Cyberpunk's are taken from that section of people which constitutes the fringe of society and represents the strife for existence on a garbage-strewn planet confirming to Rudy Rucker's image. Cyberpunk projects visions of the future deep-rooted in broad application of the conception of cyberspace, a term that finds full vent in William Gibson's novel *Neuromancer* (1984). It is very arduous to define the reality both in science fiction and cyberpunk. Vivian Sobchack points out “science fiction is the 'cognitive mapping and poetic figuration of social relations as these are constituted by new technological modes of "being-in-the-world"(225).The kind of “cognitive mapping' specifically supplied by cyberpunk is an effort 'to find a suitable means for displaying the powerful and troubling technological logic that underlies the postmodern condition'. Reality and identity are introduced as unsteady by their diminution to the position of interchangeable and disposable commodities, which are destined to a designed and quick obsolescence.

Finally it is relevant to scrutinize the connection between cyberpunk and the subculture of punk. The blend of cybernetics and punk is like an unholy marriage of two contradictory elements of which the first is associated with control, order and logic and the latter is known for anarchy, chaos and unrest. However, we should not astonish at this combination because the writers like Gibson needed that type of pairing in order to represent an absurd and ambiguous culture born of conflict and incongruity. In other words it is the call of time to find out such a figure that could aptly bring together seemingly incompatible aspects of contemporary life. Moreover, cybernetics and punk are not as utterly disparate as they seem to be at first sight. Cybernetics believes in the means to systematize social existence in accord with the abstract ideology that can be represented as data and transformed into concrete commodities for civic use. According to Istvan Csicsery-Ronay: “Cybernetics is . . . a paradox: simultaneously a sublime vision of human power over chance and a dreary augmentation of multi- national capitalism's mechanical process of expansion. . . . Cybernetics is, thus, part natural philosophy, part necromancy, part ideology.' Cyberpunk couches the ambiguity of cybernetics in explicitly popular terms by associating it with punk: a subculture that, in undermining all accepted values, was also willing to under- mine itself through 'a self-stupefying and self-mutilating refusal to dignify or trust anything that has brought about the present world”(186).

Punk formed an entire aesthetic out of a truth of socioeconomic hostility and prejudices. In fact, it promoted and augmented anything reckoned as the least savoury in the mainstream culture. It

intentionally endorsed the features that would make it the object of disgust and dislike and strengthen the institutional longing to ban it. Punks also intended at developing a self-conscious isolation by affiliating themselves with ethnic groups usually marginalized in British culture. In addition to this cyberpunk exhibits telling affinities with punk music. Cyberpunk also represents punk culture in opposition to 'hippie', one of the dominant cultures of twentieth-century subcultures. Thus the preceding pages exemplify some of the ways in which the 'cyber' and the 'punk' constituents of cyberpunk relentlessly interact to construct shifting assemblage of the relationship between the lustrous world of prominent technology and the gloomy world of addiction and felony. The term 'punk' also suggests the deconstructive temperament of contemporary writers, artists, musicians and critics who do not believe in any fixed definition because of their unremitted process of appraising its historical impact. This is to be borne on mind that the term 'punk' is not always used by cyberpunk writers to denote any context-bound and context-specific subculture. Because of this dynamic nature of the term that cyberpunk seems a novel contemporary metaphor suggesting the rootlessness, estrangement and cultural disruption in the context of contemporary society.

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CHINA'S SCIENCE AND TECHNOLOGY IN THE REFORM PERIOD : AN OVERVIEW

PROF. ADITI JHA* AND DR. KAMAL DUTTA**

China's recent emergence as a major economic power has been attracting China analysts, watchers and commoners as well to find out the factors responsible for such phenomenal development in the last three decades. Factors like massive foreign capital investment and technology transfer could be attributed to such success, enabling it to acquire the rank of world's second largest economy in terms of GDP. Given the global liberal economic and technological imperatives, the Asian countries including China and India have been left out with no other option but to depend on world's advanced science and technology [henceforth S&T]. It is now firmly believed that progress of social life and growth of national economy hinge greatly on the agenda of advancement of S&T. However, despite recent rise in its GDP, China is still confronting with challenges of social development and struggling to achieve sustainable economic growth and self reliance in technology, besides facing the challenge of increasing developmental fallout of environmental pollution. Before we examine the fundamental changes in China's economic agenda with special emphasis on the procurement and development of S&T, related plans and projects and its consequences in the last three decades, an attempt has been made to provide a brief account of its scientific and technological achievements and status in the ancient period and the economic foundation laid during the early three decades of socialist period [1950-78].

As one of the oldest civilizations, ancient China was known for its immense wealth, prosperity, rich philosophical wisdom and technical innovations. Its technological know-how and inventions of gunpowder, paper making, printing technique, paper currency, magnetic compass and much else, indeed greatly contributed to the development of the world civilization. Other scientific achievements like the use of iron tipped plough for high productivity in agriculture as early as in the Warring States period (475-221BC), development in hydraulics, improved rice varieties, wheel barrow, advanced water conservation knowledge and irrigation system, metallurgical technique, medicine and materia-medica, building construction technology, weaving, printing & dyeing technique brought China in the fore front of technologically advanced countries in the ancient world. (Joseph Needham, et al, 1954-2008) However, the rise of western imperialism and the incessant aggression by foreign forces since the middle of 19th century coupled with severe socio-economic crisis reduced China into a weak, corrupt and disintegrated country. Ironically, while China's ancient technological achievements transformed the life of Europe time and again with explosive consequences of dissemination of learning through printing and colonization by gun, it could not become the agent of violent social catalyst as it did when transferred to Europe. Printing was invented in China in the Tang period (618-907AD) many centuries before Gutenberg, but its influence on Chinese society was far, far less than might have been expected. The printing particularly created the condition for a cultural explosion in the West as China failed to appropriate its advantage due to its own stagnated, hierarchical social system, nor could it face the onslaught of the [technologically] advanced European countries later. (Dawson.R, 1972, pp.22-23) The Chinese as a nation take great pride over their ancient achievements, but cannot justify their failure of responsibility to strengthen the country by those inventions. After the establishment of PRC in 1949, large scale social transformation and economic reconstruction were initiated under the early communist regime. Massive steel and heavy industrial projects were undertaken with the Soviet technological know-how enabling China to acquire a strong heavy industrial base. However, disproportionate huge investment in heavy industry and defense led the agriculture and light industries suffer considerably which coupled with radical left political movements pushed China into a chaotic situation. China's industry suffered setback, outdated machines and technolology could not produce quality product to compete at the international market. It was reported that the quality of blade China's industry manufactured was so poor that could not

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shave his beard - once lamented the then Premier Zhou Enlai. The idea of modernization of industry and import of better technology was in fact, first putforth by Zhou, who held a balanced view on development and politics, in one of the oft conducted political sessions of the CCP. However, a more systematic approach for the development of S&T was made with the execution of 'economic structural reform and open up' policy by Deng Xiaoping, the Party General Secretary, as a follow up of Zhou's thought of Four Modernizations [agriculture, industry, national defense and science and technology] later in the early 1980s. Stressing on the need for technology, Deng as early as 1978, at a national science conference said, "…the key to the four modernizations is the modernization of science and technology. Without modernizing science and technology, it is impossible to build modern agriculture, industry or defense. Without the rapid development of science and technology, there can be no rapid development of the economy". (Deng Xiaoping, 1984 p.102) Party secretary, Jiang Zemin later at another science programme in 1989, highlighted the need for Herculean efforts to be made to turn China's weak areas of huge population, economic foundation, and scarce per-capita natural resources into strength through scientific and technological progress. (Beijing Review, Jan.1990, p.7)

In the last three decades, China has undergone a paradigm shift in policies from 'politics in command' to 'economics in command' [though economic concerns are still addressed by political guidelines] with the objective to drive away poverty and improve the economy; in other words to raise peoples' life standard. The reform started from China's rural areas by replacing people's commune [renmin gongshe] with the family responsibility system [jiating chengbao zerenzhi]. A major thrust in economic structural reform was initiated in the industrial area with an open invitation to world's biggest MNC houses to make direct investment with capital and technology and thus opening up the domestic market to the world. At the same time taking advantage of all the available facilities of the world market by joining WTO [Dec.2001] and other international organizations, China attempted to boost its economy. This shift of focus from heavy industry, economic self-reliance and command economy of the socialist period to economic liberalization and development on the western capital in the reform era has been projected as Chinese socialism with a capitalist face by many China analysts or socialism with the Chinese characteristics as China's Marxist theorists prefer to define.

As in other fields, a structural reform in S&T sector has been carried out through meticulous planning and strong political will and prudence. Realization of the Four Modernizations is considered as the main task to transform China into a modern and powerful socialist state. The reform has led to many changes in S&T policies prevalent during the early socialist period. The period was particularly characterized by reliance on Soviet model of S&T research, centrally controlled scientific research led by [mostly] non-scientists, lack of coordination between research and productions, emphasis on practical applications and restrictions on information flows. The scientific and technological undertakings suffered a serious setback during the Cultural Revolution (1966-76), the biggest political movement engulfing China far and wide, when students were sent to remote villages and mountains to acquire knowledge by doing manual labor with the peasants instead of learning in classroom, library or research work in laboratory. The formal education and scientific research work in universities and colleges were almost abandoned. (China, A General Survey, 1989, p.198) Domestic political compulsions, retarded scientific research work, outdated Soviet made machine products failed to find markets, famine in early 60s, huge foreign trade deficit pushed China to a nowhere position compared to the world's advanced countries.

Major S&T policy shift, plans and programs of the reform period

After the Cultural Revolution, China entered a new phase of reform in which a series of new S&T programs, plans and policies were initiated primarily with the aim to develop national economy and defense.

The government formulated an Eight Year Plan (1978-85) with high priority to eight major areas including agriculture, energy, raw materials, computer science, laser technology, space technology, high energy physics and genetic engineering. All these areas are closely linked with S&T as a whole. In 1985 a reform program of management system in S&T was initiated to accelerate its modernization drive and meet the challenges of new technological revolution. The main reform measures included changes in funding for research institutions and introduction of public bidding and job contracting; replacement of uncompensated transfer of technological achievement through purely

administrative means with the establishment of technology markets; encouragement of cooperation among research, educational and design institutions; establishment and maintenance of scientific and technological ties with other countries, granting of more decision making power to research institutes, and approval given to collectives and individuals to set up their own research or technical service organizations. (Ibid, pp.199-200) The emphasis on considerable decentralization and freedom to research organizations with regard to scientific and technological work, development of academic exchanges in science and technology with foreign countries and establishment of technology markets, was a sign of shift in policy from that of early socialist period. However, administrative control and decision related to development of S&T remained in the hands of the government/party leadership.

A nationwide 'Spark Program' started in the second half of 1985 to transfer S&T to China's countryside with a purpose to strengthen and modernize rural economy. Many international organizations showed interest towards this program and found it useful for the development of third world countries. Another S&T program called "Torch Plan" in the mid-1988 was carried out to promote high-tech and new technology intensive industries in China. The plan emphasized on commercialization of high-tech and greater results of new research in technical areas. (Ibid, p.200)

A national conference was held in May 1995 to outline China's S&T policy of the 21st century. The conference was attended by China's highest leadership and about 6000 delegates from across the country. The conference made an assessment of the challenges in the field of environment, food production, population, military and health in the early 21st century. The highlight of major decisions was to carry out a planned S&T development. The S&T was taken as the major productive force responsible for socio-economic transformation and overall national progress; the scientific academies and institutes of higher learning were urged to set up high-tech companies; it called for a structural reform in S&T to cater to the market needs and encourage universities and the private industries along with govt. institutes to carry out research; the state institutes were asked to initiate joint ventures with Chinese and foreign companies. With regard to S&T personnel, preference was given to talent over connection; occupational mobility, efficiency/ economic results and competence replaced the previous practice of same reward for all regardless of one's performance in work (chi daguofan). Emphasis was on improvement of information exchange, speedy flow of capital to carry out research programs and fulfill the market requirements for availability of fund; it gave importance to respecting intellectual property rights, protection of environment; public officials were urged to improve their understanding of S&T and use it while making decisions; it urged the CCP youth organizations, labor unions, and the mass media to promote respect for knowledge and talents; it also decided to develop indigenous S&T in key areas. In other words, it expected to transform every educated youth as a techno savvy to serve the country.

While talking on the need of achieving self reliance in S&T, Jiang Zemin commented that the world's most advanced technology was not for sale. China should continue to learn from others and import advanced foreign technology, at the same time, it must remain focused on raising its ability to do research and develop on its own. (A Report from U.S. Embassy, Beijing, 1996) The S&T policies aim to promote indigenous technology and innovation in industry and call for self reliance in this sector.

To overcome the shortcomings of national innovation system, the government started a 15 year 'Medium to Long-Term Plan' in Jan. 2006. This plan set the target of lifting China into an innovation oriented, well-off society by the year 2020 and a world leader in S&T by the middle of 21st century. (Cong Cao et al., 2006) Keeping this objective in mind, China has adopted measures to improve innovations by carrying out 20 mega projects in areas like nanotechnology, high-end generic microchips, aircraft, biotechnology and new drugs. Moreover, encouragement is given to cooperation between universities and industry.

China's present S&T policies give prominence to the promotion of R&D infrastructure and activities in order to minimize technology import and achieve self- reliance in technology development.

A series of long term S&T programs were outlined in a Strategic General Report of the Chinese Academy of Sciences in 2010, entitled " Science and Technology in China: A Roadmap to 2050". The report identified basic and strategic systems for socio-economic development and S&T initiatives of strategic importance to China's modernization. It also

highlighted the recent success achieved in the area that the increasing overall growth in the S&T capability has reduced the gap with the world's advanced countries. It stated that in several emerging research fields the nation has already reached the world standard or even achieved highest rank. The national output in S&T has increased greatly. Role of S&T in national socio-economic development has increased remarkably. (Lu Yongxian, 2012)

A brief account of recent S&T developments

In the process of reform in the S&T sector, initially all the science and research organizations were restructured. By the year 1996, Chinese Science Academy, Chinese government's concerned departments at central, provincial and local levels had already been strengthened and well coordinated. The number of R&D institutions that year increased to 50000. (Gai Kuang Zhong Guo, 2003, p.78) Today, China has become a big source for R&D personnel. In 2008 the number of engineers and scientists reached to 1.59 million, doubling the number that existed in the year 2000. (UNESCO Report, 2010) The Chinese government's policy of 'rejuvenating the nation by relying on Science and education', has also led to reform in the education system. The policy of education for all and emphasis on higher education in S&T has paved the way for creating a big contingent of S&T personnel and workers. For the promotion of R&D infrastructure and activities, huge investment is being made by the govt. to prepare scientists of international standard and motivate them to develop indigenous technology capacity.

The key Chinese universities, responsible for greater research output, receive large amount of research funding. The government continues to provide support to basic research; however, applied research mainly depends on support of the market. Between 1996 and 2000, the govt.'s investment in scientific research was 582.83 billion Yuan which was more than double compared to earlier five years. (China Through A Lens, 2014). Presently China is the third largest R&D spender in the world after the U.S and Japan with annual gross domestic expenditure in R&D growth rate of 18% since 2000. China plans to raise gross domestic expenditure in R&D to at least 2.5% of its GDP by 2020. (China- India: 2025, 2011 pp.62-63)

In the recent years, China's scientific research has improved dramatically in terms of number of published articles. The numbers of article published provide information about the extent and area of research activity. It has increased science and education publications four times from 1993 to 2003. As a result, during the period, its share in Asia increased from 11% to 22%, which is equivalent to that of Japan. (Ibid p.61) According to a recent news report, China produces about seven times more science research papers compared to India.

It is true that China's S&T sector has registered a number of remarkable achievements in the reform period as a consequence of fundamental changes and policy shift. However, despite serious economic crisis and repeated political unrest in the socialist days, China's preoccupation to develop technology for self defense was never ignored. To the world's surprise, it produced atomic and hydrogen bombs, missiles and launched man made satellites mostly on its own resource. Its past engagement in the development of S&T has a definite bearing on the present tangible success. In the field of military technology, some recent achievements include production of anti-ballistic missile, anti-ship missile, and anti-satellite weapon. China's military technology advancement in some areas is said to be nearly equal to that of technologically advanced countries. That there is a substantial decrease in arms import despite heavy investment in the defense sector is a newly visible phenomenon. This partially indicates increasing ability of the indigenous military production. China's defense sector remains completely state owned, however defense equipment production is assigned to corporate bodies allowing limited competition and reform in the patent system to reward innovative enterprises and individuals and to a great extent, it still depends on import from foreign manufacturers in the area. (D.T. Kate, 2012)

China has made striking achievements in electronics and IT sector in the recent years. It has already become the world's biggest exporter of computer hardware, telecom equipments and other high-tech electronics. Rapid progress is undergoing in the IT infrastructure and technology. Indigenous manufacturing of electronic components has become important source of growth. China is soon expected to be an export power house in industries such as semi conductors, passenger cars and specialty chemicals. It is claimed that in 10 to 15 years China is likely to export commercial airplanes. Despite making such tangible breakthrough in this area, China however, is faced with serious

criticism of being weak in protecting intellectual property rights that has prevented several multi nationals from transferring technology and low quality of final products in some industries has made it difficult to compete in the international market. (China-India: 2025, 2011, p.74)

The success of Special Economic Zones motivated China to create Economic and Technical Development Zones with the aim to build high tech industries and attract the foreign investment, increase export and improve the regional economy. These Development Zones have expanded rapidly due to their high success rate. (Gai kuang zhongguo, 2003 p.71)

Ever since the execution of reform policy, China has adopted a 'two leg strategy' for the development of S&T. On the one hand, it encourages indigenous research and on the other allows import of advanced technology with the purpose to bring about innovation and improvement in the indigenous S&T. Major countries with which China has signed agreements in this regard are Japan, Germany, U.S., Italy and Britain. This strategy has accelerated technological progress in Chinese enterprises and brought profound changes in production. This has also strengthened the ability of Chinese technology to develop independently and compete in the international market. (Gai kuang zhongguo, 2003,p.80)

China's S&T policies and programs, oriented towards developing high tech industries have contributed significantly to the technological success. Its low cost manufacturing power, a big market, an export promotion strategy and appropriation of advanced technology are strong factors to develop itself into a techno-industrial nation. (S. Haimowitz, 2011)

Application of advanced technology in the field of agriculture, industry, education, health and hygiene, transportation, post and telegraph, building construction etc. has yielded high economic results and growth. China's economic growth in terms of GDP and per capita income has shown distinct progress. In 1998, China accounted for11.5% of the world GDP where as India accounted for 7.7%. However, compared to their share of world population (China: 21% and India: 16.5%) their GDP is still considered moderate. (Maddison, 2001) China's present S&T policies as motivated towards economic development and national defense are playing important role by closely linking rapid economic growth with scientific and technological innovations and advancements. This has been instrumental to a great extent in fulfilling security requirements and achieving sustainable economic growth. However, in other areas, China still encounters challenges.

In the social field, China still shows poor indicators of development. According to Social Progress Index-2014, published by an US social science institute, China's performance in social development in terms of basic human necessities, happiness and opportunities is little better than India, but still considerably low. China faces serious problem of unemployment. A survey conducted by China Academy of Social Sciences in 2004-2005, shows that the urban people (the newly increased laborers and laid off workers) seeking jobs are about 24 million but only 9 million new job opportunities could be made available. Apart from that, about 740,000 university graduates are yet to get employment. Besides growing economic gap between rural-urban areas, within urban areas only it shows increasing income difference between regions, trades and industries. The people in the low income group are found very discontented with the hike of basic price of food and daily items as 50 to 60 percent of their total income is spent on food only. Meanwhile the increasing gap between the rich and poor further influences their social attitude and confidence. In China's reform policy, poverty relief work has been kept high on the govt. agenda; however, its current rural absolute poverty standard is below 625 Yuan per year for each farmer, much below the UN international poverty standard i.e., 900 Yuan. Corruption cases have increased considerably. (People's Daily, 2005) Moreover, the fallout of rapid and pervasive use and overdependence on technology are manifested in the form of severe environmental pollution and health hazards which are posing big challenges to the present government. According to a recent Xinhua news report, in west China's Lanzhou city, drinking water was found poisonous. The city administration discovered that this was due to very high level of benzene [a cancer causing agent] present in water, almost 20 times higher than the normal level. The city inhabitants were forced to purchase drinking water from local supermarket. (Xinhua News, 2014) Further, about 33lac hectare of arable land in the country has become uncultivable as it produces poisonous crops. Some 40 million farmers have lost their farm land due to rapid industrialization and urbanization. People in metro cities like Beijing,

Shanghai and Guangzhou are suffering from serious diseases because of high level of air pollution. Beijing's manufacturing industries and 5 million cars alone contribute profusely to the city's crippling air pollution. However, experts say that the primary blame goes to coal burning electrical plants surrounding Beijing. (New York Times, 2013) Such adverse situation continues to prevail despite government's policy priority and emphasis on environmental protection.

Conclusion

Nevertheless, China has achieved rapid progress in S&T which has been complementing to the phenomenal development of national economy and defense. This success is mainly attributed to strong political will of China's unitary hard state one-party-leadership, utilization of advanced technology from international system, introduction of new S&T developmental policy and program and building of large scale infrastructural support system. According to Deng Xiaoping, the father of China's reform, 'Science and technology is part of wealth, belongs to the mankind as a whole, every people or country should learn from the advanced science and technology of others.' (Deng, SW, p.107) In the ancient times, the West greatly benefited from Chinese inventions and advanced technique which they later developed further and brought about the scientific and industrial revolution. Today, the spirit of the popular saying of Mao era, 'use the old to serve present and use foreign [advanced technology] to serve China' perhaps is well understood by the present generation leaders in their effort to catch up with the West. China's strategy to integrate S&T with education and economy and the oft repeated objective to develop potential to be at par with the technically advanced West by the middle of 21st century seems reflecting a nationalist desire to restore the lost glory of past, could be an achievable target, unless the country is thrown once again into a social and political turmoil like the previous years. Classical Chinese concept of Harmony for maintaining overall social balance might be invoked, as in the past, to play a balancing role between technology and social development to make technology more humane and social.

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BIOLOGICAL TERRORISM AND BIO-WEAPONS : THREATS AND CHALLENGES

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Bioterrorism is the use of a biological weapon against a civilian or military population by a government, organization, or individual. As with any other form of terrorism, its purposes include the undermining of morale, creating chaos, or achieving political goals. Biological weapons use microorgan4isms and toxins to produce disease and death in humans, livestock, and crops.[1] Biological weapons (BW) belong to the category of "Weapons of mass destruction" (WMD) which also includes chemical and nuclear weapons in its fold. But there are crucial differences between chemical, biological and nuclear weapons in terms of incubation period, the type of first-response needed, medical interventions and quarantine measures. Similarly, biological agents also differ amongst themselves by factors such as virulence, infectivity, toxicity, incubation period, pathogenic effects and transmissibility. Biological agents can be spread through air, water, food and also through person to person contact. The biological agents that have been associated with weapons development can be divided into five key groups: bacteria, viruses, rickettsia, fungi, and toxins (bacteria, viruses and toxins are the most well-known types of BW agents).[2] Bio-weapons experts have identified that the top four most likely to be used bio-weapons are smallpox, plague, anthrax, and botulism. Other possible bio weapons can be glanders, tularemia, ricin, influenza, typhus, Marburg and Venezuelan Equine Encephalitis (VEE). Biological agents may occur naturally or are the products of genetically engineered organisms.

Biological weapons differ from conventional weapons in the sense that it consists of living organisms and are extremely difficult to detect as the illness and appearance of symptoms may take several hours to several days. This provides the motivation for the terrorist to use biological weapons, because it provides them sufficient time to make the attack and escape. The other fact is that it is relatively easy and inexpensive to obtain in comparison to conventional weapons. According to 1969 expert United Nations panel which estimated the cost of operations of different WMD and also conventional weapons against civilian populations found that to be 1$/$km^2$ for biological weapons, versus \$600/ km^2 for chemical, \$800/sq.km^2 for nuclear, and \$2000/sq km^2 for conventional armaments.[3] Hence, biological (and chemical) weapons are also called the "Poor Man's Weapons of Mass Destruction".[4] Some of the other factors that provides the motivations for its use are, 'their ability to cause widespread death and diseases, their indiscriminate nature, the shortage or complete lack of vaccines and therapeutics to treat many of the diseases caused by biological agents, their capability to invoke images of suffering and horror, and their similarity to apocalyptic biblical diseases and plague, makes them appealing to Jihadist and other terrorist groups.[5] There is no doubt that biological terrorism also has the tremendous potentialities to inflict serious physical, psychological and economic damage just like conventional weapons.

Historical background: From states to individual terrorist groups

Biological weapons have long historical antecedents dating back to centuries. Ironically it has been mostly used by states in warfare or against enemy country and only a few individual terrorist groups have used or attempted to use it, though its potential use by individual groups have increased in recent years. Of the three categories of WMD, biological weapons have been most often employed in the past.[6] One of the first recorded incidents occurred in 1346 during the siege of Kaffa, where the tartar soldiers threw diseased corpses over the walls of the city to infect the defending forces within.[7] Centuries later, during the French and Indian War (1754-1767), British forces gave small pox contaminated blankets as "gifts" to the Native American Indians, causing a deliberate outbreak of disease that resulted in widespread death.[8] During the World War I, Germany used both anthrax and the equine disease glanders to infect livestock and animal feed scheduled for export to Allied forces.[9] In the middle half of the twentieth century, United States, Great Britain, the Soviet Union and South Africa were

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among the countries that developed extensive bio-weapons programs, stockpiling a variety of organisms, both for research into defense against what was then commonly called "germ warfare", and for possible offensive use.[10] During and after World War II, Japanese, Soviets, Americans and even Canadians experimented with bio-weapons and developed their own research programs. Japanese experiments with bio-weapons killed hundreds, and perhaps thousands of Chinese.[11] Both United States and Soviet Union's program cultured and maintained significant quantities of anthrax, an organism they considered to have great potential for use as a weapon.[12] In the recent times, especially after 1990s Gulf war, new concerns were raised about use of bio-weapons. It is well known that Iraq used chemical weapons in Iran-Iraq war.

Some of the prominent cases of the use of bio-weapons by individual terrorist groups were attempts by the followers of the Rajneesh sect in the city of Oregon in the U.S. to infect salad bars with *salmonella typhimurium* bacteria to incapacitate people to participate in local elections. The attack infected 751 people, but there were no fatalities. Similarly, Japanese religious cult Aum Shinrikyo released sarin nerve agent in the Tokyo subways that led to 1038 injuries. The biological weapons program undertaken by this group was the largest and the costliest ever conducted by any terrorist group as, ' it had some 10,000-60,000 members, had assets worth about a billion dollars, a sophisticated laboratory, a long period in which to produce biological agents and a number of dedicated personnel some of whom had scientific training'[13]. Another incident occurred after 9/11 attack in 2001, when five letters containing anthrax spores were sent to U.S. media establishments as well as the U.S. government that led to death of five persons, many injuries and brought bio-terrorism to the forefront of national and international security threats. Similarly, in recent years, authorities have uncovered numerous plots, raw materials, equipments, and even small scale laboratories dedicated to the development of weapons of mass destruction, including biological and toxin weapons, and numerous statements have been made by al-Qaida spokesmen as well as other jihadists justifying the use of weapons of mass destruction against their targets.[14] From the above discussion it is clear that bio-terrorism which has its origin in the research programs and use of bio-weapon by the states, had in the recent years been attempted by individual terrorist groups by acquiring the expertise either overtly or covertly from the state agents (as will be explained below) and also through their own production.

Assessment of bioterrorism threat: Fears and reality

It is paradoxical that biotechnology which has immense potentialities to improve the quality of our lives is extremely susceptible to its possible misuse by both states and terrorist groups to spread terror and unleash devastation throughout the world. In the recent years, increasing concerns have been raised about potential use of biological weapons by rogue states and especially jihadi terrorists. Special mention can be made of Russia, which before disintegration of Soviet Union, had many laboratories carrying out bio-weapons programs and had employed more than 40,000 scientists. But after disintegration, many of these laboratories have been closed because of financial crunch, and the scientists have departed to unknown destination. Many countries like North Korea, Iraq, Iran, Syria, and Libya have been alleged to be recruiting such scientists for their bio-weaponization programs. Further, it has also led to black marketing of bio-weapons, like Dr. Wouter Basson, the former head of the chemical and biological weapons program in South Africa, is known to have travelled to China, Iraq, and Libya under the guise of business, and is believed to have sold cultures of these deadly pathogens, including genetically engineered varieties, on the black market for profit.[15] Another very interesting case of scientist involvement was in the case of Anthrax attack in U.S in 2001, where it was revealed that the sender of five letters containing anthrax spores was none other than one who was at the heart of the US bio-defence program, as he was anguished over US government not doing enough to prepare for a potential bioterrorist attack.[16] Few years back there were reports that some countries like White South Africa and Israel were believed to be manufacturing ethnic bomb, which irrespective of the veracity of reports, was practically feasible. Ethnic bombs entails the 'possibility to conceive of genetically engineering a virus or toxin-synthesizing gene in a bacterium which is "activated or induced or regulated" by the product of a gene or by binding to a specific receptor that determines an "ethnic" characteristic; e,g, pigment formation for skin or eye color or some other characteristics that is a single gene characteristics (e.g. ear lobe attachment, hitchhiker's thumb etc.)'[17].

Similarly, jihadi terrorists with their millenarian

goals, sense of injustices, along with commitment to martyrdom may provide the motivation to manipulate latest developments in life sciences as potential bio-weapons. Al-Qaida spokesman Suleiman Abu Gheith stated in 2002:

"We have the right to kill four million Americans, two million of them children…and cripple them in the hundreds of thousands. Furthermore, it is our obligation to fight them with chemical and biological weapons, to afflict them with the fatal woes that have afflicted Muslims because of their Chemical and biological weapons".[18]

Bioterrorism not only creates psychological distress but can also cause huge financial strains on the economy. This is clear from the anthrax attack in U.S in 2001 and the devastating after-effects:

"The 2001 anthrax attacks in the United States effectively shut down the nation's capitol, causing severe economic disruption to the country long after the last case of illness occurred. The attack caused severe economic damage not only from lack of business continuity, but also from the high cost of decontamination of buildings and other locations. Cleaning of Brentwood mail facility, located outside of Washington, D.C., for example, cost a staggering $ 130 million and took 26 months to complete".[19]

Another ominous threat is the possible misuse of immense information available on Internet about producing bio-weapons by the civilian groups, other than the states. Further in an era of globalization, when there are more movements of persons and goods across the world, a bioterrorist attack can make possible the spread of infection more massive and difficult to control.

Though the potentialities of bio-terrorism to create devastation are immense and there exists number of motivations to use biological weapons, but the fact is that the actual use of this weapon is much lower in comparison to use of conventional weapons. The fear of attack is there but the possibility of a mass casualty does not seem to exist in reality. There have been only 123 deaths caused by terrorists' resort to biological and chemical weapons in 99 years (1900-1999).[20] The record shows that chemical and biological agents have so far been only weapons of mass disruption rather than of mass destruction.[21] It produces more psychological effects and fear psychosis in the society rather than fatality and that increases its utility as a terrorist weapon. Further, bio-terrorist attack with the potential to inflict mass casualty requires sophisticated techniques and organization, in contrast to conventional weapons. Producing the particular organisms in large quantity and in the ultra-small particle form needed for the aerosolization is beyond the scope of average laboratory.[22] When biological agents are dispersed, the time of day the attack is launched and also the wind speed can be critical to success.[23] Further out of a range of biological weapons, only a few pose a serious problem. Its potential use depends upon a couple of other factors like availability of cultivation facilities, dispersal mechanism, level of virulence, dosage of the biological agents, availability of therapeutic measures etc. Another important factor that disadvantages both the state and the individual groups to use bioterrorism is the fact that it may alienate the community or nation they represent, they may face fear, reprisal or counter-attack and can lead to annihilation of both friends and foes.

But there cannot be complacency about bioterrorism on account of the aforementioned factors, because there are still some biological agents that may be used as a potential weapon in future wars or conflict. Out of them, according to Donald A. Henderson, two biological weapons – small pox and anthrax poses the greatest threat.[24] Fatality rates for the above two when dispersed as an aerosol are 30% for small pox to more than 80% for anthrax. They can be grown easily and in large quantities and are sturdy organisms that are resistant to destruction. Hence they are especially suited to aerosol dissemination to reach large areas and number of people.[25] Small pox is more susceptible because vaccination has stopped worldwide 20 or more years ago as a result of the eradication of the disease.[26] Further there is no treatment available for small pox and it will take long time to manufacture vaccination for large segments of the population. So, when sufficient motivations makes a lethal cocktail with favorable conditions for acquisition of biological weapons, then the question is not whether it will be used, but when it will be used. Many states like America, Canada and United Kingdom have developed legal and other defensive measures against bioterrorism, and significant efforts have also been made at the international level to check the possible menace of use of bio-weapons. It will be prudent to analyze the efforts made at the international level to discern the shortcomings in them.

Loopholes in the present International Conventions against bio-terrorism

Many interventions were made at international level to prohibit production and use of biological weapons, but each had some loopholes. In 1925, the Geneva Protocol prohibited the use of biological weapons but allowed them to be produced-an immense loophole, of which several nations would take advantage.[27]

Similarly, the 1972 Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and Their Destruction, which prohibited research into, as well as the development and proliferation of, biological weapons came into effect in 1975 and were ratified by more than 140 nations. Though it prohibited research into, as well as development and proliferation of biological weapons, it had two loopholes. First, the Convention allowed work on defense against bio-weapons to continue, and in the field of weapons, the line between offensive and defensive can be difficult, if not impossible, to draw. Second, it contained no effective means of verifying the signatory states' compliance with its provisions.[28] It is an irony that the Biological Weapons Convention (BWC), 1972 has been flagrantly violated by many of its signatories, like Iraq and Soviet Union. Even after 1972 Convention, it is believed that at least ten nations had a biological weapons capacity.[29] In subsequent years about seven review conferences of BWC, held in 1980, 1986, 1991, 1996, 2001/2002, 2006 and 2011, where state parties reaffirmed that the scope of the Convention extends to new scientific and technological developments, and have also instituted confidence-building data-exchanges in order to enhance transparency and strengthen the BWC.[30] INTERPOL, the world's largest international police organization, developed a dedicated bio-terrorism program at its headquarters in Lyon, France, after the 2001 anthrax attacks to focus on building national and international capacities to counter biological terrorism.[31] Besides the shortcomings in the present efforts, experiences from the past also illustrates that simply legal measures cannot end terrorism. The biggest culprit has been the states, which has a disposition to increase its violent power to assert its authority over its own people or against other nations and use of bio-weapons is an example of this. Unless the states stops using them and destroys all its stock and potential production , there is likelihood that it will be acquired by the financially sound individual terrorists groups either through state agents or theft.

Conclusions: Challenges Ahead

To surmise, there is political, medical, technological, legal and military aspect of responding to bio-terrorism and use of biological weapons. Though after nuclear weapons, biological weapons are most greatly feared, but countries are not properly equipped to deal with such crisis, as they are still guided by the conventional model of response to terrorism. For developing appropriate response to bioterrorism, it is important to understand the peculiar nature of it, which is different from conventional terrorism. The response has to be multi-pronged ranging from defense preparedness to prevent attack, intelligence inputs and detection devices for identifying biological agents in the environment to crisis management, criminal prosecution of perpetrators, health and medical assistance to victims. Bioterrorism is the heinous use of biotechnology, by both state and non-state actors, to achieve political ends, just like internet and other modern communication technologies have been misused by jihadi terrorists to fulfill their nefarious designs. Hence it is important to remember that though the problem is scientific in nature, but the inherent reason behind use of bio-terrorism is political, hence any response has to take into account the scientific and political nature of the problem.

Just as 9/11 attack used a novel method of using jet aircraft as a weapon to cause mass casualty by crashing into crowded buildings, in the similar way, recent advances in biotechnology, genetic engineering and vaccine production can be manipulated by the terrorists for creating new bio-weapons. Like, genetic engineering can be used to create more virulent biological agents which are resistant to current vaccines, and if they are used, it may be fatal for a large segment of population. Technologists such as Bill Joy have warned of the potential power which genetic engineering might place in the hands of future bio-terrorists.[32] Combined with the motivations, 'the ease and low cost of producing an agent, the difficulty in detecting its presence and protecting (and treating) its intended victims, and the potential to selectively target humans, animals or plants conspire to make defense against this class of weapon particularly difficult'[33]. Further the ease with each it is transmitted from person to person, with impossibility to detect in the initial stage whether it is caused by natural reasons

or deliberate attack, makes bioterrorism more a matter of concern. Hence, public health and infectious disease infrastructure has to be developed and synergized with military, diplomatic, legal and intelligence measures. The fact that terrorist have preferred conventional weapons over biological weapons, because of its predictable consequences and lesser hazards, can be a temporary respite, but there is need to build preventive preparedness because that is the best solution to this problem.

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संस्कृतवाङ्मये यज्ञस्य सार्वभौमिकं विज्ञानम्

सर्वेशकुमारशान्डिल्यः एवं प्रो. सदाशिवकुमारो द्विवेदी***

विदितविश्वसाहित्यमास्माकीनं शाश्वतिकं भारतीयं वाङ्मयं नवसरणिगवेषण-परायणाचार्यलाञ्छनमाहरत् समेषां मनोगतान्धं, कुर्वत् स्वान्तमलापहं, वर्धयद् विविधसौख्यास्पदं, विश्वबन्धुत्वभावनाञ्च जनयन्नितरामेव शोभतेतराम्।

भारतीयवाङ्मये सृष्टेरारम्भ एव परमात्मा स्वामृतपुत्रमानवेभ्य एनान् जगत्संविधानापरपर्यायभूतानग्नि-वायु-आदित्य-अङ्गिरेत्येतैश्चतुर्भिश्चतुर्वेदान् प्रकाशयाम्बभूव। सन्ति वेदाः निर्भ्रान्ताः सत्यविद्यानामागाराः, सदर्थेषु अस्तीदमीश्वरस्य निर्बाधज्ञानम्। वेदानामेकैकोऽपि सिद्धान्तः विज्ञाननिकषे सुतरां चकास्ति। वेदेष्वेवोपवर्णितो यज्ञमात्रैकशब्दस्समग्रभारतीयवैदिकसंस्कृतेः वितानाव-बोधकः। यज्ञशब्दो ह्ययं यजधातोर्देवपूजासङ्गतिकरणदानार्थेषु प्रयुङ्क्ते। धात्वर्थाधारेण एतादृशं प्रत्येकं कार्यं व्यवहारः विचारश्च यागः, यस्मिन् देवानामर्चनं, सङ्गतिकरणं, परिवारस्य सङ्गठनं, समाजराष्ट्रवैश्विकमानवेषु समताया एकतायाश्च कर्माणि विचाराश्च स्युः। समाजदृशा व्यावहारिकपरिप्रेक्ष्ये ज्येष्ठेषु सम्मानं सेवाभावना अथ च समवयस्केषु संगठनबुद्ध्या व्यवहारः, कनिष्ठेषु सस्नेहकर्तव्यभावपूर्णसहयोगः समौदार्येण साहाय्यञ्च यज्ञपदार्थाः। नूनमेवायं सद्व्यवहारः कामपि सङ्कीर्णतां परिधिञ्च नैवाङ्गीकरोति। यज्ञकलापोऽयं सृष्टेरादिकालादेव प्रारब्धो संदृश्यते।

अद्यतनीने विज्ञानयुगे कस्यचिद् धार्मिकानुष्ठानस्य विज्ञानदृशा परिपुष्योपादेयत्वं नोपस्थापयति चेदाधुनिकैः तर्कशीलैः मानवैः स्वीयतर्ककर्कशधिया तदन्धविश्वासः कृत्रिमः इत्याख्येषु निःसंकोचेनोपनिबध्यन्ते। धार्मिकानामधार्मिकतयैव विज्ञानेन कदाचिदेतत् समुद्घोषितमासीत् यन्नास्त्यस्माकमीश्वरास्तित्वम्। प्रचारप्रसरेणास्य जगतस्सञ्जातो महद्भागो नास्तिकः। परमद्य विज्ञानं जगद्कर्तृनियन्तृत्वेन वैवश्येनैवेश्वरं अङ्गीचकार। विज्ञानं नाम कस्यचिद् पदार्थविशेषस्य तर्कपूर्णोपादेयताविशिष्टञ्च ज्ञानम्। यागश्च निगमप्रथितं विविधशास्त्रसमर्थितं विशिष्टज्ञानप्रसृतं धार्मिकानुष्ठानम्। यज्ञानां विज्ञानं परिज्ञानाय राष्ट्रे-राष्ट्रान्तरेषु अपि नैके वैज्ञानिकाः विभिन्नरूपेण परीक्षयाञ्चक्रिरे। क्वचिद्यज्ञहवनीयवस्तूनां विश्लेषणं सन्दर्भीकृतवन्तः, क्वचिद्यागकुण्डवितानं विज्ञानपरिधौ प्रतिष्ठापयन्तः, क्वचिद्यज्ञफलविज्ञानान्वेषीकुर्वन्तो विज्ञानविदोऽक्षिलक्ष्यीभवन्ति। निश्चीयते तैर्यज्ञः समग्रविज्ञानपराक्रिया। नभोमण्डलं शुद्धः पुष्टः सुरभितश्च भवत्यनेन यागेन, रोगमपास्यारोग्यमास्थाप्यते, दुःखं दारिद्र्यञ्च शाम्यते, मानसिकं शममवाप्य परमानन्दोऽनुभूयते जनमानसे। यज्ञेनोत्तमविचाराः प्रादुर्भवन्ति तैश्च बुद्धिविकासः बुद्धिप्रसारेण सत्कर्मोन्मेषश्च जायते। वैज्ञानिकानां विभिन्नैरनुसन्धानैरेतैः प्रमाणीभवति यागस्य सर्वोपकारकं विज्ञानम्। तदत्र यथास्माभिरनुष्ठीयते।

आरोग्यविज्ञानम्

फ्रांसदेशस्य सुविश्रितचिकित्सकः ''हेपकिन्'' महोदयः प्रोद्घाटयति यत् घृतस्य दहनेन रोगोत्पादकाः विषाणवः (कृमयः) म्रियन्ते। फ्रांसदेशस्यैव विज्ञानवेत्ता ''ट्रिलवर्टः'' कथयति दहमानायां शर्करायां वायुशुद्धये भवति महती शक्तिः यया क्षय-चेचक-हैजा इत्यादयः रोगाः द्रुतमेव विनश्यन्ति। ''डा0 एम0 टेल्ट'' महोदयेन मुनक्का-किशमिशादीनि शर्कराप्रधानानि शुष्कफलानि प्रज्वाल्य दृष्टं यदेतेषां धूमेन ''टायफायड'' इत्याख्यस्य रोगस्य कीटाः त्रिंशत् (30) निमेषेषु, अथान्यासां व्याधीनां रोगकीटाः एक-द्विहोरानन्तरं प्रायशः समाप्ताः भवन्ति।[1]

15 मार्च 1897तमे वर्षे मद्रासविश्वविद्यालये ''डा0 कर्नलकिंग'' महोदयोऽपि भाषयति यद् घृतोदनयोः केसरं सम्मिल्याग्नौ प्रज्वालनं 'प्लेग' नामकरोगात् त्रायते। आधृत्यैवैतद् भाषणं यद्धवनकार्यं लाभकरं वर्तते बौद्धिकतायाश्च विषयोस्तीति श्रीहैफकिन्महोदयः ''व्युबानिक प्लेग'' इति पुस्तके निवेदयामास।[2] अथ च मध्यप्रदेशीय जबलपुरनगरस्य राजकीय टी0वी0सेनेटोरियम् इत्याख्यस्य संस्थानस्य चिकित्साधिकारी डा0 फुन्दललालअग्निहोत्री ''टी0वी0'' इत्यस्य क्षयरोगस्योपचारं यज्ञविधया सन्दिशन्ति यस्मिन्नशीतिप्रतिशतसाफल्यमुपगतं एवं ''यज्ञचिकित्सा'' इत्यस्मिन् ग्रन्थे समुल्लिखन्ति ''यन्नाहं जाने यज्ञार्चनेन टी0वी0 इत्यस्य क्षयरोगस्य समस्तविषाणूनामुपशमो भवति प्रत्युत अवश्यमेवेदं शक्यं वक्तुं यदनेन विधिना एतेषां प्रशमनं न भवति चेन्नान्येनायासेन भवितुं शक्यते।''[3] एतादृशाणामनेकेषां विज्ञानविदां चिकित्सकानाञ्चानुसन्धानानि अनुभूतप्रयोगाश्च यज्ञस्य महनीयतां प्रमाणीकुर्वन्ति। आधुनिकविज्ञानमाश्रित्य रोगाणुवादस्य संस्थापकः ''लुईपश्चर'' आसीदनन्तरमस्यामेव दिशि 'राबर्टकौच-स्मिथ-किलबोर्न-इत्येतेषामस्तिमहद्योगदानम्। रोगाणुवादस्य संस्थापकः 1878तमे वर्षे कश्चन व्याधिः केनचिद्रोगाणुना भवतीति संस्थापयति ''राबर्ट कॉच'' महोदयः।[4] परमस्माकं भारतीयानां महद्गौरवस्यायमास्पदं यदस्माकं वेदेषु विषयस्यास्य विवेचनं सौस्पष्ट्येन सम्प्राप्यते। संकेतयति च-

अन्वान्त्र्यं शीर्षण्यमथो, पार्ष्ण्य क्रिमीन्।

अवस्कवं व्यध्वरं क्रिमीन्, वचसा जम्भयामसि॥[5]

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*शोधच्छात्र, संस्कृतविभागः, कलासङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी

**शोधनिर्देशकः, संस्कृतविभागः, कलासङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी

अर्थादन्त्रिका – शिरोभाग – पसलीति - अस्थिविशेषादिषूत्पस्त्य-मानानां रोगकृमीनां, त्वक्समाहितानां, विकृतमाँसाशनानां व्यध्वरनामकरोगकृमीनां निगमकलितायासैः शामयन्तु इति आदिशति वेदे।

यजुर्वेदेऽपि व्युङ्क्ते- रोगकृमयः गिरि-गहन-ओषधि-पशु-पेयजलेषु प्रतीयन्ते जलादेवास्माकं वपुषि प्रविशन्ति।

''ये अन्नेषु विविध्यन्ति पात्रेषु पिबतो जनान्।''[6]

वेदेषु न केवलं रोगकृमीनां विवेचनं समुपलभ्यते प्रत्युत तेषामपाकरणोपायाः अपि सौलभ्येन प्राप्यन्ते। यथा 'अजशृंगी'' इत्योषधिसुरभिणा राक्षसाः (रोगकीटाः) कवलीक्रियन्ते।

अजशृङ्गयजरक्षः सर्वान् गन्धेन नाशय।[7]

अपि च अथर्ववेदे व्यनक्ति ''भो व्याधिग्रस्तः मनुष्यः! सम्पादयतु, तदर्थमहं हवनेन तपेदिकादिज्ञाताज्ञातरोगेभ्यस्सन्त्रासे युष्मान्''।[8]

शतपथब्राह्मणस्य कर्ता महर्षियाज्ञवल्क्येनोदीर्यते- **''भैषज्ययज्ञा वा रष्टे।'' ऋतुसन्धिषु व्याधिर्जायते तस्मात् ऋतुसन्धिषु प्रयुज्यते।**[9] अर्थादृतुसन्धिषु रोगाः उत्पद्यन्ते अत एव सन्धिष्वेव याज्ञिकाः प्रयोगाः विप्रयुक्तव्याः। मनुस्मृतौ महर्षिणा मनुना यज्ञीयचिकित्साविषये बहुविधोल्लिखितम् अत एव ब्रिटिशसामयिकः मद्रासस्य प्रमुखप्रशासकविशेषः ''एम्पथिल'' यज्ञानां प्रकृष्टसमर्थकं आचार्यमनुं समग्रस्यास्य विश्वस्य सुप्रसिद्धस्वास्थ्यसुधारकेषु समर्थयामास।

पदार्थविज्ञानम्

यागीयपदार्थानां विषये अनेकेषु देशेषु अद्यावध्यपि विज्ञानरीत्या वैज्ञानिकाः परीक्षणानि चिकीर्षन्तः दृश्यन्ते। काष्ठसमिधादियज्ञीयपदार्थानां समुन्मीलनेन निश्चीक्रियते यद्भिन्न-भिन्नतापसन्तप्ताः घृतमिष्टान्नमेवादियागपदार्थाः नैकं कृमिशामकं सल्लाभकरञ्च वाष्पमजनिषन्त। सुरभिमात्रमेव सुदूरं यावद्यागस्य प्राणीमात्रमुपकरोति। विज्ञाननिर्णीतसमीक्षणानि निरूपयन्ति यत् कुण्डाकृतिर्यज्ञस्य ऊर्जायाः समुचितं विकेन्द्रीकरणं करोति। मिश्रदेशीयपिरामिडेषु कुण्डाकृतिवैपरीत्येनैव ऊर्जां केन्द्रीकृत्य **''ममी''** संरक्ष्यन्ते। यज्ञकुण्डेन विकेन्द्रीकृतं, सद्रूपप्रसृतं मरुद्दूरं यावद् मानव-पशु-विहङ्ग-पतङ्गान् विभर्ति।[10]

अथ च यज्ञेनोपपद्यमानमस्ति धृतजीवनाधारं ''कार्बनडाईऑक्साइड'' इति वाष्पम्। वनस्पतिजगत् प्रतिवर्षमेव 60 × 10^{12} कि0ग्रा0 कार्बनडाईऑक्साइडवाष्पं नित्यमेव भोजनस्वरूपे परिवर्तयति विज्ञानदृशा। ''मैक्सोक्व'' इति अमेरिकायाः वैज्ञानिकस्य निष्कर्षे कार्बनडाईऑक्साइडवाष्पेणैतेन पादपेषु अतितीव्रवृद्धिस्समुदेति। कश्चनान्यः वैज्ञानिकः 1904 तमाद्वर्षात् केषुचिद्वर्षेषु कार्बनडाईऑक्साइडवाष्पस्य मात्रां संवर्द्धय अधिकधान्योत्पादने लब्धयशोराशिः साफल्यञ्च तिष्ठति।[11] अमेरिकायां महाराष्ट्रप्रदेशस्य स्वामी पराञ्जपे आचार्येण अग्निहोत्रविश्वविद्यालयः संस्थापितः। विश्वविद्यालयेऽस्मिन् मन्त्रोच्चरितघृताहुतिभिश्च चतुर्गुणसस्योत्पादनचमत्कारो सम्बभूव। किं वच्मीदं भारतीयविद्वद्भिर्विदेशेषु यागेन अप्रतिमधान्योत्पादनं विधीयते एवं वैदेशिकाः विद्वान्सः आयीयात्र भारते महर्षीणां यागविधानस्य वैशिष्ट्यं परिभाषयन्ति। राजस्थानप्रदेशस्य गंगानगरजनपदेऽपि कृषकानां यज्ञेन सस्यस्य संरक्षणोपायान् वृद्धिकारकोपायाञ्च देशान्तरीयाः बोधयामासुः।।[12]

अथ चान्वेषणैः सञ्जानीते समिधादिदाहनेन एवञ्च घृतादियागपदार्थघटकैरुत्पन्नानां केषाञ्चन सूक्ष्मतत्वानामन्योन्यसंयोगः 'फार्मेल्डीहाइड' नाम्नीत्यत्युपादेयं वाष्पमुद्भाव्यते। रालयुक्तकाष्ठज्वलनेनापि नूनमेवैतदेव वाष्पं जनयति। समुज्जन्यते च परं घृतस्य प्रमुखघटकस्य 'ग्लिसरोल' इत्यस्य सन्तापेनाक्सीकरणं सत्यपि 'फार्मेल्डीहाइड' वाष्पम्।[13] विज्ञानेक्षणान्यूचुः स्याद्यज्ञकुण्डे वायोरप्रवेशः यागस्थले वायोपर्याप्तमावागमनं वा यद्धि 'कार्बनमोनोऑक्साइड' वाष्पं कार्बनधूलिञ्चापि निर्माति। वस्तुतो 'कार्बनमोनोऑक्साइड' अस्त्यतिविषवाष्पं यन्निर्मितिर्नापेक्षते, परं कार्बनधूलिश्चापरा वृष्टिकारकस्वरूपे सन्तिष्ठते।[14] तदर्थमेव यागकुण्डाः प्रायशः प्राप्तपर्याप्तवायुप्रसराः अनावृतस्थानिकाश्च भवन्ति। लब्धमरुत्प्रचुरप्रसारायां यज्ञभूमौ रविरश्मिप्रकाशोऽप्यपेक्ष्यते अत एवास्माकं चिरन्तनमहर्षिभिः भास्करोदयात् दिवास्तपूर्वं यावदिह जगतीतले हवनविधानं क्रियन्ते स्म। सूर्यप्रकाशे यजनेन बहुविधलाभपरिणामैस्सह 'पराबैगनी' इति प्रकाशमरीचिषु 'कार्बनडाईऑक्साइड' वाष्पं वारिणा साकं संगम्य 'फार्मेल्डीहाइड' वाष्पमपि उत्पादयति। रविद्युतौ प्रकाशसंश्लेषणेनाप्यतिरिक्तो लाभस्समवाप्यते।[15] अवबुध्यन्त एव यज्ञमण्डपं सर्वतो हरिल्लता कदलीपत्राणि चारोप्यन्ते। वस्तुतो हरित्पादपेषु 'क्लोरोफिल' इत्यनेन पादपाः घर्मे ''कार्बनडाईऑक्साइडवाष्पं'' कार्बोहाइड्रेडरूपे परिणमन्ते। अथ च यजनकाले क्रियाभिर्नैकाभिः यज्ञद्रव्यज्वलनेन च समुत्पत्स्यमानानामनेकानां घटकानां संयोगेनैव अस्तित्वमुपयाति कृमिरोधकं, लाभप्रदं, कृमिनाशकं, धूलेर्कृम्यपाकरणकारकमतिगरिष्ठं 'फार्मेल्डीहाइडवाष्पम्'। वाष्पशीलत्वेनेदं वाष्पं क्षिप्रमेव सर्वतो प्रसरति तन्तुरागहानिं विनैव वस्त्रान्तरेण नृणां रुग्णवपुषि प्रविशते। रोगरुजानामत एव स्वच्छीकरणाय गृहाणां सौरभाय वायुशुद्धये च 'फार्मेल्डीहाइड' 'लैम्प'इति निर्मीयन्ते। लैम्प''इत्येतेषु 'मिथाइल' एल्कोहल वायुश्लेष्णप्लेटिनमितिधातुविशेषोपरि सन्दाह्य 'फार्मेल्डीहाइड' वाष्पमुत्पादयन्ते। अत एवात्यन्तं निगूढमपि रोगमपास्य दीर्घायुष्यं यागकलापा एते वितितनिषतः परिलक्ष्यन्ते।[16]

वृष्टिविज्ञानम्

यागस्यात्यौपादेयत्वं वृष्टिकारकत्वमपि। अर्थाद्यज्ञाः सामान्यातिरिक्तं वर्षणार्थमेव यजन्ते येषां वृष्टियागेनाख्यायते। यथा यजुर्वेद- **निकामे-निकामे नः पर्जन्यो वर्षतु इति प्रार्थयन्ते।**[17] आशयोऽयं वृष्टिकामयमानाः यदा वयं स्याम तदा वर्षणं स्यादेनेन

यजुर्वेदे यागः **''वर्षवृद्धम्''**[18]इत्याख्याति। अथर्ववेदादिशति च – **तन्वतां यज्ञस्य बहुधाविसृष्टा।**[19] अर्थाद् वृष्टेरावश्यके बहुष्वास्पदेषु यागाः विविध्युः। प्राक्तनेतिहासादेरद्यावध्यप्येषा अवधारणा यजनेन वृष्टिविज्ञानस्य सुतरामेवानुभूतास्माभिः।

सिखधर्मेतिहासेप्याचार्यगुरुगोविन्दसिंहः 1754 तमवर्षस्य मधुमासे निर्बाधं पं0 केशवदासस्य ब्रह्मत्वे चतुर्मासीयबृहद्यज्ञस्यायोगे समर्चयाम्बभूव।

केनचिद्यज्ञफलमभिभाषितमिहपङ्क्तिषूपनिबध्यते-

जा दिन ते जग्य होम करयो गुरु, पूर रहयो जस भूर उदारे।
घोर जिते जग्य होमन के फल, वेद अने वर ते जग सारे॥
वारस होन लगी मनवाञ्छित, रोगविसूचिक लौ सब हारे।
लोगन केर स्वभाव स्वते सिध, ये बदले सब काज विधारे॥[20]

भारतीयसंस्कृतेरस्माकं समेऽपि सिद्धान्ताः धार्मिकानुष्ठानानि च समग्राप्येतेषां अनुष्ठानपद्धतिः विज्ञानव्यवहारयोर्निकषे प्राधान्यमादायैव समचीकमन्त।

वृष्टिसम्बद्धयज्ञविज्ञानविषये योगेश्वरः श्रीकृष्णोऽपि मुखरयति श्रीमद्भगवद्गीतायान्न पुनर्वेदा एवाभिभाषन्ते-

अन्नाद्भवन्ति भूतानि, पर्जन्यादन्नसम्भवः।
यज्ञाद्भवति पर्जन्यो, यज्ञः कर्मसमुद्भवः॥
कर्म ब्रह्मोद्भवं विद्धि, ब्रह्माक्षरसमुद्भवम्।
तस्मात्सर्वगतं ब्रह्म, नित्यं यज्ञे प्रतिष्ठितम्॥[21]

समष्टिविज्ञानमेतद्यागस्य परस्परं स्पर्धिभावेन अन्योन्याश्रितत्वेन च विलसति। यज्ञाः न पुनर्वृष्टिकारकाः एवं प्रत्युत सकलधराभूतानामाधारभूतस्य अन्नस्य हेतुत्वमपि धारयन्ति। अर्थाद्यागेन पर्जन्यं, पर्जन्यादन्नमन्नान्नरास्सम्बोभुवन्ति। अतो यज्ञाः समेषामेव ऋजुकुटिलनानापथजुषान्नृणां प्राणिनाञ्च प्राणाधायकाः, पुष्टिकराः, तुष्टिकराः आधारभूताश्च प्रतीयन्ते। कवयोऽपि मन्ये प्रकृतिसौन्दर्यतितनिषतः विषयेऽस्मिन्नपि सन्देशस्थापने दत्तचित्ता इव परिलक्ष्यन्ते। यथास्माकीनः महाकविकालिदासः मेघदूते विवृणुते-

धूमज्योतिस्सलिलमरुतां सन्निपातः क्व मेघः,
सन्देशार्थाः क्व पटुकरणैः प्राणिभिः प्रापणीयाः।[22]

मेघो नाम धूमज्योतिवारिवाय्वित्येतेषां समवायः। अर्थाद्धूमादेवाभ्रनिर्माणं भवति तस्मात् जलवृष्टिस्सञ्जायते वर्षणाद्धनधान्यं चतुर्दिक्षु मानवोत्थानं समाजकल्याणञ्च सम्भवति।

शतपथब्राह्मणस्य कर्ता याज्ञवल्क्योप्याह-

''अग्निर्वै धूमो जायते धूमादभ्रमभ्रमाद् वृष्टिः।''[23]

अर्थाद्यागपावकाद्धूम, धूमान्मेघस्थितिः, मेघाद्वर्षोज्जाजन्यते । लेलिखन्ति च पाश्चात्यविज्ञानविपश्चिदः डा0 हार्टनिड महोदयाः यदफ्रीकाराष्ट्रस्य काननेषु तृणादिसमेवतपदार्थानां सन्दाहनेन जलवृष्टिनिराशायामपि समजनि उत्कटवर्षा। अथ च **''मेहवृष्टिविज्ञानम्''** इत्यालेखप्रबन्धे अर्वाग्विदः अमेरिकायाः ''एण्ड्रो जैक्सन'' महोदयस्य वर्षाकारकाभिनवसिद्धान्तः प्राज्ञागीयवृष्टिविज्ञानेन सार्धं सम्बद्ध एवालोक्यते। मरुत्सञ्चरन्ति धूलकणानि नीरसम्पृक्तपवनानामुशम्य स्थैर्यकर्मसम्पादयन्ति। आश्चर्यजनकेक्षणैरेतैः प्रमीयते यज्ञे वृष्टिभूमिका। विज्ञानवेत्तारः उदीरयन्ति यद्धवनधूमौ वाष्पं धूलिकणानि चाबीभवन्ति। धूम पवने तरत्सूक्ष्मांशानां 'कोलाइडी विलियम' (मिश्रितद्रवम्) अस्ति एवञ्च यागधूमेन समुत्पन्नेषु समेष्वपि कोलाइडी अंशेषु ऋणात्मकविद्युत्-कणास्सन्तिष्ठन्ते ते च ऋणात्मकविद्युद्युक्ताः कणास्साहय्यं कुर्वते वर्षायाम्।[24]

तापविज्ञानम्

आदिकालादेव प्रचलितस्य यज्ञस्याधुनिकसन्दर्भेषु उपादेयताप्राकाश्ये नूनमेव ततोऽप्यधिकमावश्यकमनिवार्यस्वरूपञ्च सम्प्राप्तो यागः संदृश्यते। विश्वे उद्योगाविकासे पर्यावरणं तावत् प्रदूषितं नासीत् यावदाधुनिकतायाः द्रुतगतौ दोषत्वमुपगतमिति विचार्यैव हृदयं चकम्प्यते। अहर्निशं औद्योगिकगृहेभ्यः धूमविषमुद्गीर्यते, निर्माणगृहेभ्यः निर्बाधमेव आयायमानसदुर्गन्धदूषिता- म्ब्वपशिष्टपदार्थैश्च वातावरणं विषाक्ततामतिक्राम्यति। पर्यावरणसन्तुलनं तु क्षितेराधारभूतं, ऋतुविषये परिवर्तनम् अतिवृष्टि-अनावृष्टि-भूकम्प-भूस्खलन-सुनामीत्यादिप्राकृतिकापदामुत्पादयति। एनेनाधुनातने समस्तेऽपि विश्वे काचिन्नूत्नैव वैश्विकतापसंवर्द्धनस्य (Global Warming) इति समस्या समुत्पन्ना संदृश्यते।

15.05.2007 दिनाङ्के 'नवभारत टाइम्स' दैनिकसमाचारपत्रे प्रकाशितः कश्चनलेखः सङ्केतयति- ''यत् Global Warming इत्यनेन गृहविहीनाः भविष्यन्ति एकार्बुन्नराः''। ब्रिटिशसमवायस्य 'क्रिश्चियन एण्ड संगठनं' दुःखातिक्रान्तानां विषयाणां परिज्ञाने चिन्तयाम्बभूवाह- समग्रेऽपि भूमण्डले संघर्षेण प्राकृतिकापद्भिश्च दशकचतुष्टयेषु एकार्बुज्जनाः निर्गृहीयाः स्युरिति आशङ्कते। अथ चान्यत्र चीनादिराष्ट्रेषु षोडशकोटिमानवाः प्राकृतिकसंघर्ष-अतिवृष्टि-अनावृष्टि-आर्थिकविकासपरियोजनाभिश्च विस्थापिताः एवं अद्यप्रभृति 2050 तमवर्षं यावत् अर्बुन्मानवाः विस्थापितं जीवनं वहन्तः द्रक्ष्यन्ते।[25] U.N. समूहस्य Inter Governmental Panel on Climate Change (IPCC) इति संस्थायाः प्रधानशासकस्य उपात्तवक्तव्ये विपरीतदशा परिदृश्यते-

"Clearly we are endangering all species on earth, we are endangering the future of human race."[26]

प्रदूषितवातावरणेन सम्प्रति विश्वस्य 130देशानां 2500विज्ञानबुधाः ध्यापयन्ति-

''यत्पर्यावरणशुद्धये अधुनाऽपि क्षिप्रमपेक्षितायासान्न प्रयतन्ते, क्षोणेस्सततं वर्धमानं तापं रोद्धुमवान्तरप्रभाव्युपायाः नोपादीयन्ते चेत् ''ग्लेशियर'' इति हिमशैलानामम्भसि परिवर्तनेन, उष्णवीचिभिः,

अतिवर्षादिभिश्चाखण्डलस्य कतिपयनगराणि जलधिलीनानि भविष्यन्ति''।[27] अत एवास्माभिः "Global Warming" एनम् 'Global Warning' इतिरूपेण बोद्धव्यम्। अस्याः पृथिव्याः निम्नतलस्योपरि विस्तृतवायुमण्डलतापन्न वरीवर्धेत्तथा प्रयतितव्यम्।

''हिन्दुस्तानटाइम्स'' समाचारपत्रस्य 12.07.07 दिवसे प्रकाशिताङ्के Global Warming इति विषयमवधानाय'' Do not blame the sun इति शीर्षकस्थलेखे लन्दननगरस्य लेखकः "James Randuson" अवोचत्- ''धरायाः सन्तापो 0.2 डिग्री0 प्रतिशतं, उदधितलञ्च 10-12 सेमी0 प्रतिशताब्द्यां भूयशोऽभिवर्धते। वस्तुतो रविस्तापो न वृद्धिं प्राप्तः तर्हि कथमस्याः धरण्यास्तापं वृद्धिमेति येन ध्रुवस्थितहिमगिरयः मुहुर्मुहुरपक्षीयन्ते उदधितलञ्च परिवर्तते एतद्धि रहस्यमुत्पादयति।''

अङ्गीचक्रुर्विज्ञानज्ञाः यदध्रैः दिवाकरस्य ''कास्मिक'' (Cosmic) इति दुष्करमरीचयोऽवरुद्ध्य क्षितेस्तापं, नृणां सन्तापं, मानवप्रतानञ्च संरक्ष्यन्ते। परं मेघाः केनायासेन, केन व्यापारेण कथञ्च त्रातव्याः वर्धितव्याश्चेति जिज्ञासमाने निरुत्तरितविज्ञाने च सति समाधानमस्यास्माकं वेदेषु लभते। वेदेषु यागीयपद्धत्याध्राणामुपपत्तिर्विधीयते घनत्वमपि विवर्धते एवमेते मेघाः हानिकरैर्विरश्मीभिस्त्रान्ति सर्वप्राणिनः क्षितेरतिरिक्तं तापञ्चाहृत्य समुचितमेव प्रेषयन्ति। सुकरतापमानेनैनेन "Global Warming" इत्यस्मान्न विभ्यन्ति प्राणिनः। अत एव निवसतां प्राणिनां जीवनस्य मानवमात्रस्य त्राणाय यज्ञाः व्यवहारावश्यकनित्यकर्म-स्वरूपेणापादनीयाः।[28]

पर्यावरणपरित्राणाय प्रदूषणेनानवस्थितायाः ''ओजोन परत'' इत्यस्याः सन्तुलनमप्यत्यावश्यकं या हि हवनयागादिभिः विशुद्धा व्यवस्थिता च भवति। ओजोन (OZONE) इति ''आक्सीजन'' इत्यस्मादपि शुद्धवायुः। हवनवायावपि ''ओजोन'' इत्यस्य अंशाः प्राचुर्येणोपलभन्ते अतो विपुलमात्रायां ओजोनवाष्पस्य निर्मितर्भवति यजनेन, एवमुच्चैर्यात्वा निर्गतवाष्पमिदं ''ओजोन परत'' इत्यस्यां सुमिलति या हि भुवो रक्षाकवचमिव राजते। इयं भानोर्विषाक्तमरीची अवरुन्ध्य लाभप्रदानां रश्मीणामेव धरण्यां सम्प्रेषयति येन क्षितौ जीवनं संगच्छते, रोगाणामुपशमोऽपि भवति। परं ''ओजोन परत'' इत्यस्याः क्षीणे विनष्टे च रव्युपघातककिरणैः समस्तजीवजन्तवो मनुष्यजातिश्च पीडां वैनश्यञ्चोपलभते।

अतः ''ओजोन परत'' सन्त्राणाय निष्प्रदूषणाय च प्राचुर्येण हवनान्यस्माभिर्विधातव्यानि। यजमानः यज्ञे पौष्टिक-सुगन्धित-ओषधियुतान् पदार्थान् गोघृतेन साकं जुहोति तर्ह्येते ओषधयः वाष्पं सम्भूयान्तरिक्षे मलार्कस्य (प्रदूषितवाष्पस्य) परिमाणुभिस्संयुज्य विषण्णपरिमाणून् प्रणाशयन्ति यथास्माकमन्तश्शरीराणां रोगाणून् Antibiotics इत्याख्याः ओषधयः अपाकुर्वन्ति। तच्छुद्धमन्तरिक्षवाष्पं विशुद्धमेघे परिवर्त्य भुवि वर्षति पर्जन्यत्वेन। एतेषामभ्राणाम्भसि सौलभ्येन पुष्टिकारकता, कष्टशामकता, सस्योत्पादकता चाधिक्येनोपलभ्यते। इत्थमयं यागस्य नभोवायुचक्रः समग्रभुवो वातावरणं संयमति। येन ''वनमृत्युः'' इति व्याधिना पीडितानां शुष्ककाननानां सन्त्राणमासाद्यते।

प्रमाणरूपे पश्चिमजर्मनीराष्ट्रे 1948तमे वर्षे संशुष्क्य विनाशस्थितिषु सत्स्वरण्येषु प्रततं मासत्रयात्मकयजनेन तस्मिन्नेव वर्षे साश्चर्येण वसन्तऋतोरनन्तरं समे हरित्पादपास्समबीभवन्।''[29] अतो यज्ञेन काननवृद्धिः, अरण्यवृद्धौ वायुप्रदूषणाभावः येन वायुमण्डले ''आक्सीजन'' इत्यस्य मात्रा स्वयमेव वरीवर्धते, अधिकवनानि वर्षाफलं जनयन्ति, शुद्धवायुमण्डलेन ''ओजोन वाष्पस्याधिक्यं भवति एवं "Global Warming" इत्यस्मात् भीतिर्न जायते। इतोऽपि निश्चप्रचमेव भुवो धुर्यां कृतो यागः क्षितेस्समृद्धस्वरूपं प्रदर्शयति, उषितानां नृ-पशु-पक्षी-सरीसृपादिचराणां विटप-पादप-सस्य-वनस्पत्याद्यचराणां जीवानां जीवनञ्च प्रतिष्ठापयति। यागविधानमिदं नहि धर्म-जातिविशिष्टानामपितु प्रत्येकव्यक्तेर्कर्त्तव्यमीश्वरव्यवस्थितेः एकं चक्रम्। ईश्वरोऽप्यस्य गरिष्ठत्वमभिप्रेतत्वमाह-

''यज्ञो वै श्रेष्ठतमं कर्म''[30] इति।

अतोऽस्माभिर्पुनरारण्यकसभ्यता विकसितव्या।

यागपदार्थेषु गोघृतमेव मुख्यं हविद्रव्यम्। रूसदेशस्य विदग्धाः समुद्घोषयामासुरिति ''धेनुपयसि एटोमिक रेडियेशन'' इत्यस्मात्त्राणातिशयशक्तिर्वर्तते तद्गोघृतमग्नौ समर्प्य तज्जन्यधूमेन वायुमण्डले ''एटोमिक'' इति (परमाणुविकिरणस्य) प्रभावोपशाम्यते।'' इत्थं परमपवित्रं यज्ञ एव समासां प्राकृतिकापदां सन्तुलनस्य सामर्थ्यं दधाति।

इत्थमियं प्रमाणोपगता यागीया समग्रापि वैज्ञानिकी प्रक्रिया कतिपयवैज्ञानिकशास्त्रप्रमाणैश्च जनानां समक्षमुपस्थापयेत् येनास्माकीनाश्चिरन्तनगुणगौरवभूताः, विविधपदार्थवर्णनपराः, विविधघटनोद्घाटनपृथुलाः, पण्डितपुरन्दरैरनुभूताः ग्रन्थाः, सम्पूर्णमपि प्रथितयशोवाङ्मयञ्च तेषामनुभवपथ्याश्रितास्स्युरिति शम्।

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सिद्धान्तज्योतिषदृशा ग्रहाणां वक्रगतिविज्ञानम्

मधुसूदनमिश्रः एवं प्रो. रामजीवनमिश्रः***

अदृश्यरूपाः कालस्य मूर्त्तयो भगणाश्रिताः।
शीघ्रमन्दोच्चपाताख्याः ग्रहाणां गतिहेतवः॥
तद्वात् रश्मिभिर्बद्धास्तैः सव्येतरपाणिभिः।
प्राक्पश्चादपकृष्यन्ते यथासन्नं स्वदिङ्मुखम्[1]॥

अनया भगवदुक्त्या ज्ञायते यत् खगोलविज्ञाने ग्रहगतिसाधनपरम्परायां शीघ्रमन्दोच्चपाताख्याः ग्रहाणां मूलरूपेण गतिहेतवः, किञ्च आकर्षणविकर्षणवशात् ग्रहाणां भवन्ति गतयः अष्टधा। यथा हि सूर्यसिद्धान्ते –

वक्रातिवक्रा विकला मन्दामन्दतरा समा।
तथा शीघ्रतरा शीघ्रा ग्रहाणामष्टधा गतिः[2]॥

अत्र हि गतिभेदानामष्टकेऽपि या अतिशीघ्रा गतिः सैव शीघ्राख्या,या च मन्दा सैव मन्दतरा, या वक्रा सा ह्यतिवक्रा निगद्यते। अतः ग्रहगतीनामष्टभेदत्वेऽपि पञ्चभेदा एव सिद्धान्तमान्याः। तद्धि स्पष्टतया सूर्यसिद्धान्ते–

तत्रातिशीघ्रा शीघ्राख्या मन्दा मन्दतरा समा।
ऋज्वीति पञ्चधा ज्ञेया या वक्रा सातिवक्रगा[3]॥

ग्रहगतिविज्ञाने आकर्षणसिद्धान्तस्यापि मूलं दृश्यते। अथ च विशिष्टोऽयं पक्षः यत् गतिमन्तो ग्रहाः वक्रिणोऽपि भवन्ति। स्वकक्षायां स्वभावतया निजगत्या पूर्वाभिमुखीं गतिं विहाय यदा कश्चन ग्रहः पश्चिमाभिमुखो भवति किं वावलोक्यते तदाऽसौ ग्रहः वक्र इति सिद्धान्तदृशा निगद्यते। वक्रग्रहगतिविषये नैसर्गिकीयं जिज्ञासा समुदेति यत् किं ग्रहाः वस्तुतो वक्रिणो भवन्ति? उत् वा केवलं कक्षाभेदात् ग्रहाः वक्रिणः प्रतीयन्ते। जानीमो वयं यत् प्रतीतेरपि भारतीयसिद्धान्तज्योतिषे साम्प्रतिके खगोलविज्ञाने च महन्महत्त्वं विद्यते नो चेत् सूर्यस्य गतिः भूमेश्च सापेक्षिकस्थिरता कथं स्वीकर्त्तुं शक्यते। अतः भवतु नाम कक्षाभेदात् ग्रहाः वक्रिणो प्रतीयन्ते परन्तु तेषां राश्यादिमानेनापि पञ्चाङ्गेषु वक्रत्वमुद्घोष्यते खगोलीयदृशा वक्रकालश्च निर्धार्यते किञ्च प्रभावशास्त्रे वक्रग्रहस्य शुभाशुभविचारोऽपि पृथग्तया विधीयते। अथ च लोकानां भावाभावाय परस्परं याम्योत्तरपूर्वापरोर्ध्वाधरत्वभेदसमाश्रितानामपि ग्रहनक्षत्राणां युतिवियुति-विचारः कृतो वर्तते। तत्र ग्रहयुतौ युद्धसमागमास्तविषयेऽपि वक्रगतिज्ञानमावश्यकम्। अतः ग्रहेषु वक्रता समायातीति प्रतीयते चेत्युभयोर्पक्षयोस्स्वीकारे न काचिद्धानिः। अथ साम्प्रतिकेषु विविधपञ्चाङ्गेषु वक्रकालमधिकृत्य भेदो दृश्यते। शनिबृहस्पतयोस्तु वक्रारम्भकाले वक्रावसानकाले च महदन्तरमवलोक्यते। अतः कदा को ग्रहो कियता कालेन वक्री भवतीति जिज्ञासा समुदेति। अष्टविधगतीषु सामान्यतया कदा कस्मिन् राशौ स्थिते ग्रहस्य शीघ्रकेन्द्रे कीदृशी ग्रहगतिर्भवतीति आचार्येण श्रीपतिना निरूपितं यथा हि सिद्धान्तशेखरे–

मीनाजादेरतिशयचला गोघटादेश्च शीघ्रा,
शीघ्रे केन्द्रे मिथुनमकरादौ तु नैसर्गिकी स्यात्।
कर्काद्यर्धे भवति धनुषश्चान्त्यखण्डेऽतिमन्दा चापाद्यर्धे
कुहिरशकलेऽन्त्ये च मन्दा प्रदिष्टा[4]॥

आचार्यलल्लेन वक्रगतिकवषये प्रोक्तं यत्–

मध्यस्फुटान्तरदलेन चलात् समेतान्मध्ये
स्फुटात्समधिके सति चान्यथोनात्।
स्पष्टं त्यजेत् कृतषडष्टसु तत्र भेषु
वक्रातिवक्रकुटिलागतयो भवन्ति[5]॥
वक्रगतिविषये सैद्धान्तिकावधारणा

सैद्धान्तिकदृष्ट्या ग्रहाणां भूसापेक्षिकं भ्रमणप्रतीतिः भवति भूपृष्ठवासिभ्यो दर्शनन्तु नक्षत्राभिप्रायिकमतः भूवासिभिः भिन्नकक्षाभिप्रायेण वक्रग्रहा अवलोक्यन्ते। सूर्यसिद्धान्ते हि प्रतिपादितमस्ति यत् यदा कश्चन ग्रहः स्वशीघ्रोच्चाद् दूरस्थितः अर्थात् स्वनीचोन्मुखो भवति तदा शीघ्रोच्चाकर्षणापेक्षया शीघ्रनीचस्यापकर्षणमधिकं भवतीति कृत्वा ग्रहाः विपरीताकर्षणबलेन वक्रिणो भवन्ति। अर्थात् वक्रग्रहे मन्दोच्चशीघ्रोच्चोपचयापेक्षया शीघ्रनीचकृतापचयोऽधिकतरो भवति। स्थितिरियं शीघ्रेच्चाद् मकरादिकेन्द्रे स्थिते ग्रहे संभवति, यतो हि तत्रैव शीघ्रोच्चापकर्षणस्यापचयः ऋणत्वञ्च सञ्जायते। इत्थं वक्रगतौ शीघ्रोच्चमेव हेतुः। अतः येषां ग्रहाणां शीघ्रोच्चं न भवति ते वक्रिणो न भवन्ति। अयमेव सिद्धान्तः अर्वाचीनखगोलविज्ञानसमवायेऽपि एवमेव स्वीकृतं वर्तते। यथोक्तं भगवता सूर्येण–

दूरस्थितः स्वशीघ्रोच्चाद् ग्रहः शिथिलरश्मिभिः।

सव्येतराकृष्टतनुर्भवेद्वक्रगतिस्तदा[6]॥

सिद्धान्ततत्वविवेके आचार्यकमलाकरभट्टेनापि निरूपितमित्थम्–

वक्रं गतोऽपीन्द्रदिशं राहुवद्गच्छति ग्रहः।
भोगस्यापचयात् प्रत्यगवृद्धतत्पातवन्नहि॥
ग्रहोऽनुलोमं निजकक्षिकायां भ्रमन्नपि स्वाजमुखात् स्फुटोऽसौ।
स्वनीचभीतश्चलतीह वक्रादिको विलोमं शृणु तत्र युक्तिम्[7]॥

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*आचार्यः, (ज्योतिषविभागः) गुरूकुल श्रीमातावैष्णोदेवी, कटरा, जम्मू।
**प्रोफेसर, ज्योतिषविभागः, संस्कृतविद्याधर्मविज्ञानसङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी।

वस्तुतः कक्षामध्यतिर्यग्रेखासम्पाते ग्रहाणां मध्यमागतिरेव सपष्टा भवति। यतो हि ''**कक्षामध्यतिर्यग्रेखाप्रतिवृत्तसम्पाते। मध्यैवगतिस्स्पष्टा परं फलं तत्र खेटस्य**।।'' इति खगोलीयग्रहगतिसिद्धान्तः। ततोऽधः यथा-यथा शीघ्रकर्णमानं त्रिज्यापेक्षयापचीयते फलकोटिज्यामानञ्च वर्द्धते तथा -तथा शीघ्रगतिफलमृणं भवति। नीचासन्ने स्थितग्रहे यदा ऋणगतिफलस्य मानं शीघ्रकेन्द्रगतिमानापेक्षयाधिकतरो भवति तदा ग्रहस्य स्पष्टकेन्द्रगतिः ऋणात्मिका जायते। एतदर्थं गतिफलस्य ऋणत्वात् शीघ्रकेन्द्रगतितोऽधिकत्वाच्च ऋणात्मिका स्पष्टकेन्द्रगतिःशीघ्रोच्चकेन्द्र-गतितोऽधिका भवति। इत्थं ग्रहेषु वक्रता समायाति। अतः सिद्धान्तानुसारेण सूत्रम्–

मन्दस्पष्टगतिफलम्< ऋणात्मकं शीघ्रगतिफलम् = वक्रगतिः।

वा, ऋणं शीघ्रोच्चगतिफलम्>मन्दस्पष्टगतिफलम्= वक्रगतिः।

अतः सारांशतया, व्यावहारिकरीत्या,

अद्यतनग्रहः> श्वस्तनग्रहः = वक्रगतिः।

यदा च मन्दस्पष्टगतिफलं शीघ्रगतिफलञ्च तुल्ये तदा ग्रहाणां वक्रारम्भकालः वक्रावसानकालश्च भवति। अयमेव कालः आधुनिकग्रहगणिते शून्यकालः (Zero Motion Period), स्तब्धककालःस्तम्भककालो वा निगद्यते यतो हि वक्रारम्भे वक्रत्यागे गतेस्सत्ता न विद्यते। अतः कदा स्पष्टकेन्द्रगतिः उच्चगतिश्च समे इति ज्ञानाय सिद्धान्ते वस्तुतः ध्यातव्यमिदं यत् प्राचीनसिद्धान्तानुसारेण ग्रहाणां भूसापेक्षिकं भ्रमणं भवति, दर्शनन्तु क्रान्तिवृत्तीयं नक्षत्राभिप्रायिकमतः भूवासिभिः भिन्नकक्षाभिप्रायेण ग्रहाः वक्रिणः अवलोक्यन्ते।

ग्रहगतिसिद्धान्ते पाश्चात्यसंवाहकाः

आधुनिकखगोलीयग्रहगणितपरम्परायां तु हिपार्कस-टॉलमी-आर्कमिडीज – गैलेलियो – अपोलोनियस - कॉपरनिकस – केपलर – न्यूटन -स्मार्टमहाशयाश्च प्रमुखास्सन्ति । साम्प्रतिकाधुनिकपरम्परायां केपलरमहोदयस्य (1473-1543 ई.) गतिसिद्धान्तेन अपोलोनियस-महोदयेन एम.स्मार्टमहोदयेन च वक्रगतिनियमो प्रतिपादितः। आधुनिकसमवाये ग्रहाणां द्विविधा श्रेणी विद्यते –अन्तर्ग्रहाः, बहिर्ग्रहाश्च। बुधशुक्रावन्तर्ग्रहौ, अन्ये च बहिर्ग्रहाः। अन्तर्ग्रहौ रविकेन्द्रिकमार्गगत्या भवन्तौ यदा शीघ्रनीचासन्नौ भवतस्तदा भूसापेक्षं तौ वक्रिणौ दृश्येते। तत्र भुवो ग्रहस्य चैकदिक्त्वे भुवो गतिलम्बनं गतिवक्रतां निरोद्धुमीहते परं भुवोऽपेक्षया ग्रहगतेरधिकत्वाद् तत्र सम्भवति। अतो गतेर्वक्रत्वं तु जायत एव, परं तस्य मात्रा कालश्च न्यूनौ जायेते। बहिर्ग्रहणां वक्रतायास्तु भुवो गतिलम्बनमेव हेतुः। तत्र ग्रहस्य स्वीयागतिर्बाधिका यतोहि तत्र ग्रहगतेर्भूरपेक्षया न्यूनत्वाद् ग्रहगतिवक्रत्वं तु भवति,परं तस्य कालो मात्रा च न्यूने जायेते। बहिर्ग्रहाणां भौमार्कीज्यानां शीघ्रोच्चं सूर्य एव। यथा हि सौरसिद्धान्ते–

भौमार्कीज्यविहीनमध्यमरविः स्यात् स्वाशुकेन्द्रं तु वित्[8]**॥**

अतः रविनाभियुते दीर्घवृत्ते भ्रमणकाले यदा बहिर्ग्रहो भूमे आसन्नवर्ती रवेश्च दूरतरो भवति तदाऽसौ ग्रहो वक्री भवति। अन्तर्ग्रहयोर्बुधशुक्रयोःमन्दोच्चं सूर्यसममेव, अतःबुधशुक्रौ यदा सूर्यासन्नवर्तिनौ भूमेश्च दूरतरौ भवतस्तदैतौ ग्रहौ वक्रिणौ। प्राचीनमते वस्तुतः ताराग्रहसूर्ययोर्मध्ये यः तीव्रगतिकः स शीघ्रोच्चसंज्ञकः यश्चाल्पगतिकः स ग्रहसंज्ञको भवति। बुधशुक्रयोर्गतिः सूर्यादधिका, अतः तयोस्स्वकीया गतिः शीघ्रोच्चगतिःसूर्यगतिश्च तेषां मध्यमा गतिः भवति। बहिर्ग्रहाणां कुजगुरूशुक्राणां गतिः सूर्यापेक्षया न्यूना अतः सूर्य एव तेषां शीघ्रोच्चम्,स्वकीयागतिश्च ग्रहगतिः।

भारतीयप्राच्यग्रहगणितपरम्परायां अन्तर्ग्रहयोर्भ्रमणं शीघ्र-नीचोच्चवृतस्थग्रहद्वारा शीघ्रप्रतिवृत्तकेन्द्रद्वारा भुवो भ्रमणञ्च द्योत्यते । शीघ्रनीचोच्चपरिधिस्थो ग्रहः शीघ्रगत्या चलति, तस्य केन्द्रं (मन्दस्पष्टग्रहः) स्पष्टकेन्द्रगत्या (संस्कृतरविगत्या)चलतीति कल्पितम्। अतः कक्षामध्यतिर्यग्रेखातोऽधः (नीचासन्ने) स्थिते ग्रहे यदा स्पष्टकेन्द्रगतिः स्वशीघ्रगतेरपेक्षयाधिका जायते तदा ग्रहस्य वक्रत्वं भवतीति सिद्धान्तः। बहिर्ग्रहाणां तु शीघ्रपरिधिवृत्तस्थेन भुवो गतिः। शीघ्रपरिधिकेन्द्रेण (मन्दस्पष्टग्रहेण) च ग्रहस्य वास्तविका गतिर्व्यज्यते। भारतीयविधिना यद्यपि सूर्यकेन्द्रिकभ्रमणस्य वास्तविकं कारणं सूर्यकेन्द्रिकत्वं न साक्षात् प्रतिपादितं तथापि वक्रतायाः स्थितिः तादृश्यामेवावस्थायां जायते यादृश्यां नूतनखगोलविज्ञानक्रमेण।

प्राचीनार्वाचीनरीत्या ग्रहाणां वक्रकेन्द्रांशसाधनम्

कदा स्पष्टकेन्द्रगतिरूच्चसमा भवति एतदर्थं गणितीयं सूत्रं सिद्धान्ते निष्पादितं विद्यते। तच्च सूत्रं यथा-

स्पष्टकेन्द्रगतिः = शीघ्रकोज्याफलम् ×केन्द्रगतिः/शीघ्रकर्णः

अत्र यदा शीघ्रफलकोटिज्या = त्रिज्या
(आचार्यकमलाकरभट्मतेन)

मानमुत्थाप्यते तदा, स्पष्टकेन्द्रगतिः=त्रिज्या ×केन्द्रगतिः/शीघ्रकर्णः।

अतः गणितीयविन्यासेन वक्रारम्भज्ञानाय सूत्रं जायते –

उच्चगतिः^{2}× ज्या^{2}+ त्रिज्या^{2}(उच्चगतिः^{2}-केन्द्रगतिः^{2})/ ग्रहशीघ्रान्त्यफलज्या (ग्रहशीघ्रोच्चगतिः+मध्यमग्रहगतिः)

सौरसिद्धान्ते शीघ्रकेन्द्रकोटिज्यावशात् वक्रकेन्द्रांशज्ञानमित्थं सूत्रेणानेन क्रियते–

त्रिज्या^{2}×मध्यमग्रहगतिः+ग्रहशीघ्रान्त्यफलज्या ×ग्रहशीघ्रोच्चगतिः/ ग्रहशीघ्रान्त्यफलज्या। (ग्रहशीघ्रोच्चगतिः+मध्यमग्रहगतिः)= वक्रारंभे ग्रहस्य केन्द्रकोटिज्या।

90अंशाः + वक्रारंभीया केन्द्रकोटिज्या=वक्रारंभीयाः शीघ्रकेन्द्रांशाः।
तथा च, 360 अंशाः – मार्गीयकेन्द्रांशाः।

अत्र हि त्रिज्यास्थाने 3438(बृहज्ज्या),120 (लघुज्या) वा गृहीतुं शक्यते। सौरसिद्धान्तीयमानापेक्षया आचार्यबापूदेवशास्त्रिकृतं वक्रकेन्द्रांशसाधनं सूक्ष्मतरं भवति यतो हि सूर्यसिद्धान्ते तु कोज्याफलम् त्रिज्याप्रमितं सवीकृतमस्ति। सारांशतः सौरपक्षस्यैव दृढीकरणं कृतमित्थमाचार्यैः–

त्रिज्याकृतिः खचरमध्यमभुक्तिनिघ्नी,

शीघ्रोच्चभुक्तिगुणितोऽन्त्यफलस्य वर्गः॥

योगस्तयोः परफलज्यकया विभक्तः,

शीघ्रोच्चभुक्तिखगवेगसमासहृच्च॥

लब्धस्य धनुषो भागाः वियदङ्कसमन्विताः,

वक्रारम्भे ग्रहस्य स्युः शीघ्रकेन्द्रलवाः स्मृताः[9]॥

दृश्यपद्धत्यां तु शीघ्रान्त्यफलज्यावशात् शीघ्रकर्णज्ञानं विधाय साधनं भवति। ग्रहयोर्प्रदक्षिणाकालवर्गयोः तन्मन्दशीघ्रकर्णघनयोश्च समैव निष्पत्तिरिति केपलरीयतृतीयसिद्धान्तेन वक्रग्रहकेन्द्रांशाः साध्यन्ते।

(ग्रहकर्णः/सूर्यकर्णः)^3 =(ग्रहगतिः/सूर्यगतिः)^2

अत्र तावत् प्राचीनार्वाचीनानि (रूपतुल्यत्रिज्यायाम्) शीघ्रान्त्यफलज्यामानानि च परस्परं समीक्ष्यते[10]-

ग्रहाः	सौरमतम्	साम्प्रतिकमतम् (आधुकिविज्ञानानुसारेण)	धनर्णान्तराणि (प्राचीनापेक्षया)
भौमः	0.653	0.656	+0.003
बुधः	0.3984	0.387	-0.0094
बृहस्पतिः	0.1972	0.1922	-0.0050
शुक्रः	0.727	0.723	-0.004
शनिः	0.1083	0.1084	+0.0001

शीघ्रान्त्यफलज्यावशादेव ग्रहाणां वक्रारंभकाले भेदो दृश्यते अर्थात् वक्रमार्गकेन्द्रांशयोरप्यन्तरं समुत्पद्यते। यथा हि सारिण्या ज्ञातुं शक्यते–

ग्रहाः	सौरमतम् (वक्रमार्गकेन्द्रांशाः)	साम्प्रतिकमतम् (आधुकिविज्ञानानुसारेण)	धनर्णान्तराणि (प्राचीनापेक्षया)
भौमः	164/196	$163^0 13'/196^0 47'$	$-/+47'$
बुधः	144/216	$145^0 17'/214^0 43'$	$+/-1^0 17'$
बृहस्पतिः	130/230	$125^0 33'/234^0 27'$	$-/+4^0 27'$
शुक्रः	163/197	$167^0 16'/192^0 44'$	$+/-4^0 16'$
शनिः	115/245	$114^0 29'/245^0 31'$	$+/-31'$

अथ ग्रहाणां भूसापेक्षं रूपतुल्ये त्रिज्यास्वीकारे गणितबलेन त्रिज्याः समायान्ति–

यदि भुवः त्रिज्या = अ तदा

भौमस्य = 1.5237 अ

बुधस्य = 0.387 अ

गुरोः= 0.3871 अ

शुक्रस्य = 0.7233 अ

शनेः = 9.5388 अ

सूर्यसिद्धान्ते हि वक्रकेन्द्रांशनिर्धारणे विषयेऽस्मिन् निगदितमस्ति यत्–

कृततुंचन्द्रैवेदेन्द्रैः शून्यत्र्यैकगुणाष्टिभिः।
शररूद्रैश्चतुर्थाशुकेन्द्रांशैभूसुतादयः॥
भवन्ति वक्रिणस्तैस्तु स्वैः-स्वैश्चक्राद्विशोधितैः।
अवशिष्टांशतुल्यैस्ते केन्द्रैरूज्झन्ति वक्रताम्[11]॥

प्रायः सर्वेषु प्राचीनसिद्धान्तग्रन्थेषु एतान्येव मानानि स्वीकृतानि। ध्यातव्यमिदं यत्सौरपरम्परायां गणितीयसौलभ्यार्थं मानानि स्वल्पान्तराद् पूर्णसंख्यात्मकरूपेणाङ्गीकृतानि। गणितीयरीत्या तु शीघ्रगतिफलसाधनोपक्रमे ऋणशीघ्रगतिफलस्य मन्दस्पष्टगतितोऽधिके सति ऋणात्मकशीघ्रफलगतितो मन्दस्पष्टगतिफलं विशोधनेन शेषं वक्रगतिः समायाति। वस्तुतो यदा शीघ्रगतिफलसाधने शीघ्रकर्णमानं त्रिज्यातोऽधिकं भवति तदानीं फलस्य धनावशेषाद्धनम्। यदा च शीघ्रकर्णमानं त्रिज्यातो न्यूनं भवति तदानीं फलस्य ऋणत्वाद् गतिफलमृणमिति सिद्धान्तः। परन्तु त्रिज्याधिकः शीघ्रकर्णः मकरादिके शीघ्रकन्द्रे, त्रिज्याल्पस्तुकर्कटादिशीघ्रकेन्द्रे भवतीत्यपि गोलरीत्या स्फुटम्। यदि मन्दस्पष्टगतितः शीघ्रगतिफलमृणमधिकञ्च स्यात्तदा तयोस्संस्कारेणार्णमेवावशिष्यतेऽतस्तदानीमद्यतनस्पष्टग्रहाच्छवस्तनः स्पष्टो ग्रहोपृष्ठस्थो भवतीत्यतः सा गतिः वक्रागतिरित्युच्यते। तद्यथा हि ग्रहगणितायनियमः–

मन्दस्फुटीकृतां भुक्तिं प्रोज्झ्य शीघ्रोच्चभुक्तितः ।
तच्छेषं विवरेणाथ हन्यात् त्रिज्यान्त्यकर्णयोः ॥
चलकर्णहृतं भुक्तौ कर्णे त्रिज्याधिके धनम्।
ऋणमूनेऽधिके प्रोज्झ्य शेषं वक्रगतिर्भवेत्[12]॥

वक्रगतिसिद्धान्तसमीक्षणेन सैद्धान्तिकनिष्कर्षाः

प्राचीनार्वाचीनसिद्धान्तानुसारेण वक्रगतिसिद्धान्तसमीक्षणेन केचन महत्त्वपूर्णनिष्कर्षाः समायान्ति –

- सर्वेषु सिद्धान्तेषु कक्षाभेदाच्छीघ्रोच्चमेव वक्रग्रहकारणं स्वीकृतम्।
- वस्तुतो ग्रहाणां भ्रमणं सूर्यकेन्द्रिकं दर्शनञ्च भूकेन्द्राभिप्रायिकमतः ग्रहाः वक्रिणो भवन्तीति भूपृष्ठीयं भूकेन्द्रिकं चानयनं प्रचीनसिद्धान्तानुसारेण यथा विधीयते तथैव सम्प्रत्यर्वाचीन समवायेष्वपि।
- सूर्यसिद्धान्तानुसारेण यद्यपि वक्रग्रहाणां वास्तविकं कारणं

सूर्यकेन्द्रिकत्वं न साक्षात् प्रतिपादितम्, तथापि बहिग्रर्हाणां शीघ्रोच्चं सूर्यमेव किञ्चान्तर्ग्रहाणां कृते तु रविगतिः भूगतिश्च तुल्ये, तस्मात् न हि कश्चन सैद्धान्तिको भेदः।

- वक्रकेन्द्रांशे बृहस्पतौ (-/+$4^0 27'$) ऋणात्मकमन्तरं शुक्रे च (+/-$4^0 16'$) धनात्मकमन्तरमवलोक्यते। अन्येषां ग्रहाणामन्तरं न हि किमपि गण्यमन्तरम्।
- प्राचीनग्रहगतिसिद्धान्तपरम्परायां सौरपक्षीयमानानि स्वकाले सूक्ष्मं सम्प्रति सूक्ष्मासन्नान्येव।
- त्रैराशिकानुपातापेक्षया केन्द्रग्रहगतिमानं चलराशिं मत्वा तात्कालिकसम्बन्धेन चलनकलनपद्धत्या वक्रकेन्द्रांशसाधनं विधीयते तदा दृश्यमानेन प्राचीनमानान्यंशपर्यन्तं तुल्यानि। म.म.पं. सुधाकरद्विवेदिना प्रकाशितेयं पद्धतिः।
- सूक्ष्मज्यासाधनमपि सूक्ष्मवक्रकेन्द्रांशसाधने महत्त्वपूर्णम्, यतो हि 225 कलातो न्यूनायां सत्यां ज्याचापयोरभेदस्वीकारात्। तेन 450 कलातो न्यूने कलानां ज्यानाञ्च मानानि तुल्यानि। म.म.बापूदेवशास्त्रिभिः पक्षेऽस्मिन् संशोधकप्रयासो विहितः।
- ग्रहाणां वक्रगतिसाधनोपक्रमे सौरदृष्ट्या शीघ्रोच्चगतेः तात्कालिकज्ञानम्, शीघ्रफलस्य चयापचयज्ञानम्, केन्द्र च्युतिवशात् केद्रगतेस्तात्कालिकज्ञानं कथं कर्त्तव्यमित्यादिषु क्षेत्रेषु सम्प्रत्यपि प्रयासोऽपेक्षितः।

सारांशतया सिद्धान्तज्योतिषीयदृशा वक्रगतिसिद्धान्तानां समीक्षणेन ज्ञायते यत् भारतीया ग्रहसाधनरीतिः वक्रग्रहस्थानकालगतिनिर्धारणपद्धतिश्च सूक्ष्मतमा वैज्ञानिकी चेति निष्कर्षः।

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वैदिकशिक्षाविषयिणी महामनसां वैज्ञानिकी दृष्टिः

दीपककुमारशर्मा[*] एवं डॉ. पतंजलिमिश्रः[**]

पुण्यभूमावस्यां यदा कदापि सङ्कटः सञ्जायते तदा महापुरुषाः महात्मनः मनीषिणश्चावतीर्य लोकोपकाराय धर्मव्यवस्थां निर्दिशन्ति उपदिशन्ति च सर्वेभ्यो मानवेभ्यो धर्ममूलकं कर्ममूलकञ्च कल्याणमार्गम्। धर्मसंस्थापनार्थमेव युगे-युगे धरातलेऽस्मिन् भगवानपि जन्म गृह्णाति। तेष्वेव भगवदंशयुक्तेषु महापुरुषेष्वन्यतमाः धन्यतमाश्च महामनापण्डितमदनमोहनमालवीयाः, यैः सा धर्ममूला कर्ममूला च शिक्षापद्धतिः प्रसारिता संस्कृतिपरा चरित्रनिर्माणदृष्टिश्च प्रदत्ता या खलु सनातनधर्मव्यपदेशेन श्रुतिस्मृतिपुराणादिषु प्रतिपादिता वर्तते। भारतदेशोऽयमनादिकालात् विभिन्नानां धर्माणां सम्प्रदायानां जातीनां विभिन्नदेशीयमनुजानां तत्संस्कृतीनाञ्च पोषको वर्तते। अस्मादेव कारणादनादिकालाज्जगतितले भारतभूमिरियम् **'विश्वगुरु'** इति विशेषेण प्रतिष्ठिता वर्तते। परन्तु एकविंशतिशताब्द्यामस्यां वैश्वीकृतसमाजे जनाः भौतिकसाधनैस्सम्पन्नाः सन्तोऽपि मानसिकरूपेणाशान्ताः व्यथितेन्द्रियाश्च सन्ति। समाजस्य कृते राष्ट्रस्य कृते किं कर्त्तव्यमित्यपि ते विस्मृतवन्तः। नैतिकशिक्षायाः ह्रासत्वेन समाजे चरित्रहीनता किंकर्त्तव्यविमूढता कलुषिता च मानसिकी भावना सर्वत्र दरीदृश्यते। **'धनेभ्यः परो बान्धवः नास्ति लोके'** इति विचारधारा सर्वत्र प्रवहमाना वर्तते। आधुनिकच्छात्राणां कृते विद्या सैव या नियुक्तियोग्या, व्यवसायिनां कृते केनापि प्रकारेण लाभार्जनमेव परमलक्ष्यम्। राजनेतृणां कृते सत्ताप्राप्तिरेव प्रधानतमा नीतिः। अतः धनलोलुपान् पदलोलुपान् जनान्नाचारहीनान् छात्राँश्च दृष्ट्वेदं प्रतिभाति यत् स्वतन्त्रमपि राष्ट्रमिदं पाश्चात्यसंस्कृत्याः कुप्रभावेन आबद्धमतः तद्दृष्ट्या परतन्त्रमेव। गुरुशिष्ययोः पितापुत्रयोर्भ्रातरोर्वा सम्बन्धो भवतु सर्वत्र चरित्रस्य ह्रासमेव दरीदृश्यते। इयमेव स्थितिमवलोक्य केनचित् नीतिकारेणोक्तं यत्–

गीता कथं विगतर्थिता केशव! त्वदीये भारते।
आत्मैव अत्र विहन्यते वपुषाहतानां का कथा[1]?

अतः एतादृशे चरित्रशून्ये समाजे कथं सा रामराज्यकल्पना पूर्णा भवेत्? इमाः भावनाः प्रसृज्येत यत् **''ईशावास्यमिदं सर्वम्[2]'' ''सर्वे भवन्तु सुखिनः'' ''वसुधैव कुटुम्बकञ्चेति''** विचिन्तनीयम्। एतादृशेषु विचारप्रवाहेष्वेव महामनसां चरित्रनिर्माण-विषयिणी दृष्टिरावश्यकी। तेषामिदं मतमासीद्यद् छात्रा एव राष्ट्रस्य संरक्षकाः, अतः कथं तेषां चरित्रं समुज्ज्वलं भवेत् तेभ्यो ज्ञानमिदमुपपद्येत् विद्या न हि धनार्जनवस्त्वपितु विनयदायिनी मुक्तिदायिनी च। अस्यामेव स्थितावस्माकं दृष्टिः तेषां महापुरुषाणां जीवनचरिते पतति येषां ध्येयमिदमासीद्यत्–

एतद्देशप्रसूतस्य सकाशादग्रजन्मनः।
स्वं-स्वं चरित्रं शिक्षेरन् पृथिव्यां सर्वमानवाः[3]॥

आविर्भूते मालवीयमहोदये पारतन्त्र्यरज्जुभिर्बद्धोऽयं भारतदेशः आध्यात्मशक्त्या बहिर्मुखः कुशिक्षया च ग्रस्तः। एतेषां सर्वा अपि क्रियाः भारतीयसंस्कृतेः सर्वान्नपि पक्षान् परिपुष्टानकार्षुः। महात्मनां यल्लक्षणं भर्तृहरिणा निर्णीतं यत्–

विपदि धैर्यमथाभ्युदये क्षमा सदसि वाक्पटुता युधि विक्रमः।
यशसि चाभिरुचिर्व्यसनं श्रुतौ, प्रकृतसिद्धमिदं हि महात्मनाम्[4]॥

एतैः सर्वैरपि गुणैः युतानां महामनसां चरित्रविषयिणी दृष्टिः विलक्षणा अप्रतिमा च।

महामनसां शिक्षाविषयिणी दृष्टिः कीदृशी आसीदिति तेषां वचनेनैव परिलक्ष्यते –काशीहिन्दूविश्वविद्यालयोऽयं तादृशो भवेद्यत्रोच्चस्तरीय-शिक्षया सह भारतीयनवयुवकानां चरित्रनिर्माणं स्यात्। तेषु देशप्रेमदेशसेवयोः भावनायाः सञ्चारो भवेत्। तेषां भारतीयसंस्कृतेः संस्कृतस्य च समुचितं ज्ञानं भवेत्तथा च सहैव आधुनिकसर्वासां विद्यानां ज्ञानमवाप्य देशसमृद्धौ समुचितं योगदानं कर्त्तुं प्रभवेयुः। तैः प्रतिपादितं यन्नैतिकमूल्यानां धर्मसंस्कृतीनाञ्च समुचितमध्ययनमेव विश्वविद्यालयस्यास्य प्रधानं लक्ष्यं भविष्यति[5]।

तेषां विचाराणां मूर्त्तरूपोऽयं विश्वविद्यालयः। तै ईदृशः विश्वविद्यालयः स्थापितः यत्र भारतीयसंस्कृतिसदाचारैस्सह विभिन्नज्ञानविज्ञानानामध्ययनाध्यापनस्य व्यवस्था भवेत्, यत्र प्राकृतिके रम्यपरिसरे तथैवाचार्यैस्सह निवसन्तः छात्राः शिक्षां प्राप्नुयुः यथा प्राचीनकाले गुरुकुले आसीत्। अनेनैव तेषां समुचितं चारित्रिकोत्थानं सम्भविष्यति। अतः महामनसां चरित्रपरा दृष्टिः स्पष्टा। भारतीयसंस्कृतेः प्राणभूतस्य धर्माचरणेनैव चरित्रोन्नतिरिति तेषामभिमतम्। अतः चरित्रनिर्माणार्थं सर्वेषां कृते तेषामयमेव धर्ममूलकः सन्देशः आसीद्यद्–

अभयं सत्यमस्तेयं ब्रह्मचर्यं धृतिः क्षमा।
सेव्यं सदामृतमिव स्त्रीभिश्च पुरुषैस्तथा॥

एषा धर्ममूला भावना एव मानवचरित्रस्य दुर्गुणानपनयति चेतः प्रसादयति विश्वबन्धुत्वभावनाञ्चोत्पादयति। चरित्ररूपभवनस्य निर्माणार्थं निम्नलिखिताः स्तम्भाः महामनोभिस्स्थापिताः–

1) धर्मनिष्ठता धर्माचरणञ्च

सच्चरित्राय सर्वप्राथम्येन तैः धर्मनिष्ठाचरणं प्रतिपादितम्। अत्र

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[*]शोधच्छात्रः (वेदविभागः), संस्कृतविद्याधर्मविज्ञानसङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी
[**]असिस्टेन्ट प्रोफेसर (वेदविभागः), संस्कृतविद्याधर्मविज्ञानसङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी

धर्मशब्दस्य न हि कश्चन संकुचितार्थः, भारतीयदर्शने **यतोऽभ्युदयनिःश्रेयससिद्धिः स धर्मः**[6]। अतः तेषां मतं यज्जगन्मूलत्वेन संसृतिनियामकानि तत्त्वानि धर्म इति व्यपदिश्यन्ते। यत्र जगद्धारकत्वं तत्र धर्मत्वम्। अतस्तैर्निगदितं यत्–

धर्मेण विश्वस्य जगतः प्रतिष्ठा, लोके धर्मिष्ठं प्रजा उपसर्पन्ति।

धर्मः सनातनः सार्वभौमिकः सार्वकालिकश्च। यैर्गुणैरिहलोके परलोके चोत्तमा गतिर्भवति चारित्रिकगुणानां विकासो भवति स एव धर्मः। अतः सच्चरित्रमूलं मनुप्रतिपादितमेव एतद्धर्मलक्षणं तैरनुमोदितम्–

धृतिः क्षमा दमोऽस्तेयं शौचमिन्द्रियनिग्रहः।
धीर्विद्या सत्यमक्रोधो दशकं धर्मलक्षणम्[7]**॥**

जनानां मनसि धर्मस्यैषा भावना यदोद्गमिष्यति तदा नूनमेव चरित्रिकोन्नतिः भविष्यतीति महामनसामभिमतम्। अत एव धर्माचरणविषये तेषामियमेव दृष्टिरासीद्यत् –**आत्मनः प्रतिकूलानि परेषां न समाचरेत्।** तथैव **यद्यदात्मनि चेच्छेत् तत्परस्यापि चिन्तयेत्।** अर्थाद्यत्कर्म आत्मनः प्रतिकूलं प्रतिभाति तत्कर्म कस्मैचिदप्यस्माभिर्न विधेयम्। धर्म एव प्राणिमात्रे दानं दया मार्दवं कारुण्यं ब्रह्मचर्यमिन्द्रियाणां वशीकरणं सत्यानुपालनं परदुःखनिवारणं धैर्यञ्चोत्पादयति। एतान्येव चरित्रिनिर्माणस्य मूलतत्त्वानि सन्ति। अतः सम्पूर्णे चरित्रे एते धार्मिकगुणाः अवश्यमेव भवेयु :

सत्यं दया तपः शौचं तितिक्षेक्षा शमो दमः।
अहिंसा ब्रह्मचर्यञ्च त्यागः स्वाध्याय आर्जवम्॥

महामनोभिस्सर्वथोक्तं यदयं धर्म एव भारतीयसंस्कृतेः प्राणाः। तेषां जीवने पश्यामो वयं प्रतिदिनं गायत्र्युपासनं श्रीमद्भगवद्गीतापुराणादीनामध्ययनं छात्राणां कृते धर्ममूलकं प्रवचनं शौचाचारपालनञ्च। तैस्सर्वदोक्तं यत्विद्या तपः ब्राह्मणयोनौ जन्म चेति त्रयाणामपि ब्राह्मणत्वप्राप्तौ कारणं भवति। एभिर्हीनैपुरुषो ब्राह्मणत्वाच्च्युतो भवति, यथा–

शौचेन सततं युक्तः सदाचारसमन्वितः।
सानुक्रोशश्च भूतेषु तद्विजातीषु लक्षणम्॥

अतः कदाचिदपि धर्मत्यागं न कर्त्तव्यम्। यतो हि **धर्मो रक्षति रक्षितः**। उक्तमपि तैर्यत्–

नाहं कामान्न संरंभान्न द्वेषान्नार्थकारणात्।
न हेतुवादाल्लोभाद्वा धर्मं जह्यां कथञ्चन[8]**॥**

अत एव तैर्विश्वविद्यालये अनिवार्यतया छात्राणां कृते सर्वप्राथम्येन धर्मशिक्षायाः व्यस्वथा कृता। उद्देश्यस्यास्य पूर्त्तये एवादौ काशीहिन्दूविश्वविद्यालये संस्कृतविद्याधर्मविज्ञानसंकायस्य स्थापना कृता।

2) संस्कृतिसंरक्षणं तदनुरूपाचरणञ्च

अस्माकं शिक्षायाः सर्वाण्यपि मूलतत्त्वानि संस्कृतभाषायामेव निबद्धानि सन्ति। सम्पूर्णे वैदिकवाङ्मये स्मृतिनीतिधर्मेतिहासग्रन्थाः भारतीयसनातनपरम्परायामुपलभ्यन्ते। अतः धर्मशास्त्रैर्नीति-शास्त्रैश्चानुप्रणितास्मदीया संस्कृतिरस्माभिः रक्षणीया पालनीया च। मनसः परिष्करणं संस्करणं दुरितव्यपोहनं दुर्भावदहनमेव संस्कृतिः। उच्यते हि–

सत्याहिंसागुणैः श्रेष्ठा विश्वबन्धुत्वशिक्षिका।
विश्वशान्तिसुखाधात्री, भारतीया हि संस्कृतिः॥

इयं संस्कृतिरेवात्मनो मनसो लोकस्य चरित्रोत्कर्षं विदधाति, दुर्गुणानपनयति मनोऽमलीकरोति पापान्यपाकरोति दुःखादिद्वन्द्वान्निर्दहति चेतः प्रसादयति सुखं साधयति धृतिं धारयति सत्यं स्थापयति शान्तिं समादधाति च। अत एव महामनसां मतमिदमासीद्यत् संस्कृतिमिमां धृत्यैव वयं जगति स्वकीयं गौरवपदं प्राप्स्यामः। एवं तैर्प्रीतिपादितं यत्सर्वेभ्यः छात्रेभ्यः भारतीयसंस्कृतेः वाङ्मयस्य च गौरवपूर्णोपलब्धीनां परिचयः दातव्यः येन स्वयमेव तेषां चारित्रिकविकासो भवेत्। अतः संस्कृतिरेवास्मासु नैतिकगुणान्नुद्भायति। तैस्सर्वथा स्वीये भाषणे उक्तं यत्–

अनाथाः विधवाः रक्ष्याः मन्दिराणि तथा च गौः।
धर्म्यसंघटनं कृत्वा देयं दानं च तद्धितम्[9]**॥**

छात्राणां मनसि सद्विचाराः उद्भवन्ति एतदर्थं स्वयमेव महामनामालवीयैः छात्रेभ्यः गीतोपदेशं क्रियते स्म। विश्वविद्यालयोद्देश्ये तेनोक्तं यत् छात्राणां कृते गौरवमयीसंस्कृतिज्ञानं सच्चरित्रनिर्माणमेव विश्वविद्यालयस्यास्य परमलक्ष्यम्। विश्वविद्यालयोऽयं भारतीयसंस्कृतेः प्रतिबिम्बरूप एव। विश्वविद्यालयभवनानां निर्माणं हिन्दूशिल्प-शास्त्ररीत्या भवेत्। भागीरथ्याः पश्चिमे तटे विश्वविद्यालयस्य स्थापना, केन्द्रे हि भगवतो विश्वनाथस्याधिष्ठानं स्वत एव महामनसां चरित्रविषयिणीं धर्मकेन्द्रिकां दृष्टिं प्रतिपादयति। तैरूक्तं यत् गङ्गागोगीतानां सांस्कृतिकप्रतीकानां संरक्षणमस्माभिर्कर्त्तव्यम्। गीतां प्रति महामनसां श्रद्धा तु प्रसिद्धा एव। ते अकथयन् यत् गीताज्ञानेनैव सत्कर्मप्रेरणा समायाति। इत्थं स्वसंस्कृतेरनुपालनं संरक्षणञ्च चरित्रनिर्माणस्य द्वितीयं सोपानम्।

3) चरित्रनिर्माणे शिक्षायाः महत्त्वम्

चरित्रनिर्माणे शिक्षा अनिवार्यतमा। अशिक्षितो जनः कदापि चरित्रोन्नतिं कर्तुं न पारयति। अतः सर्वेभ्यो धर्मसमन्वयात्मिका शिक्षा दातव्या। विद्यायाः परमलक्ष्यं विनयाचारसम्पादनम्–

विद्या ददाति विनयं विनयाद्याति पात्रताम्।
पात्रत्वाद्धनमाप्नोति धनाद्धर्मस्ततः सुखम्[10]**॥**

अर्थाद् विद्या नाम अमृतपायिनी विनयप्रदायिनी च। अविनीतो भवेत् यया न सा विद्या। आत्मनः तत्त्वतः परिचयेनैवाज्ञानमोक्षः, अज्ञानमोक्षाद्बन्धनमुक्तिः ततो अमृतलाभः परमविनयश्च वाप्यते। एषा विद्यैव सत्यपथप्रदर्शिनी आत्मत्यागप्रेरिका सम्मानप्रदा च। अत एव महामनसां कामनेयमासीद्यद् संस्कृतिसंस्कृतभाषायाश्च अध्ययनाध्यापनक्रमः एतावान् विस्तृतो भवेद्यन्माध्यमेनैव विद्यार्थिनः

चरित्रोत्थानं कृत्वा राष्ट्रविकासे योगदानं कर्त्तुं शक्नुयुः[11]।

परतंत्रताकालीनां दोषपूर्णां देशभावनाभक्तिरहितां दास्यभावनायुक्तां भारतीयशिक्षानीतिं विलोक्यैषामतीवक्लेश आसीत्। अत एव राष्ट्रियचेतनाधायकः ब्रिटिशशासनतन्त्रप्रभावमुक्तः भारतीयादर्शदर्शकः प्राच्यपाश्चात्योभयज्ञानविज्ञानसमन्वितः विश्व-विद्यालयोऽयं सांस्कृतिकराजधान्यां विंशतिशताब्द्याः द्वितीयदशके स्थापितः। एतद्दृष्ट्वैव केनचिदुदीरितं विश्वविद्यायाः लयं दृष्ट्वा विश्वविद्यालयः स्थापितः। चरित्रमेव पुरुषस्य सर्वस्वम्। महामनोभिरपि प्रतिपादितं यत् चरित्ररक्षणेनैव मानवत्वं देवत्वञ्च, तदभावे दानवत्वं पिशाचत्वञ्च। यथा हि प्रतिपादितं वर्तते–

धर्मो हि तेषामधिको विशेषो धर्मेणहीना पशुभिस्समानाः।

अतः चरित्रं सर्वथा संरक्ष्यम्। अत एवोक्तं तेन यत्–

वृत्तं यत्नेन संरक्षेद् वित्तमायाति याति च।

अक्षीणो वित्ततः क्षीणो वृत्ततस्तु हतो हतः[12]॥

3.(अ) स्त्रीशिक्षायाः महत्त्वम्

चरित्रनिर्माणे स्त्रीशिक्षाविषयेऽपि ते दत्तवधानाः आसन्। तेषां विचारोऽयमासीद्यत् पुरुषाणामपेक्षया स्त्रीणां शिक्षा महत्त्वपूर्णा यतो हि ता एव मातृरूपेण सर्वेषां प्रथमाः शिक्षिकाः भवन्ति। महाभारते उक्तमप्यस्ति यत् ''नास्ति मातृसमः शिक्षकः कोप्यन्यः''। अतः स्त्रीणां शिक्षणार्थं महामनोभिः महिलामहाविद्यालयः स्थापितः। तेषां कामनेयमासीद्यत्– स्त्रियःविद्योतमेव विदुष्यः, गांधारीलक्ष्मीबाई इव वीराङ्गनाः, सीता इव सत्यःसावित्री इव गुणशीलाश्च स्युः। तासां सम्पूर्णं आचारव्यवहारवेशभूषावार्तालापादिकं भारतीयसंस्कृत्यनुकूलं भवेद्येन बाल्यकालादेव जनाः सच्चरित्राः भवेयुः। अत एव तैरुक्तं यत् ''स्त्रीणां समादरः कार्यः''। अपि च–

ग्रामे ग्रामे सभा कार्या, ग्रामे ग्रामे कथा शुभा।

पाठशाला मल्लशाला प्रतिपर्व महोत्सवः॥

3. (अ) समन्वयात्मिका शिक्षापद्धतिः

विदाङ्कुर्वन्तु तत्र भवन्तः आसीत्किल महामनसां सूक्ष्मेक्षणमयी दृष्टिः। महामनोभिः चिन्तितं यत् परिस्थितीनां चरित्रनिर्माणे महत्त्वपूर्णं स्थानं भवति। बुभुक्षितः दरिद्रश्च समाजः कथमपि चरित्रसंरक्षणं कर्त्तुं न प्रभवति। तेषामेव वचनमिदमासीद्यदस्माकं प्रथमं कर्त्तव्यं सर्वेषां कृते अन्नवस्त्रादीनां समायोजनं वर्तते। अतः प्राचीनभारतीयसंस्कृतिपोषकैः महामनस्कैः प्राचीनज्ञानविज्ञानानां शिक्षणेन सह समाजस्यार्थिकविकासाय अत्याधुनिकचिकित्साधातुकृषिखननविज्ञानानां वैद्युदभियान्त्रिकीत्यादिविषयाणामुच्चशिक्षायाः प्रबन्धः विश्वविद्यालये कृतः। अनेनैव ज्ञायते यच्चरित्रनिर्माणे परम्परया सह अर्वाचीनतायास्सद्गुणानामपि समर्थका आसन्। इत्थं चरित्रनिर्माणे शिक्षायामुभयोर्मिश्रणं वांछितम्।

4) शिक्षायां नैतिकगुणानां समावेशः

चरित्रोन्नयने दयादानसदाचारपरोपकारदृढतात्यागमैत्रीभावसत्य-धैर्यप्रभृतीनां नैतिकगुणानां समावेशोऽपेक्षते। समेषामेतेषां नैतिकगुणानां विकासमूलं धर्माचरणमेव। महामनोभिः प्रतिपादितं यत्– भारतीयगृहस्थैः पञ्चयज्ञाः दैनिककर्त्तव्यत्वेनानुष्ठेयाः। सर्वैः सर्वतो भावेन एते गुणाः धारणीयाः–

(अ) सत्याचरणम्

मनसा वाचा कर्मणा सर्वदा सत्यं समाचरणीयं नानृतम् -यत् सर्वलोकहितसम्पादने प्रभवति, समाजस्य संरक्षणं विदधाति तत्सत्यम्। जीवने सर्वदा तैः राजनीतिज्ञरूपेण अधिवक्तृरूपेण च सत्यस्यैव पक्षः गृहीतः। तेषां वचनमासीद्यत्–

यतः सत्यं यतो धर्मो यतो ह्रीरार्जवं यतः।
ततो भवति गोविन्दो यतो कृष्णस्ततो जयः॥

बाल्यकालेऽपि स्वकीयां दैनिकचर्यां मातरं प्रतिदिनं मालवीयमहोदयाः कथयन्ति स्म्। सत्यवचनादेव नैकेभ्यः दोषेभ्यः मदीयं रक्षणं जातमिति मालवीयमहोदयानां वचनम्। कस्यामपि परिस्थितौ सत्येतराचरणं न विधेयमिति। स्वजीवनेऽहर्निशमनुपालितं तैरिदन्यत–

चलेद्धिहिमवाच्छैलो मेदिनी शतधा भवेत्।
द्यौः पतेत सन्नक्षत्राः न मे मोघं वचो भवेत्॥

अपि च –

सत्याधारतपस्तैलं दया वृत्तिं क्षमा शिखा।
अन्धकारे प्रवेष्टव्ये दीपो यत्नेन धार्यताम्॥

(ख) दृढता

जीवने स्वकीये सङ्कल्पे दृढता स्यादिति महामनसां दृष्टिः। विश्वासः दृढता स्वीये विचारमिदं प्रतिपादयतां महामनसां कथनमासीद्यत् सङ्कल्पो शीर्षतमो भवेत् प्रवृत्तिश्च दृढतमा भवेत्, यावत्पर्यन्तञ्च लक्ष्यप्राप्तिर्न स्यात्तावद्यत्नो विधेयः। यतो हि–

मनस्येकं वचस्येकं कर्मण्येकं महात्मनः।

ते सर्वदोद्बोधयन्ति स्म ''अर्जुनस्य प्रतिज्ञे द्वे न दैन्यं न पलायनम्''। सर्वेषां कृते गीतायाः मामनुस्मर युद्ध्य चेति भगवद्वचनमिदमुद्धृत्य स्वकर्मणि प्रेरयन्ति स्म।

(ग) प्राणिमात्रेषु मैत्रीभावः

सामाजिकत्वात् समाजे सर्वेभ्यो मित्रवदाचरणं भवेत् सौहार्द्रञ्चोत्पद्येदिति तेषामभिमतम्। मैत्रीभावनेयमेव राष्ट्रभक्तिप्रेरिका आत्मोन्नतेश्चाधारशिला। समाजे न हि कश्चन श्रेष्ठः न वाधमः यथा ब्राह्मणः अध्ययनाध्यापनेन पूज्यः क्षत्रियः प्रशासनेन श्रेष्ठः तथैव कृषिकार्यकौशलेन अर्थव्यवस्थासञ्चालनेन च वैश्यशूद्रयोरपि समाजे स्वानुगतं वैशिष्ट्यं वरीवर्ति। अतः सर्वदा ध्यातव्यम् –स्वे-स्वे कर्मण्यभिरताः संसिद्धिं लभते नरः।

प्राणिमात्रेषु बन्धुत्वभावना स्यादेतदर्थमेवोपदेशः कृतः–

सनातनीयाः समाजाः सिक्खाः जैनाश्च सौगताः।
स्वे स्वे कर्मण्यभिरताः भावयन्तः परस्परम्॥

चरित्रवता पुरुषेण सर्वदेयं भावना मनसि धेया यत् ''**सर्वे भवन्तु सुखिनः**''। चरित्रस्य विकासः एतादृशो भवेत् येन जनानां व्यवहारे - एते गुणाः उद्भन्तु–

विश्वासः दृढता स्वीये, परनिन्दाविवर्जनम्।
तितिक्षा मतभेदेषु, प्राणिमात्रेषु मित्रता॥

(घ) परोपकारभावना

परोपकारेणैव समष्टेर्व्यष्टेर्वा समुत्कर्षो जायते। विश्वबन्धुत्वं समाजसेवित्वं देवत्वञ्च विकसति। स्वत्वपरत्वभाव-परित्यागेनैवोदारचरितत्वं महात्मत्वं चरित्रोन्नतिं च सिद्धयति। स्वजीवनस्य लक्ष्यमेव महामनोभिरुद्घोषितं यत्–

न त्वहं कामये राज्यं न स्वर्गं न पुनर्भवम्।
कामये दुःखतप्तानां प्राणिनामार्तिनाशनम्॥

छात्रेभ्योऽपि तेषामुपदेश आसीत्–

परोपकारशून्यस्य धिड्मनुष्यस्य जीवनम्।

त्यागभावनया एव चरित्रोन्नतिर्भविष्यति। यत्र हि प्राणिनां दुःखोन्मूलने परोपकारमूला प्रवृत्तिर्नास्ति तत्र हि चारित्रिकगुणानामुन्नतिर्कदापि भवितुं नार्हति। अत एव महामनसां दृष्टिरियं यत्–

दया बलवता शोभा न त्याज्या धर्मचारिभिः।

5) छात्राणां कृते चिन्तनम्

पूर्वोक्तसद्गुणैः युक्तेषु सत्स्वपि छात्राणां विशेषदायित्वं वर्तते। त एव राष्ट्रविकासस्य सूत्रधाराः, विद्यार्थिणां कृते मुख्यतयोद्बोधनमासीद्यत्–

सत्येन ब्रह्मचर्येण व्यायामेनाथ विद्यया।
देशभक्त्यात्मत्यागेन सम्मानार्हो सदा भव॥

अर्थात् नैतिकगुणैस्सह छात्रैश्शारीरिकविकासोऽपि कर्त्तव्यः तदर्थं ब्रह्मचर्यानुष्ठानञ्च कर्त्तव्यम्। ब्रह्मचर्यं नाम मनसा वाचा कायया धर्मसंस्कृत्योर्पालनम्। ब्रह्मचर्येणैव व्यवहारे कुशलता मनसि स्थिरता बुद्धावेकाग्रता आचारे शुचिता कर्मणि तत्परता चोत्पद्यते। भारतीयसंस्कृतेर्प्राणभूतस्य धर्मस्य बीजमिदं ब्रह्मचर्यम्। एवमेव देशभक्तिपूर्वकं स्वार्थरहितं जीवनंयापनं विधाय छात्राः सम्मानयोग्याः भविष्यन्ति।

6) सामाजिकराजनैतिकोन्नतिविषये शिक्षायाः चिन्तनम्

चरित्रवता पुरुषेण समाजे कथमाचरितव्यमिति महामनसां जीवनेनैव ज्ञायते। ते स्वयमेव कुशलाध्यापकाः राजनीतिज्ञाः, धर्मज्ञाः न्यायवादिनश्चासन्।

भारतीयसंस्कृत्यनुसारं जीवनमिदं न केवलं भोगार्थमेवापित्वात्मोन्नतेः प्रमुखं साधनम्। सर्वेषां मनसि **वसुधैव कुटुम्बक**स्य भावना भवेदिति तेषां विचारः। समाजसुधारकैः मालवीयैः समाजस्य ह्रसितमूल्यानां व्याप्तकुप्रथानामुन्मूलनाय 1916 तमे इस्वीये वर्षे **प्रतिज्ञाबद्धकुलिप्रथायाः** विरोधः कृतः,बालविवाहस्य अन्तर्जातीयविवाहस्य बलिप्रथायाः धनप्रथायाश्च सर्वदा विरोधः कृतः। हिन्दूनां धर्मपरिवर्तनेन क्षुब्धैरेभिः शूद्राणामुद्धाराय **अंत्यजोद्धार**नामकः कार्यक्रमः प्रचालितः। सामाजिकचरित्रविकासार्थं समाजे सरसतायाः भावना तैर्प्रसारिता। अत एव समाजस्य चत्वारो वर्णाः स्तम्भरूपाः तैर्प्रतिपादिता यथा–

चातुर्वर्ण्यं यत्र सृष्टं गुणकर्मविभागशः।
चत्वार आश्रमाः पुण्याश्चतुर्वर्गस्य साधकाः॥

समाजे कीदृशमाचरितव्यमिति तैरूपदिष्टं यत्–

स्त्रीणां समादरः कार्यो दुःखितेषु दया तथा।
अहिंसका न हन्तव्या आततायी वधार्हणः॥

तैर्निगदितं यत् – यदैषा मानवतावादिविचारधारा जनानां मनसि समागमिष्यति तदा समाजे विद्यमानानां सर्वासां समस्यानां निराकरणं स्वयमेव भविष्यति किञ्च चरित्रनिर्माणमपि उत्कृष्टतया भविष्यतीत्यत्र न कश्चन संदेहावसरः।

राजनैतिकधर्मराजनीत्योः विषये ते स्पष्टमाहुः यद्धर्मं विना राजनीतिरुच्छृंखला एव। सम्प्रति व्यवस्थां नियन्त्रितुमक्षमेयं राजनीतिः किंकर्त्तव्यविमूढतया विषीदन्ती तिष्ठतीति पश्यामो वयम्। अतः धर्मयुक्ता सच्चरित्रयुता राजनीतिरेव राष्ट्रस्य कल्याणाय प्रजासु सुखशान्त्योः प्रवर्तनाय च कल्पिता महामनोभिः।

7) राष्ट्रभक्तिः

अस्माकं सर्वेषां शैक्षणिकोपलब्धीनां परमलक्ष्यं राष्ट्रोन्नतिरेव । यत्र देशभक्तिर्नास्ति तज्जीवनं शुष्कमेव। अतः सर्वदा **माता भूमिः पुत्रोऽहं पृथिव्याः** इति सर्वदा मनसि ध्येयम्। महामनोभिरुक्तं यत् राष्ट्रभक्तिं विना शून्यमिदं जीवनम्। तद्यथा–

न यत्र देशोद्धृतिकामनास्ते न मातृभूमेर्हितचिन्तनञ्च।
न राष्ट्ररक्षा बलिदानभावः श्मसानतुल्यं नरजीवनं तत्॥

तेषां जीवने पश्यामो वयं तैः राष्ट्रसेवायै स्वपदवी त्यक्ता। देशभक्तेर्भावना अस्माकं मनसः स्वार्थत्वमपनयति। स्वार्थं परित्यज्य देशभक्त्यामेव स्वकीयोन्नतिः, देशसेवायां न हि कश्चन प्रमादः कर्त्तव्यः। सर्वेऽपि जनाः मातृसेवकाः–

पारसीयैर्मुसल्मानैरीसाईयैर्यहूदिभिः।
देशभक्तैर्मिलित्वा च कार्या देशसम्मुन्नतिः॥

एषा राष्ट्रभक्तिः संस्कृतिसंरक्षणेन धर्मानुपालनेनैव सम्भवति। यथा सर्वाः नद्यः सागरे शान्तिमुपयान्ति तथैव सर्वेषां नैतिकगुणानां

राष्ट्रहितौ एव पारमार्थिकत्वम्। अतः–

मातृभूमिः पितृभूमिः कर्मभूमिः सुजन्मनाम्।
भक्तिमर्हति देशोऽयं सेव्यः प्राणधनैरपि॥

४) शिक्षाक्षेत्रे महामनसां सदुपदेशाः

चरित्रनिर्माणे महामनसां केचन प्रमुखाः सूत्रात्मकाः विचाराः- एते सन्ति–

- मनुष्येषु श्रद्धा भवेत्। इयं श्रद्धैव भक्तिः। एषा भक्तिः राष्ट्रं प्रति मातापितृगुरुन् प्रति प्राणिमात्रस्य कल्याणाय च भवेत्।
- दुर्व्यसनरहितं जीवनं यापनीयम्। मनुष्यविवेकघातकं व्यसनं कदापि सच्चरित्रपोषकं भवितुं नार्हति।
- स्वभावे कर्त्तव्यपरायणता भवेत्। स्वधर्मानुसारं कर्माचरणेनैव जनाः संसिद्धिमाप्नुवन्ति।
- स्वकीयं कर्म स्वयमेव कर्त्तव्यम्। स्वावलम्बनं चरित्रस्य विशिष्टमेकं गुणम्। पराश्रितः जनः कदाप्यात्मोन्नतिं राष्ट्रोन्नतिञ्च कर्तुं न प्रभवति।
- सर्वेषां दुगुर्णानां मूले लोभ एव। अतः चरित्रनिर्माणार्थमिन्द्रियाणां वशीकरणमत्यावश्यकम्। लोभादेव क्रोधः, तास्माद्मोहः प्रवर्तते, एष मोह एव सर्वेषां चारित्रिकदुर्गुणनां मूलम्। अतः, सन्तोषमवधेयम्।
- राष्ट्रधर्मः, राष्ट्रभूषा, राष्ट्रभाषा च सदानुपालनीया तेनैव स्वकीयायाः परम्परायाः गौरवानुभूतिर्भविष्यति।
- दानभोगनाशरूपा त्रिविधा धनस्य गतिः, अतः दानानुपूर्वको भोगः कर्त्तव्यः। एषा त्यागभावना एव सच्चरित्रस्य लक्षणम्।
- स्वस्थशरीरे एव स्वस्थचित्तं निवसति। अतः योगाभ्यासव्यायामादिभिः स्वस्थशरीरमवाप्तव्यम्।
- सर्वतोन्मुखी प्रतिभोत्पादनीया। राष्ट्रभाषया सह विश्वस्तरीया भाषापि ज्ञातव्या। प्राचीनैस्सहार्वाचीनज्ञानविज्ञानमप्यध्येतव्यम्। इत्थं चरित्रस्य सर्वाङ्गीणविकासः सम्भविष्यति।
- इत्थं स्पष्टतया ज्ञायते यत् कीदृशी धर्मपरम्परा उदारकल्पनादृष्टिश्च चरित्रनिर्माणे महामनसामासीत्। चरित्रनिर्माणस्य विभिन्नेषु पक्षेषु विलक्षणा दृष्टिः महामनोभिः प्रदत्ता। वस्तुतः भागीरथ्याः पश्चिमतटे सांस्कृतिकराजधान्यां काश्यां प्राचीनार्वाचीन-ज्ञानविज्ञानयोः अप्रतिमे केन्द्रे काशीहिन्दूविश्वविद्यालये भगवतो विश्वनाथस्यावस्थितिः, विश्वविद्यालयीयभवनेषु भारतीय-शिल्पकलायाः विन्यासः, गुरुशिष्ययोः गुरुकुलसदृशी आवासव्यवस्था प्रकृतेः मनोहरत्वञ्च स्वयमेव महामनसां धर्मनिष्ठवैज्ञानिकचिन्तनपरम्परायाः द्योतकं वर्तते। महामनसां धर्मोपदेशमिदमासीद्यत् - पृथ्वीमण्डले यद्वस्तु मह्यं सर्वाधिकं रोचते तद्वस्तुधर्मोऽस्ति, स च सनातनो धर्मः। अतः समाजेऽपि धर्माचरणेनैव स्वकीया चरित्रोन्नतिः राष्ट्रस्य प्रगतिश्च भविष्यति।[13]

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अङ्गविद्या ''एकं प्राचीनं विज्ञानम्''

गणेश त्रिपाठी एवं डा0 शत्रुघ्न त्रिपाठी***

प्राचीनकालादेव भारतीयसंस्कृतेः पुरातनज्ञानविज्ञानं जनमनस्सु धर्मप्राणगङ्गारूपेण प्रतिष्ठितमासीत्। तत्कालस्य सर्वं प्रस्फुटितं ज्ञानविज्ञानं वेदब्राह्मणारण्यकोपनिषत्पुराणदर्शनधर्मशास्त्रव्याकरण-ज्योतिषायुर्वेदादिषु शास्त्रग्रन्थादिषु निगुढरूपेण प्रसरितमासीत्। एतत्सर्वं वेदादिकं विज्ञानं चतुर्वर्णादिषु धर्मतत्वादिमाध्यमेन दीयते स्म। एषु वेदादिषु प्रत्यक्षविज्ञानरूपेषु सिद्धान्तसंहिताहोरास्कन्धस्य ज्योतिषशास्त्रस्य सर्वोत्कृष्टं स्थानं वरीवर्ति। सिद्धान्तहोरां विहाय संहितास्कन्धेषु विश्वस्य समग्रं भौगोलिकं, रसायनं, खगोलीयं, मेदिनीयं, प्रवर्षणं, गृहनगरपुरादिकं, वृक्षायुर्वेदादिकं, सर्वं विज्ञानमयमेव। पुनश्च वराहोक्ततिसृषु वास्तुविद्याङ्गविद्यावायसविद्यासु व्यक्तिगतरूपेण मानवीयं शरीरस्थशुभाशुभलक्षणचिन्हादिकं स्पर्शा-स्पर्शादिकं वीक्ष्य प्रागेव तच्छुभाशुभमानोन्मानलाभालाभफलकथनं तु अङ्गविद्ययैव क्रियते। अङ्गविद्यायां भूचरादिजीवानां विशेषतया मानवानां आपादादारभ्य नख – गुल्फ - जङ्घा – जानु - मेढ्र - मुरुष्क – नाभि – कटि – उदर – हृदय – स्तन - जत्रु – हस्त – ओष्ठ – स्कन्ध – ललाट - शिरादिकं प्रत्येकमङ्गं सुतरां सम्यक्तया सूक्ष्मदृष्ट्या च विचार्य तज्जन्यगुणस्वभावप्रकृतिविकृतिलाभालाभादिकं फलं विचार्यते। अङ्गविद्याया अपरं नाम सामुद्रिकशास्त्रमपि विद्यते। यतः अङ्गशास्त्रस्य सर्वं मानोन्मानलक्षणप्रकृतिस्वरस्वभाव-चेष्टास्नेहगतिसारधातुक्षेत्रादिकं शुभाशुभलक्षणं तत्फलं च सर्वप्रथमं समुद्रनाम्ना ऋषिणा जनकल्याणहेतवे मानवाय प्रोक्तम् ।पुनश्च ज्योतिषशास्त्रीयसंहिताग्रन्थेषु प्रक्षिप्तस्थलेषु **समुद्रवचनं यथा, प्राह समुदः,** इत्यादिकं वचनं प्राप्यते। अतः तेन समुद्रेण प्रोक्तमङ्गलक्षणचिन्हादिकमभिलक्ष्य प्रसरितं शास्त्रं सामुद्रशास्त्रमिति लोके प्रसिद्धम्। सामुद्रिकशब्दस्योत्पत्तिः समुद्रशब्दे ठञ् प्रत्यये कृते सति भवति। यस्यार्थः भवति समुद्रे प्रोक्तं पुरुषस्त्रीलक्षणमिति ।अतः सामुद्रिकशास्त्रस्यापरमामैवाङ्गविद्येति। यतः प्रोक्तम्–

सामुद्रमङ्गलक्षणमिति सामुद्रिकमिदं हि देहवताम्।
प्रथममवाप्य समुद्रः कृतवानिति कीर्त्यते कृतिभिः॥[1]

ज्योतिषशास्त्रस्य वैज्ञानिकत्वं न केवल प्राच्यविद्वांसः स्वीकुर्वन्ति अपितु पाश्चात्यविद्वांस अपि मुक्तकण्ठेन स्तुवन्ति। समग्रज्ञानविज्ञानसमोपेतमिदं ज्योतिषशास्त्रं सर्वत्र समानरूपेण लोके प्रतिष्ठितमस्ति। The Spiritual Science research foundation नाम्ना प्रसिद्धा एका भारतीयसंस्था विद्यते। या खलु ज्योतिषशास्त्रस्य विविधविषयमधिकृत्य तस्य वैज्ञानिकत्वं विविधानुसन्धानप्रयोगैः परीक्षणैः आध्यात्मिकप्रयोगैश्च सिद्ध्यति। विविधवैज्ञानिकयन्त्रप्रयोगै अनया संस्थया प्रमाणितं यत् ज्योतिषशास्त्रं सुतरां प्राचीनं विज्ञानमस्ति। इदं शास्त्रं कालानुक्रमेण समये समये परीक्षणं संशोधनं चेच्छति यथा आधुनिकैः विज्ञानविद्भिः क्रियते। अथ चाध्यात्मिकीं शक्तिमेवानुसृत्य ज्योतिषज्ञाः सटीकफलादेशं कर्तुं शक्नुवन्ति।

यथोच्यते

Astrology just like **modern sciences** is part of the all-encompassing science of Spirituality. The reason for this is that Astrology has been confirmed and reconfirmed based on observation, inference and conclusion just like modern sciences. However the use of intuition in the science of Astrology is only possible if the astrologer is of a high spiritual level. Astrology has its roots in the ancient Indian Vedic scriptures. Sages of ancient India knew many facts about our universe thousands of years ago that are only being known to modern science in the recent past. Astrology is quite unique as a science and knowledge system as it perceives a certain extent of the subtle world that cannot be perceived by the five senses mind and intellect. For example, Astrology can tell if one is being affected by ancestors, based on the position of celestial bodies. Also with regards to the entire debate about whether Astrology is a science or not and the reasons or arguments made against it the following points can be borne in mind. It seems that Astrology has got the shorter end of the stick in terms of modern sciences judging it. A science does not have to be 100% right to be considered a science. For example, if a geologist (despite billions of dollars in funding) cannot tell where and when the next earthquake will strike, we do not say that geology is not a science. If a doctor makes a wrong diagnosis we do not discredit the entire medical profession. Doing so would be like throwing the baby out with the bath water. On account of fairness we should use the same rigorous judgment system that we have for knowledge systems, like Astrology, for **modern sciences** too.[2]

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*शोधच्छात्रः, ज्योतिषविभागः, संस्कृतविद्याधर्मविज्ञानसङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी
**सहायकाचार्यः, ज्योतिषविभागः, संस्कृतविद्याधर्मविज्ञानसङ्कायः, काशीहिन्दूविश्वविद्यालयः, वाराणसी

अङ्गविद्याप्रकाराः Kinds of physiology

अङ्गशास्त्रस्य विषयक्षेत्रं तु अत्यधिकं विस्तृतमस्ति। यस्मिन् गो- वाजि – हस्ति – काक - मृग - शृगाल – कुक्कुट – छाग – पक्षि – मयूर - मनुष्य नारी - इत्यादिकानां प्राणीनां सर्वमङ्गचिन्हादिकमध्ययनं भवति। विशेषतया केवलं नृनारीणामङ्गानां चिन्हानामध्ययनमङ्गविद्यायां भवति। एतेष्वपि द्वयोः नृनार्योः विचार्यक्षेत्रमत्यधिकं विशदमस्ति। यथा पुरुषशरीरलक्षणं, स्त्रीशरीरलक्षणं, पादतलं, पादतलरेखा, पादपृष्ठं, पादाङ्गुल्यः, अङ्गुष्ठः, नखाः, रोमायुः, जानु, जङ्घा, कटिः, गुप्ताङ्गं, मैथुनं, उदरं, नाभिः, नितम्बः, वक्षः, स्तनौ,बाहू, स्कन्धौ, हस्तरेखा, हस्ताङ्गुल्यः, ग्रीवा,कण्ठः, नासिका, दन्ताः, मुखं, ललाटं, वर्णः, शिरः, कर्णौ, कपोलौ, गण्डौ, हनु, चिबुक, भ्रुवौ, प्लक्ष्म, नेत्रे, जीह्वा,स्वप्नः, पल्लीपतनं, अङ्गस्पर्शः, छिक्का, स्वप्नः, प्रश्नकालिकाङ्गस्पर्शः, प्रकृतिः, गतिः, संहतिः, स्वरः इत्यादयः। सामुदिकशास्त्रस्य लक्षणानि पूर्वमेव विलोक्य सामुद्रवित् व्यातितानि शुभाशुभफलानि आगतानि शुभाशुभफलानि च पूर्वमेव प्रदर्शयति। तत्र आचार्य वराहमिहिरेण अङ्गविद्यायाः मुख्यरूपेण त्रयोदश भागाः स्वीकृताः। एतेषु त्रयोदशभागेष्वेव अङ्गविद्यायाः सर्वे विषयाः समाहिताः भवन्ति।एते विभागाः केवलं मनुष्याणां कृते न भवति अपित स्त्रीणां कृते अपि भवति। वस्तुतस्तु नृनार्योः स्वभावः मिथः भिन्नः भवति। कतिपयेषु स्थलेषु द्वयोः साम्यं भजते कतिचिच्च वैषम्यं भवति। यतः पुरुषस्वभावः तीक्ष्णः नारीस्वभावश्च प्रकृत्या मधुरः भवति। अतः अङ्गविद्यायाः लक्षणानि पुरुषस्त्रियभिलक्ष्य विभिन्नानि विरचितानि। तथापि अधिकं साम्यमेव प्रतीयते। अङ्गविद्यायां पुरुषलक्षणस्य त्रयोदश प्रकाराः वर्तन्ते। यथा–

1.उन्मानम् Height	2.मानम् Weight	3.गतिः Momentum	4.संहतिः Intensity
5.सारः Substance	6.वर्णः Complexion	7.स्नेहः Balsamic	8.स्वरः Vocal
9.प्रकृतिः Nature	10.सत्वम् Entity	11.अनूकम् Rebirth fiction	12.क्षेत्रम् Parts of body
13.छाया Shadow			

उन्मानमानगतिसंहतिसारवर्णस्नेहस्वरप्रकृतिसत्वमनूकमादौ।
क्षेत्रं मृजा च विधिवत् कुशलोऽवलोक्य-
सामुद्रविद्वदति यातमनागतं वा।।[3]

अथ च वराहोक्तपुरुषस्य त्रयोदशप्रकारमुक्त्वा विशेषेण स्त्रीणामङ्गविद्यालक्षणप्रकरणे अष्टधा लक्षणानि वर्णितानि वर्तन्ते स्कन्दपुराणे काशीखण्डे। तासां स्त्रीणां पादादारभ्य शिरः यावद् षट्षष्टिः शरीरस्य अङ्गानि सलक्षणानि सफलानि च प्रोक्तानि । एतेषां सर्वेषामङ्गानामन्तर्भावः अष्टाङ्गे भवति। यथोक्तम्-

वपुरावर्त गन्धाश्च छाया सत्वं स्वरो गतिः।
वर्णश्चेत्यष्टधा प्रोक्ता बुधैर्लक्षणभूमिका।।[4]

1.वपुः Body	2.आवर्तः Spire	3.गन्धः Smell	4.छाया Shadow
5.सत्वम् Entity	6.स्वरः Vocal	7.गतिः Momentum	8.वर्णः Complexion

पुनश्चोभयोः स्त्रीपुरुषयोः समानत्वमाह –

यन्नोक्तं पूर्वस्मिन्नौचित्यात्तन्नरेऽपि नारीवत्।
यदमुष्मिन्नपि न पुनः सकलं तन्नरवदप्यूह्यम्।।[5]

अतः पुरुषस्त्रीणामङ्गविद्यायाः विचारः समतोवभावेनैव क्रियते। यल्लक्षणं स्त्रीषु नोक्तं तत्सर्वं पुरुषस्यावशिष्टं लक्षणं स्त्रीषु विचार्यं पुनः यल्लक्षणं पुरुषेषु नोक्तं तत्सर्वं स्त्र्या अवशिष्टं लक्षणं पुरुषेषु विचार्यमिति भावः। यथा पुरुषेषु त्रयोदशभागादतिरिक्तं वपुः, आवर्तः, गन्धश्चाधिकतया विचार्यम्। पुनश्च स्त्रीषु अष्टधा प्रकारमतिरिक्तं पुरुषलक्षणप्रोक्तत्रयोदशविभागेषु छाया-सत्व-स्वर-गति-वर्णान् विहाय सर्वं संयोज्यमिति। एवम्प्रकारेण अङ्गविद्यायाः अष्टादशविभागाः भवन्ति शुभाशुभफलकथनप्रसङ्गे। येन विज्ञाय सामान्यपुरुष अपि भूतभविष्यवर्तमानसम्बन्धिनं ज्ञानं सम्यग्तया कर्तुं शक्यते ।किन्तु अस्य शास्त्रस्य फलादेशकथनस्य सात्विकी यथार्थता तु पूर्णतया दैवज्ञोपरि निर्धारिता भवति। यदि दैवज्ञः परिपूर्णरूपेण सामुद्रिकशास्त्रस्य ज्ञानमवाप्य प्रायोगिकरूपेण वैज्ञानिकविधिनानुदिनं परीक्षणं करोति तथा तस्येष्टानिष्टफलं दिक्देशकालानुसारेण निर्धारयति तदेव तस्य फलकथनस्य साफल्यं ज्ञेयमन्यथा तु नगरद्वारलोष्ठवदेव नक्षत्रसूची भवति केवलमनर्गलं प्रलपति वैदग्धं विपरीतं च भाषते। इदमेवोक्तं वर्तते–

According to the science of astrology, on an average in the present era **65% of our lives** are ruled by destiny and **35% by willful** action (freedom to choose). As mentioned earlier, Astrology is generally applied in **four** ways. What is the maximum amount of accuracy that can be obtained on average in these four applications of Astrology? Astrology research carried out indicated the following results: This accuracy is based on the ability to ascertain the root cause of a problem across the physical, psychological and astrology dimension.[6]

Application	Predictive	Diagnostic	Basic nature and compatibility	Decision making
Meaning of application	To know about what lies ahead	To act as an aid to understand the root cause of a difficulty affecting any aspect of life.	To understand one's basic nature and compatibility with life partners or profession based on each other's star signs or horoscope.	This includes knowing the auspicious time for a planned event or answering a specific question such as when one should get married.
Maximum accuracy (through research**)**	30%	27%	27%	5%

अतः पूर्वोक्तसंस्थाद्वारा वैज्ञानिकविधिना परीक्षणैः तथ्यैरेव ज्ञानमवाप्य सामुद्रिकशास्त्रस्य ज्ञाता इष्टानिष्टफलमादिशेत् ।अत्र ज्योतिषशास्त्रोक्तानुसारेण क्रमशः त्रयोदशानां अङ्गविद्यातत्वानां वर्णनं साररूपेण संहिताग्रन्थाधारेण च क्रियते।

1. उन्मानम् Height

उन्मानं नाम शरीरस्योन्नति उर्द्ध्वमङ्गुलप्रमाणेन ।यदि पुंसामात्मीयाङ्गुलप्रमाणेनाष्टाधिकशतं 108 परिमाणं भवति तदोत्तममुन्मानं परिज्ञायते। यदि षण्णवति 96 अङ्गुलानि शरीरस्योन्नतिः भवति तदा तु मध्यम्। पुनश्चात्मीयाङ्गुलप्रमाणेन पुंसां चतुरशीतिरङ्गुलान्युन्मानं भवति तदा तु हीनं मानं भवति। गणनेयमुत्थितस्य पुरुषस्य भूपादसंयोगाच्छिरो मध्यं यावत् सूत्रेण मापयेत्। यथा-

अष्टशतं षण्णवतिः परिमाणं चतुरशीति पुंसाम्।
उत्तमसमहीनानामङ्गुलसंख्या स्वमानेन॥[7]

2. मानम् Weight

मानं नाम भारः। पुरुषस्य केवलं भारमेव ज्ञात्वा सामुद्रिकशास्त्रे शुभाशुभपरिज्ञानं क्रियते। यदि स्वस्थपुरुषस्य भारः तुलायां तुलिते सहस्रपलप्रमाणं यावत् भवति तदा सः सुखभाक् भवति। सहस्रपलाद्रस्वं यदि स्यात् तदा तु दुःखभाक् भवति ।यदि पलसहस्रद्वयं भारः भवेत् पुरुषस्य तदा तु सः सार्वभौमः राजा भवति ।भार इति पदेन सहस्रपलद्वयं गृह्यते। यथा –

भारार्धतनुः सुखभाक् तुलितोऽतो दुःखभाग्भवत्यूनः।
भारोऽतीवाढ्यानामध्यर्धः सर्वधरणीशः॥[8]

3. गतिः Momentum

गतिर्नाम पुरुषस्य स्वाभाविकगत्या गमनम्। केवलं पुरुषस्य गतिमेवालोक्य फलकथनसामर्थ्यं तु सामुद्रवेत्तैव कर्तुं शक्नोति ।इदमेव प्राचीनं विज्ञानं ज्योतिषम्। यदि कस्यचन पुरुषस्य गमनं वीक्ष्य इदमेव प्रतीयते यत् एषस्तु शार्दूल-हंस-सिंह-हस्ती-वृष-मयूरवच्च चलति तदा सः राजतुल्यो भवति। एषां गमनैस्तुल्याः सदृशगतयः राजानः भवन्ति। येषां गमनेन पृथिव्यां शब्दं न भवति निःशब्दं चलन्ति ते धनिनः भवन्ति। ये च मण्डूकवत् शीध्रगामिनः भवन्ति ते स्वभावेन दरिद्राः भवन्ति। यथोच्यते –

शार्दूलहंससमदद्विपगोपतीनां तुल्या भवन्ति
गतिभिः शिखिनां च भूपाः।
येषां च शब्दरहितं स्तिमितं च
यातं तेऽपीश्वरा द्रुतपरिप्लुतगा दरिद्राः॥[9]

4. संहतिः Intensity

संहतिर्नाम निर्दिष्टाङ्गानां सर्वाङ्गसन्धिनां च सुश्लिष्टत्वं सघनता च। यदि देहस्य सर्वसन्धिस्थानं जानु-कूर्पर-कटिप्रभृतं समुचित-पलेनोपनिबद्धं तदा एतादृशः पुरुषः धनी भवति। पुनश्चेत् पुरुषस्य पञ्चस्थानानि **दन्त-अङ्गुलिपर्व-केश-त्वक्-नखाश्चेति** स्थानानि सूक्ष्माणि स्युस्तदा पुरुषः सर्वसुखान्वितो भवति। उच्यते–

सूक्ष्माणि पञ्च दशनाङ्गुलिपर्वकेशाः
साकं त्वचा कररुहा न च दुःखितानाम्॥[10]

5. सारः Substance

सारो नाम देहस्थ धातुनां शक्तिः ।प्रत्येकं शरीरे सप्तसाराः अधिकाल्पमात्रायां निवसति ।कस्यचिद् शरीरे प्रभूतेन कस्यचिच्चाल्पेन परिमाणेन। सारेणैव पुरुषस्यान्तरिकबाह्यञ्च सौष्ठवं ज्ञायते ।मेद-मज्जा-त्वक्-अस्थि-शुक्र-रक्त-पलानि चेति सप्तसाराः जीवधारिणः शरीरे भवन्ति। यदि मेदाधिक्यः पुरुषस्तदास्थ्यन्तरभागः गभीरः, मज्जाधिक्ये कपोलौ पुष्पवन्तौ, त्वकाधिक्ये सुन्दरं चर्म, अस्थि प्रसिद्धमेव, शुक्रेण कामाधिक्यं, रक्तेन रक्तशरीरं, पलेन च मांसलशरीरं भवति।

सप्त भवन्ति च सारा मेदोमज्जात्वगस्थिशुक्राणि।
रूधिरं मांसं चेति प्राणभृता ंतत्समासफलम्॥[11]

6. वर्णः Complexion

वर्णो नाम शरीरस्य कान्तिः। इह जगति गौर–श्याम-कृष्णवर्णश्च भवति। एतेषु गौरः श्यामश्च शस्तः भवति ।किन्तु कृष्णवर्णः मध्यमः नात्युत्तमः नातिहीनः। स्वजात्यानुसारेणापि वर्णः जायते यथा श्वपचचाण्डालादयः नैसर्गिकाः कृष्णवर्णीयाः भवन्ति। यदि एते नैसर्गिकेतेरवर्णात् स्युस्तदा तेऽनिष्टकराः। यथा गौरवर्णीयः चाण्डालः नेष्टः। पुनश्च विप्राः प्रकृत्या गौराः भवन्तीति श्रुतिः। यदि कृष्णवर्णीयः विप्रः भवेत् तदा स सर्वदानिष्टकारकः भवति। लोकेऽपि प्रायोगिकरुपेणेदं दृश्यते। तद्यथा-

गौरः श्यामः कृष्णो वर्णः सम्भवति देहिनां त्रेधा।
आद्यौ द्वावपि शस्तौ शुभोऽपि शस्तो न सङ्कीर्णः।।[12]

7. स्नेहः Balsamic

स्नेहो नाम स्निग्धता माधुर्यञ्च ।सौभाग्यपुरुषेषु शरीरस्य पञ्चस्थानानि स्निग्धानि भवन्ति। प्रथमं वचनं, द्वितीयं जिह्वा, तृतीयं दन्ताः, चतुर्थं नेत्रयोः, पञ्चमं नखाः। यदि एतानि पञ्चस्थानानि पुरुषस्य शरीरे स्निग्धानि स्युस्तदा सः पुरुषः सुतैः धनैः सौभाग्यैश्च संयुक्तो भवति। यथा जनेषु वाचि यदि मधुरता स्यात् तदा सः जनानाकर्षयति। यदि एतेषु पञ्चसु स्निग्धस्थानेषु जनाः स्निग्धहीनाः भवन्ति तदा ते प्रायः निर्धनाः जायन्ते ।निर्धनशब्देन न केवलं धनमपितु तदङ्गजन्यनिर्धनता ज्ञातव्या। यथोक्तम्–

स्नेहः पञ्चसु लक्ष्यो वाग् जिह्वादन्तनेत्रनखसंस्थः।
सुतधनसौभाग्ययुताः स्निग्धैस्तैर्निर्धना रूक्षैः।।[13]

8. स्वरः Vocal

स्वरो नाम वाणी, कस्यचिदपि पुरुषस्यास्तित्वं परिज्ञानं मनोभावश्च स्वरेणैव ज्ञायते। वाणी एव पुरुषमलङ्करोति। अतः यस्य पुरुषस्य वाणी गज-वृष-अश्व-भेरी-मृदङ्ग-सिंह-मेघसदृशा भवति सो जनः राजा भवति। पुनश्च येषां नराणां वाणी गर्दभ-विकृत-रूक्षसदृशा भवति ते नराः धनसौख्यैश्च रहिताः भवन्ति। यथोक्तम्–

करिवृषरथौघभेरीमृदङ्गसिंहाभ्रनिःस्वना भूपाः।
गर्दभजर्जररूक्षस्वराश्च धनसौख्यसन्त्यक्ताः।।[14]

9. प्रकृतिः Nature

प्रकृतिर्नाम स्वभावः। सिद्धान्तोऽयं प्रसिद्धः यत् अग्नि-पृथ्वी-वायु-जल-आकाशात्मकं पञ्चतत्वात्मकमात्मीयं शरीरं प्रादूर्भवति। एतेषामेव संघटनविघटनेन अधिकाल्पप्रवाहेन च नराणां शरीरे तज्जन्यस्वभावस्योत्पत्तिर्जायते। अग्निस्वभावनरश्चपलः, खलः, अतितीक्ष्णः, क्षुधालुः, क्रूरश्च भवति। पृथ्वीस्वभावनरः स्थिरस्वभावः, सुखी, सम्भोगशीलश्च भवति। वायुजातस्वभावनरः कृशः, अस्थिरमतिः, क्षिप्रक्रोधी भवति। जलस्वभावयुतनरः बहुतोयपायी, अनुकूलभाषी, रसभाजनश्चेति भवति। आकाशस्वभावनरः कलासु निपुणः,शास्त्रकुशलः,सुशिरावयवश्च भवति। अतः बाह्यलक्षणमेव वीक्ष्य जनानां प्रकृतिः अङ्गविद्यया सरलेन परिज्ञायते। तद्यथा–

भूजलशिख्यनिलाम्बरसुरनररक्षः पिशाचकतिरश्चाम्।
सत्वेन भवति पुरुषः लक्षणमेतद् भवति तेषाम्।।[15]

10. सत्वम् Entity

सत्वं नाम चेतोधर्मः, यस्मिन् सति न कुतश्चिद्भयमुत्पद्यते न कस्यामप्यवस्थायां विषादः समुपजायते। प्रत्येकं ग्रहाणां भिन्नं भिन्नं सत्वं समुपजायते। तत्र सूर्यात् परिपूर्णगुणविभागः ज्ञायते। चन्द्रात् शरीरकान्तिः मनोगुणश्च ज्ञायते। भौमात् सत्वं, बुधात् गुरुता, वृहस्पतेः स्वरः, सितात् स्नेहः, सौराच्च वर्णः ज्ञायते। एतेष्वपि विशेषेण सूर्यचन्द्राभ्यामेव शरीरस्य स्वभाव-गुण-पञ्चमहाभूत-प्रकृति-वर्ण-धातु-कान्ति-देहादिपरिज्ञानं भवति। सूयचन्द्रौ यस्मिन् राशौ भवतः तस्माद्बलवशादेव शरीरस्य गुणादिकानामुत्पत्तिर्जायते। यथा यदि सूर्यचन्द्रौ बुधस्य राशौ स्यात् तदा गुणेषु गौरवं समायाति। सूर्यात्सत्वगौरवगुणं चन्द्राच्च शरीरमानसगौरवगुणं जायते ।यदि सूर्यचन्द्रौ कस्मिंश्चिदपि राशौ बलहीनौ भूत्वा स्थितौ भवतस्तदा प्राक्तनेषु गुणेषु न्यूनता दोषश्च सञ्जायते। यथा प्रोक्तम्-

ग्रहाः	सूर्यः	चन्द्रः	भौमः	बुधः	गुरुः	शुक्रः	शनिः
सत्वादिकम्	सत्वम्	शरीरं मानसञ्च	गुणः	गौरवम्	स्वरः	स्नेहः	वर्णः

सत्वमहीनं सूर्याच्छारीरं मानसं च चन्द्रबलात्।
यद्राशिभेदयुक्तावेतौ तल्लक्षणः स पुमान्।।
भौमात् सत्वं गुरुता बुधात् सुरेज्यात् स्वरः सितात् स्नेहः।
वर्णः सौरादेषां गुणदोषैः साध्वसाधुत्वम्।।[16]

11. अनूकम् Rebirth fiction

अनूकं नाम प्राग्जन्म तच्च मुखात् कल्पनीयम्। तच्च त्रिविधं प्राग्जन्म शुभं मध्यं हीनञ्च। येषां पुरुषाणां प्राग्जन्मोत्तमं भवति ते नरा इह जन्मनि पृथिव्यां विशेषमुखादागच्छन्ति। येषां पुरुषाणां वक्त्राः गौ-वृष-सिंह-गरुणतुल्याकाराः भवन्ति तेषां प्राग्जन्म शुभं भवति। पुनश्च ते जितरिपवः, मानवेन्द्राश्च राजानः भवन्ति। अथ च येषां नराणां मुखाः कपि-महिष-सूकर-अजसदृशाः भवन्ति तेषां प्राग्जन्म मध्यमं भवति। ते पूर्वजन्मनि धनिकाः, सुखिनः, शास्त्रज्ञाश्च भवन्ति। येषां नराणां मुखपृष्ठानि गर्दभ-उष्ट्रसदृशानि भवन्ति तेषां प्राग्जन्म हीनं भवति। ते पूर्वजन्मनि निर्धनाः सुखरहिताश्च भवन्ति। अङ्गविद्यायां केवलं मुखमेवालोक्य पूर्वजन्मनः परिकल्पना सामुद्रिकशास्त्रेणैव क्रियते। किमेतद् न विज्ञानमिति। प्रोच्यते-

साध्यमनूकं वक्त्राद् गोवृषशार्दूलसिंहगरुणमुखाः।
अप्रतिहतप्रतापा जितरिपवो मानवेन्द्राश्च।।
वानरमहिषवराहाजतुल्यवदनाः श्रुतार्थसुखभाजः।
गर्दभकरभप्रतिमैर्मुखैः शरीरैश्च निःस्वसुखाः।।[17]

12. क्षेत्रम् Parts of body

क्षेत्रं नाम पदात् प्रभृति शिरः यावत् शरीरस्य सर्वाङ्गानि। अयमेव विभाग अङ्गविद्यायाः सर्वोत्कृष्टतमः वृहत्विभागः। तत्र वराहेण शरीरस्य सर्वाङ्गानि दश क्षेत्रेषु विभक्तानि। प्रत्येकं क्षेत्रस्याध्ययनं विशदं रुपेण क्रियते। शरीरस्य सर्वं शुभाशुभलक्षणं, अधिकाङ्गं, हीनाङ्गं, व्रणः, तिलकमशकादयः, अङ्गस्फुरणं, हस्तरेखा, प्रश्नकालिकाङ्गस्पर्शास्पर्शः, दुःस्वप्नः, छिक्का, आयुःपरिक्षणं, शिरोरेखा, पादरेखा, ललाटमित्यादयः समेषामङ्गानामवशिष्ट-स्थानक्षेत्राणां च विचारः क्षेत्रखण्डे एव क्रियते। दशक्षेत्राणां विभाजनं

पदादारभ्य शिरः यावद् वराहमिहिराचार्येण कृतं सामुद्रिकशास्त्रदृष्ट्या। एतेषु दशक्षेत्रेषु एव समेषामध्याहारो भवति। तद्यथा विभागः

क्षेत्रम्	1	2	3	4	5	6	7	8	9	10
अङ्गानि	चरणौ, गुल्फौ	जङ्घे, जानुनी	उरू, लिङ्गम्	कटिः, नाभिः	उदरम्	हृदयं,स्तनौ	स्कन्धौ, जत्रुणी	ओष्ठौ, ग्रीवा	सभ्रूनेत्रे	शिरः

अत्र कतिचन अङ्गलक्षणानि उच्यते संक्षेपेण। वस्तुतस्तु इदं दशक्षेत्रं तु अत्यधिकं विस्तृतमस्ति। यथा केषाञ्चित् पुरुषाणां ललाटेषु काश्चन रेखाः भवन्ति। तासामेवोल्लेखः क्रियते ललाटलक्षणं चोच्यते। यथा-

तिस्रः रेखा शतजीविनां ललाटायताः स्थिता यदि ताः।

चतसृभिरवनीशं नवतिश्चायुः सपञ्चाब्दा॥

ललाटेनार्धचन्द्रेण भवन्ति पृथिवीश्वराः।

विपुलेन ललाटेन महाधनयुताः स्मृताः॥

विषमेनाधमा ज्ञेया पापा मर्त्याः शिराततैः।

निम्नेन तु ललाटेन क्रूरकर्मरता नराः॥[18]

एवम्प्रकारेणैव पदादारभ्य शिरः यावत् सर्वाङ्गानां शुभाशुभलक्षणानि इष्टानिष्टफलानि च प्रोक्तानि सन्ति ।किन्तु गौरवादत्र नोच्यते जिज्ञासिते वृहत्संहिता द्रष्टव्या।

13. छाया Shadow

छादयति लक्षणानीति छाया, पुनश्च छाया नाम शरीरकान्तिः या शुभाशुभानि फलानि निवेदयति। पञ्चविधा छाया पार्थिवा-वारुणी-आग्नेयी-वायवी-नाभसी चेति। प्रत्येकं छायायाः लक्षणं सफलं प्रोक्तं विद्यते। पुनश्च आभ्यन्तरिकी बाह्या चेति द्विविधा छाया ।आन्तरिकी छाया शरीरान्तर्गततेजसम्बन्धिगुणान् प्रकटीकरोति। बाह्या च शरीरस्थबाह्यगुणान् प्रकटीकरोति। पञ्चमहाभूतात्मिका छाया पञ्चमहापुरुषान् प्रकाशयति। यतः प्रोक्तम्–

छाया शुभाशुभफलानि निवेदयन्ती

लक्ष्या मनुष्यपशुपक्षिषु लक्षणज्ञैः।

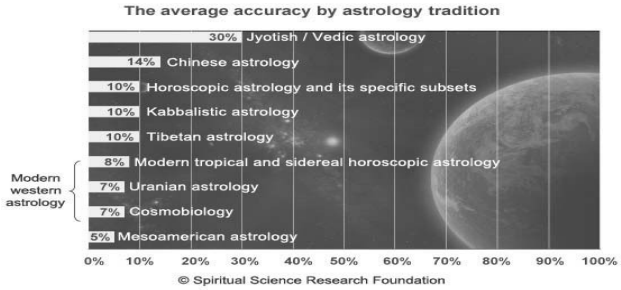
तेजो गुणान् बहिरपि प्रविकाशयन्ती

दीपप्रभा स्फटिकरत्नघटस्थितेव ॥[19]

निष्कर्षः

एतान् सर्वान् विषयबाहुल्यसिद्धान्तान् वीक्ष्यैवेदं ज्ञायते यत् ज्योतिषशास्त्रस्य विज्ञानमपरिमितं विद्यते। येषु सामुद्रिकशास्त्रस्य स्थानं तु सर्वोत्कृष्टमेव। यत अस्य विज्ञानस्य परिज्ञानं तु सामान्यपुरुषैरपि कर्तुं शक्यते। एदत्कृते तु न कस्यचिदपि ग्रहाणां गतिसाधनादिकमपेक्षते। केवलं अङ्गविद्यायाः ज्ञानमवाप्य शुभाशुभलक्षणं दृष्ट्वा आदेशकर्तारूपेण भविष्यवक्तारूपेण च जनमनस्सु विराजते। सामुद्रिकशास्त्रस्य ज्ञाता तु स्वकीयः फलादेशः पत्रिकां विनैव क्रियते। यदि कश्चन जन आगत्य स्वमनोभिलषितकार्यसिद्ध्यर्थं प्रश्नं पृच्छति तदा सामुद्रवित् तज्जन्याङ्गस्पर्शास्पर्शादिरूपेण वातावरणं चालोक्य मनोवैज्ञानिकरूपेण तस्य प्रश्नस्य सटीकं समाधानं ददाति ।पूर्वोक्तसंस्थया सर्वेक्षणमेकं कृतं यत् कस्य देशस्य ज्योतिषविद्या कियत्साफल्यमस्ति ।प्रश्नस्य समाधानं तु अधोलिखिततालिकारूपेण सर्वेक्षणैः वैज्ञानिकपरीक्षणैश्च प्राप्तम्। तेषु भारतीयवैदिकज्योतिषस्य स्थानं सर्वोत्कृष्टं सर्वोपरि च विद्यते। भारतीयज्योतिषस्य फलादेशः सर्वविज्ञानं च विश्वस्य शतप्रतिशतेषु त्रिंशतप्रतिशतं विद्यते। अन्यत्सर्वं ततोऽल्पमिति। यथोच्यते–

Astrology is quite unique as a science and knowledge system as it perceives a certain extent of the subtle world that cannot be perceived by the five senses mind and intellect. For example, Astrology can tell if one is being affected by ancestors, based on the position of celestial bodies. There are various traditions used in Astrology. Each of them has varying methodology. The following table is a comparative chart of the accuracy able to be achieved by the more significant traditions obtained through astrological research. Accuracy is based on the same ability of the astrologer who is able to achieve a 30% accuracy in Vedic Astrology.[20]



सन्दर्भाः

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2. www.spiritualsienceresearchfoundation.org
3. वृहत्संहितायां पुरुषलक्षणाध्याये 1श्लोकः
4. वीरमित्रोदये लक्षणप्रकाशे स्त्रीलक्षणप्रकरणे
5. वीरमित्रोदये लक्षणप्रकाशस्यारम्भकथने
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7. वृहत्संहितायां पुरुषलक्षणाध्याये 105 श्लोकः
8. वृहत्संहितायां पुरुषलक्षणाध्याये 106श्लोकः

9. वृहत्संहितायां पुरुषलक्षणाध्याये 115श्लोकः
10. वृहत्संहितायां पुरुषलक्षणाध्याये 87श्लोकः
11. वृहत्संहितायां पुरुषलक्षणाध्याये 96 श्लोकः
12. सामुद्रतिलकपुरुषप्रकरणे वर्णलक्षणे
13. वृहत्संहितायां पुरुषलक्षणाध्याये 101श्लोकः
14. वृहत्संहितायां पुरुषलक्षणाध्याये 95 श्लोकः
15. वृहत्संहितायां पुरुषलक्षणाध्याये 108 श्लोकः
16. वृहत्संहितायां पुरुषविभागाध्याये 3-5 श्लोकौ
17. वृहत्संहितायां पुरुषलक्षणाध्याये 103-104 श्लोकौ
18. वृहत्संहितायां पुरुषलक्षणाध्याये 75-76 श्लोकौ
19. वृहत्संहितायां पुरुषलक्षणाध्याये 87 श्लोकः
20. www.spiritualsienceresearchfoundation.org

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नवाचार, अनुसंधान तथा चिकित्सकीय पेशे का समावेश*

पूर्व राष्ट्रपति डॉ. ए.पी.जे. अब्दुल कलाम

मुझे भारतीय यूरोलोजी सोसाइटी के 47वें वार्षिक सम्मेलन में भाग लेने में बहुत प्रसन्नता है। यह सोसाइटी विभिन्न स्थूल एवं उप-विशेषज्ञताओं जिसमें वृक्क प्रत्यारोपण भी सम्मिलित हैं, का प्रतिनिधित्व करती है। मेरा उन सभी विशेषज्ञों को अभिवादन है जो कि इस वार्षिक बैठक में भाग ले रहे हैं। जैसा कि आप सभी जानते हैं कि यूरोलोजी शल्य कौशल में सूक्ष्मता तथा दक्षता का प्रतिनिधित्व करती है। आज यहाँ एकत्रित समूह शल्य चिकित्सा में सर्वोत्कृष्ट दिमाग तथा कौशल का प्रतिनिधित्व करता है।

कल रात्रि को मैं अपने मित्र डॉ. सुहास देसाई जो कि केन्टकी, संयुक्त राज्य अमरीका में यूरोलोजी के पेशे में कार्यरत हैं, से बात कर रहा था। मैंने उनसे पूछा था कि मैं भारत के यूरोलोजी विशेषज्ञों को आज क्या संदेश दूँ? डॉ. देसाई ने मुझे न्यूनतम क्षति वाली प्रक्रियायें जिनमें प्रतिरक्षा चिकित्सा का प्रयोग किया जाता है और वृद्धि गुणांक संदमन के प्रयोग ने यूरोलोजी रोगों के उपचार में नई क्रांति ला दी है, के बारे में बताया है, पोजीट्रॉन उत्सर्जन टोमोग्राफी (पी.ई.टी.) स्कैन और अबुर्द (ट्यूमर) को पहचाने वाली तकनीकें यूरोलोजी विशेषज्ञों को पहले अपने मरीजों हेतु उपलब्ध नहीं थीं।

हाल ही में मैं सोलहवीं सदी के फ्रांसीसी शल्य चिकित्सक एम्ब्रोइज पारे द्वारा लिखी गई पुस्तक 'आन मोनस्टर्स एण्ड मार्वेल' पढ़ रहा था। उन्होंने लिखा है कि शल्य कर्म करने का अर्थ है– 'उसको निकालना जो कि अतिरिक्त (अवांछनीय) है, उसको पुनः स्थापित करना जो विस्थापित हैं, उसको जोड़ना जो कि आपस में बँट गया है और प्रकृति द्वारा प्रदत्त विकृत्तियों को ठीक करना है।' कितना उत्तम कार्य है जिसमें मानक उत्कृष्टता के सर्वोच्चतम स्तर की आवश्यकता है। मैं भारतीय यूरोलोजी सोसाइटी के सभी सदस्यों को बधाई देता हूँ जो कि चिकित्सा के क्षेत्र में सर्वोत्तम है तथा सर्वोत्तम दक्षता का प्रतिनिधित्व करते हैं।

चिकित्सा को सही ही पेशा कहा गया है। यह जीवन पर्यन्त सीखने वाली प्रक्रिया है। हीपोक्रेटस ने कहा था जो बहुत प्रसिद्ध है 'यह जानना आवश्यक है कि किस प्रकार के व्यक्ति को रोग है, बजाय इसके कि किस व्यक्ति में क्या रोग है' चिकित्सकीय पेशेवरों का चिकित्सकीय अनुभव यह बहुत हद तक सिद्ध करता है कि निदान में, पूर्व लक्षण एवं उपचार में व्यक्ति को जीवन-शैली एवं आनुवांशिकी भी रोग की जानकारी के समान जिम्मेवार है।

भारतीय यूरोलोजी सोसाइटी जैसी पेशेवर संस्थाओं की यह जिम्मेवारी है कि स्वास्थ्य और सामुदायिक सेवाओं को सहयोगी, नवाचार एवं दीर्घकालीन मॉडलों का विकास करें जो कि सेवा प्रदान करने वाली संस्थाओं और व्यक्तियों, परिवारों एवं समुदाय के मध्य देखरेख हेतु एक ढाँचा (फ्रेम वर्क) प्रदान करें। मैं विचार कर रहा था कि आज मैं विशिष्ट चिकित्सा विशेषज्ञों को क्या संदेश दूँ?

जब मैं यूरोलोजी के विशेषज्ञों और विशिष्ट समूह के साथ हूँ तो एक लेख से कुछ उद्धृत करना चाहूँगा जिसे डॉ. टी.ई. उडवाडिया ने लिखा है जिसे मैं सभी चिकित्सा विज्ञान के सम्मेलनों में उद्धृत करना चाहूंगा। एक जो कि है एक विश्व एक मनुष्य और एक शल्य कर्म। लेख में लिखा है– 'गरीब से गरीब व्यक्ति को भी किसी अन्य व्यक्ति की तरह शल्य कर्म के बाद कम वेदना, कम दवाईयों, कम विकृति, अस्पताल में कम दिन रहने एवं अपने गृह, परिवार एवं कार्य पर शीघ्र लौटने का अधिकार है। ऐसी शल्यक्रिया जो कम अंगों को क्षति पहुँचाये एवं खर्चीली प्रौद्योगिकी जिसके बारे में कहा जाता है, नई प्रौद्योगिकी की प्रशंसा अथवा श्रद्धांजलि देने हेतु नहीं है वरन् जो कई प्रकार के लाभ हमारे रोगियों एवं लोगों को नई प्रौद्योगिकी पहुँचाती है। यह विचार सभी शल्य चिकित्सकों को ध्यान में रखना चाहिए जो कि शल्य कर्म कर रहे हैं।'

पिछले कुछ वर्षों में वर्तमान चिकित्सा के पहलुओं और स्वास्थ्य के संबंध में जनमानस की समझ में स्थिर और महत्वपूर्ण परिवर्तन हुए हैं। लोग नैदानिक परीक्षणों और जो दवायें उन्हें दी जाती है उनके प्रतिकूल प्रभावों को संदेह की दृष्टि से देखने लगे हैं। चिकित्सा रोगियों के इलाज के लिये है और यह चिकित्सा की संपूर्ण चिकित्सा व्यवसाय भेषजों से बिना क्षति पहुँचाये पद्धतियों एवं शल्य कर्म से आनुवांशिकी रोगी की सुरक्षा और स्थिर परिणामों की ओर घूमती है। सभी जो कि नया है अच्छा नहीं है। प्रत्येक नई औषधि जिसकी खोज की गई है एवं नई प्रौद्योगिकी जिसका आविष्कार किया गया है, की बुराईयाँ तथा अच्छाइयाँ दोनों होती है। अतः आज मैंने **'नवाचार, अनुसंधान तथा चिकित्सकीय पेशे का समावेश'** पर बोलने हेतु सोचा है।

विशेषज्ञताओं का अनोखा संगम

नेफ्रोलोजी और यूरोलोजी परंपरा के तौर पर आपस में सहयोग करने वाले जैसे कि हृदय रोग और हृदय रोग शल्य चिकित्सा जैसे क्षेत्र हैं। नेफ्रोलोजी के विशेषज्ञ आतंरिक चिकित्सा के

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*भारत के पूर्व राष्ट्रपति भारत रत्न डॉ. ए.पी.जे. अब्दुल कलाम द्वारा 30 जनवरी 2014 को 47वें यूरोलोजी सोसाइटी ऑफ इंडिया के वार्षिक अधिवेशन जो कि अशोक होटल, दिल्ली में हुआ था का उद्घाटन भाषण का हिन्दी अनुवाद। *अनुवादक – श्री घनश्याम तिवारी, वैज्ञानिक एफ, अपर निदेशक, राजभाषा निदेशालय, डीआरडीओ भवन, राजाजी मार्ग, नई दिल्ली-110011*

पहलुओं जैसे कि गुर्दा का कार्य करना और रोग, इलेक्ट्रोल में संतुलन का बिगड़ना, उच्च रक्त चाप, गुर्दे में पथरी और गुर्दे का कार्य न करना से संबंध रखते हैं। यूरोलोजी के विशेषज्ञ शल्य कर्म के विशेषज्ञ होते हैं जो कि गुर्दे और यूरीनरी ट्रैक के संरचना के विकारों को शल्य कर्म द्वारा ठीक करते हैं। अतः यूरोलोजी के विशेषज्ञों का संबंध कम क्षति पहुँचाने वाली तकनीकें जो कि उसी समय में अल्ट्रासाउण्ड निर्देशित, तंतु-प्रकाश एंडोस्कोप उपकरण और विभिन्न लेजरों का कई बिना क्षति पहुँचाने वाली और कैंसर से ग्रसित स्थितियों के इलाज में प्रयोग करते हैं। इसके अतिरिक्त उन्होंने दूरबीन के शल्य कर्म जिसमें रोबोट का प्रयोग होता है में महारथ हासिल की होती है।

यूरोलोजी के विशेषज्ञ अक्सर कैंसर रोग विशेषज्ञों, स्त्री रोग विशेषज्ञों, जठरात्र विशेषज्ञों एवं अंतःस्रावी रोगों के विशेषज्ञों के साथ मिल करके कार्य करते हैं। यूरोलोजी चिकित्सकीय एवं शल्य क्रिया विशेषज्ञताओं को बेजोड़ संगम है। जैसे कि पथरी का पहले प्रभाती तरंग लियोट्रिप्सी द्वारा उपचार किया जाता है परन्तु बाद में खाने वाली दवाईयों जैसे कि थाइजाइड (मूत्र को निकालने वाली दवा) द्वारा होने से रोका जा सकता है। गुर्दे अथवा मूत्र मार्ग की पथरियों को त्वचा प्रवेशी जैसे कि तकनीकें अंतःमूत्र मार्ग पश्चगतिक मूत्र मार्गीय दूरबीन की तकनीक द्वारा उपचार किया जा सकता है।

वर्तमान में यूरोलोजी सबसे अधिक विकास करने वाली शल्य कर्म की सुपरविशेज्ञता है। इस क्षेत्र के द्रुतगति से आगे बढ़ने का कारण विशेषकर पिछले दशक में दोनों कारणों की वजह से जैसे कि वैज्ञानिक खोजें और निदान तथा उपचार हेतु सफलतापूर्वक अभियांत्रिकी और प्रौद्योगिकी का मिलान है। सबसे कम क्षति पहुँचने वाले द्वारा सफलतापूर्वक निकाला जाता है और उनका पुनः निर्माण का कार्य पहले कभी नहीं हुआ था और बहुत ही महत्वपूर्ण है। यूरोलोजी की प्रत्येक उप-विशेषज्ञता में न केवल द्रुत विकास हो रहा है। वरन् ऐसे विकास सतत् विकसित हो रहे हैं।

भेषज के परीक्षण के मामले से भिन्न, यूरोलोजी के व्यवसाय में नई प्रौद्योगिकी को किसी नैतिक समिति अथवा संस्थान समीक्षा बोर्ड द्वारा अनुमोदन की आवश्यकता है। भारतीय चिकित्सा अनुसंधान परिषद ने जैवस्वास्थ्य अनुसंधान जो कि मनुष्यों के भाग लेने पर किये जाते हैं हेतु मार्गदर्शी जारी की थी, परन्तु इस मार्गदर्शी प्रौद्योगिकी, मानवाधिकार और रोगी के विकल्पों के मामले से संबंधित कोई उल्लेख नहीं है। भारतीय यूरोलोजी सोसाइटी अपने सदस्यों को इस बारे में मार्गदर्शी जारी करने हेतु विचार कर सकती हैं। मित्रों मुझे चिकित्सा से संबंधित तीन मुख्य विकास क्षेत्रों पर आपका ध्यान आकर्षित करना है। ये संकल्पनायें पद्धतिबद्ध जैव विज्ञान जो कि भिन्न तरीके से स्वस्थ रहना, बीमारी और रोग को देखती है। पोषण-आनुवंशिकी एक्सिस जो कि बचाव पर जोर डालती है और नैनो चिकित्सा जो कि मानव शरीर के अन्तर्जात प्रतिरोधक क्षमता पर आधारित है।

1. पद्धतिबद्ध जीव विज्ञान में विकास

हाल ही में हुए इंफ्लुएंजा की महामारी में यह पाया गया है कि उचित परिस्थितियों में एक नया संक्रमण जो कि विश्व में कहीं भी पाया जाता है, कुछ दिनों अथवा सप्ताहों में कई महाद्वीपों की यात्रा करके फैल सकता है। कई ऐसे संक्रमण जो कि रोगजनक (पैथोजेन) जो कि पर्यावरण में पहले ही से उपस्थित हैं, में नई पोषक जनसंख्या को चुनने का लाभ उठाते हुए संक्रमित करके या एक अथवा गुमनामी का लाभ उठाते हुए पैदा होते हैं।

उच्च-मात्रा में शीघ्र संचलन केवल पर्यटन को ही इंगित नहीं करता है वरन् वर्तमान सोसाइटी में अन्य उद्योगों को भी दर्शाता है। संक्रियायें जिनमें खाद्यान्न का उत्पादन होता है जिनमें जैविक मूल के उत्पादों का प्रयोग अथवा परिष्करण होता है, यद्यपि आधुनिक उत्पादन विधियाँ बढ़ी हुई दक्षता तथा लागत में कमी प्रदान करती है तथापि अकस्मात् संदूषण की संभावनाओं को बढ़ती है एवं इस प्रकार के संदूषण के प्रभावों को बढ़ाती है। इस समस्या में वैश्वीकरण के कारण और अधिक बढ़ोत्तरी होती है, जिससे कि दूरस्थ स्थित एजेन्टों को प्रवेश करने का अवसर मिलता है। एक रोगजनक जो कि किसी कच्चे माल में रहता है को अंतिम उत्पाद के बड़े बैच में प्रवेश करने का अवसर मिल सकता है, जैसा कि हैमवर्गर मॉस को ई.कोली स्ट्रेज के द्वारा संदूषित होने का अवसर मिला था जिससे कि हीमोलयटिक यूरेमिक के लक्षण प्राप्त हुए थे। जीवविज्ञानियों ने आकलन किया है कि जीवों की 50 से 1000 लाख की स्पीसियों जो पृथ्वी रहती है संरचना, जैवरसायन एवं जीन के क्रमों के आकड़ों से स्पष्ट है कि पृथ्वी पर समस्त जीव आपस में जीन के द्वारा संबंधित है। कोशिका में जीन के उत्पाद जिस स्तर तक आते हैं और अपनी कार्यक्षमता को दर्शाते हैं कि नियमन अन्य जीनों के मध्य अन्योक्रय क्रिया द्वारा होता है। यह आपस में अंतरसंबंध इंगित करती है कि जीन नियमित नेटवर्कों की पहचान जीन के दोषों के व्यक्तरूपी प्रभावों एवं उनसे संबंधित विकृतियों को समझने हेतु महत्वपूर्ण हैं।

उच्च-संवेशप्रवाह प्रौद्योगिकी

उच्च-संवेशप्रवाह प्रौद्योगिकीयों जैसे कि जीनोम-के स्तर पर अनुक्रम और सूक्ष्म व्यवस्थित प्रयोगों ने प्रतिलिपिस्तर पर हमारी आणविक व्यवहार को समझने में बढ़ोत्तरी हुई है। यद्यपि ये वृहद स्तर पर आँकड़े आर.एन.ए. उपस्थिति एवं सापेक्षिक प्रचुरता के विषय में महत्वपूर्ण सूचना प्रदान करते हैं। जीन में आणविक प्रक्रियाओं एवं नियमन से संबंधों को विभिन्न व्यक्तरूपी परिस्थितियों को सम्यक स्तर पर समझने की चुनौती प्रदान करते हैं।

कई रोगों जैसे कि हृदय रोग तंत्रिका ह्रास रोग, आँतों एवं जोड़ों की बीमारियों हेतु कोशिकीय शोध जिम्मेवार है। प्रत्येक शोध की एक खास जीन के स्तर पर पहचान होती है।

पोषण-आनुवंशिकी धुरी (एक्सिस)

पिछले सप्ताह में मैंने अहमदाबाद में 39वीं वार्षिक मानव आनुवंशिकी की भारतीय सोसाइटी एवं मानव आनुवंशिकी पर अंतर्राष्ट्रीय सम्मेलन का उद्घाटन किया था। 300 से अधिक आनुवांशिकी विशेषज्ञों ने विभिन्न विषयों के अतिरिक्त पोषण जैनोमिकी जो कि एक उभरती हुई, जो शाखा है मानव जेनोम, पोषण और स्वास्थ्य के संबंध पर अध्ययन करती हैं।

कई रोगों जैसे कि हृदय रोग, तंत्रिका तंत्र ह्रास रोग, आँतों एवं जोड़ों की बीमारियों हेतु काशिकीय शोथ जिम्मेवार है। प्रत्येक शोथ की एक खास जीन के स्तर पर पहचान होती है। जीन अभिव्यक्ति पेंटर्नों में परिवर्तन जो कि शोध की परिस्थितियों हेतु निहातार्थ हैं ने दीर्घकालीन शोध की चिकित्सा में नये आयाम खोले हैं। मूत्राशय शोथ अथवा ब्लैडर में शोथ की तरूण एवं मध्यम आयु वर्ग की महिलाओं में होता है का पहले ही कारण स्पष्ट था।

भारतीय जनसंख्या में कुपोषण एक मुख्य समस्या है। सोसाइटी के समृद्ध वर्गों में 30 से 50 प्रतिशत ऐसे रोगी हैं जिन्हें इलैक्ट्रालाइट बीमारियों के कारण अस्पताल में भर्ती की आवश्यकता पड़ती है। कुपोषण के चिकित्सकीय लक्षण भौतिक परीक्षण के दौरान दिखाई देते हैं। परन्तु गुर्दे की कार्यप्रणाली में परिवर्तन शुरूआती परीक्षण के दौरान दिखाई नहीं पड़ते हैं। प्रोटीन-कैलोरी कुपोषण के चिकित्सकीय एवं प्रयोगात्मक मॉडलों में गुर्दे की होमो-गतिकी, गुर्दे को सांद्र करने की क्षमता एवं गुर्दे से अम्ल के निष्कासन में महत्वपूर्ण परिवर्तनों की पुष्टि की है। बच्चों एवं अधेड़ में जो कि कुपोषण से ग्रस्त हैं, में वृक्क छननी दर, वृक्क प्लाज्मा बहाव है और मूत्र को सांद्र करने की तथा अम्ल के निष्कासन में कमी पाई गई है। कुपोषण के कारण वृक्क की कार्य प्रणाली में परिवर्तन को अब ठीक से समझा जा चुका है।

अभी हाल तक उन मरीजों पर जोर दिया जाता था जिन्हें कि डायलयसिस अथवा प्रत्यारोपण की आवश्यकता है। जो चिकित्सकीय विशेषज्ञ यहाँ उपस्थित हैं उन्हें मैं सलाह दूंगा कि वे कम गंभीरता वाली दीर्घकालीन गुर्दा बीमारी पर और अधिक ध्यान दें और ऐसे तरीकों की पहचान करें जिससे कि उन मरीजों की मॉनीटरिंग प्राथमिक चिकित्सा केन्द्र में हो सके। इससे उन मरीजों की पहचान मिलेगा जिनकी बीमारी बाद में गंभीर हो जाती है। यह महत्वपूर्ण है चूँकि जितना जल्दी हस्तक्षेप होगा, उतना अधिक उसका प्रभाव होगा।

3. नैनो चिकित्सा

नैनो चिकित्सा एक नई अलग वैज्ञानिक विशेज्ञता है जो कि नैनो स्केल के पदार्थों का विभिन्न जैव चिकित्सा अनुप्रयोगों हेतु अनुसंधान करती है। मैंने भारत में और विदेशों में कई संस्थानों में गया हूँ, जिन्हें कि नैनो चिकित्सा अनुसंधान तथा विकास में विशेज्ञता प्राप्त है और उसने विस्तार में विचार-विमर्श भी किया है। स्थानान्तरीय नैनो चिकित्सा में तेजी से प्रयोगात्मक पशुओं के मूल्यांकन से चिकित्सकीय विधियाँ में तेजी से विकास हुआ है। भविष्य में, यह आशा की जाती है कि नैनो टैक्नोलॉजी, यूरोलोजी विशेषज्ञों को एक नई सोच प्रदान करेगी जिससे कि वे रोग के होने की प्रक्रिया, शीघ्र निदान हेतु विधियाँ/उपकरण और उपचार हेतु प्रभावी तरीके प्रदान करेगी। मैं आप लोगों के मध्य नैनों चिकित्सा के यूरोलोजी में उभरते हुए अनुप्रयोगों की चर्चा करूँगा।

(क) कीमो-थेरा-प्यूटिक दवाईयाँ जिनमें नैनो कैरियर भी रखा होता है। ब्लैडर कैंसर के उपचार हेतु उपभोग केवल दवा से और दक्ष तथा विशेषिक तरीके प्रदान करते हैं।

(ख) अपनी उच्च गतिशीलता के कारण प्रोस्टेट कैंसर सदैव अनुसंधानकर्ताओं हेतु कौतुहल का विषय बना रहता है। ऐसे कई उदाहरण हैं जहाँ कैमो थेराप्यूटिक दवाईयों में नैनो कैरिअर भी रखे जाते हैं। प्रोस्टेट कैन्सर के उपचार में प्रयोग किया जाता है।

(ग) प्रोस्टेट कैंसर हेतु नैनो कैरियर द्वारा तापीय चिकित्सा ऐसी संभावनायें प्रदान करती हैं। विशेषकर जहाँ पर कैमोथेरेपी कारगर नहीं है।

(घ) कई संस्थानों का चरण – प्रोटीन ऊर्जा ग्लाइसेटिक प्रोटीन का चरण परीक्षण में मूत्रीय मार्ग के स्थानीय काफी बंद हुए कैंसर में चिकित्सकीय अनुक्रिया दर अनुकूल विषाक्तता प्रोफाईल प्रदान की है।

खतरे के कारणों की पहचान

आधुनिक चिकित्सा ने इलाज में कई चमत्कार प्रदान किये हैं। इक्कीसवीं सदी में हमें कई विकसित रोग पर विजय प्राप्त करने वाली विधियाँ जैसे कि कार्यप्रणाली जेमोमिक्स, प्रोटीनमिक्स और स्टेम कोशिकायें प्राप्त है। चिकित्सकीय और औषधीय अनुसंधानों ने कई हजारों दवाइयाँ विकसित की हैं जिनसे कि हम पहले की अपेक्षा रोग का बेहतर इलाज कर सकते हैं और रोक सकते हैं। कई बड़े रोगों के लिये खतरे के कारणों की पहचान कर ली गई है। उदाहरण के लिये, हम जानते हैं कि अधिक कोलेस्ट्रोल और दीर्घकालीन शोध दो मुख्य ऐसे कारण हैं जो कि हृदय रोगों के लिये जिम्मेवार हैं। हम यह भी जानते हैं कि टाइप-।। मधुमेह के लिये मोटापा एक मुख्य कारण हैं। सिगरेट पीना और वायु प्रदूषण साँस के रोगों एवं फेफड़ों के कैंसर हेतु मुख्य पर्यावरणीय कारण है। यह दुर्भाग्य है कि कई यूरोलोजी के रोगों हेतु विशेषिक खतरे के कारणों की पहचान की जाती है।

यूरोलोजी के रोगों में विकासशील और कार्यप्रणाली की कमियाँ, फाइब्रोमिस, असाधारण कोशिकाओं का बढ़ना तथा कैंसर सम्मिलित है। इनमें से प्रत्येक प्रकार के रोगों हेतु विशेष आनुवंशिक तथा पर्यावरणीय कारण हो सकते हैं। मैं प्रस्तावित करता हूँ कि यूरोलोजी सोसाइटी ऑफ इंडिया की वार्षिक बैठक ऐसे उभरते यूरोलोजी के खतरे के कारणों पर हाल के अनुसंधान के नतीजों एवं हम आगे क्या कदम उठायें पर विचार-विमर्श करें। खतरे के कारणों को समझना आवश्यक है। चूँकि यह समय से पूर्व रोग के होने के रोकने में कामयाब होगी। खतरों का मूल्यांकन चिकित्सकीय पूर्वानुमान एवं रोग के बढ़ने की प्रक्रियाओं को समझने में सहायता प्रदान करता है।

3 जनवरी, 2014 को मैं ग्लोबल हेल्थ सीमट 2014 जो कि अहमदाबाद में हुई थी। मैं 500 भारतीय मूल के चिकित्सकों से मिला था। वहाँ मुझे पता चला था कि गुर्दा, पोषण, मोटापा एवं मधुमेह अध्ययन (के.एन.ओ.डी.) जो कि नेशनल इंस्टीट्यूट ऑफ हेल्थ अमेरिका में रोग विज्ञान, आनुवांशिकी रोग विज्ञान की तकनीकों द्वारा मनुष्यों में गुर्दे तथा प्रोस्टेट की बीमारीयों, प्रोस्टेट, जठर-आंत तथा जिगर की बीमारियों, मोटापा और उपापचयी रोगों एवं मधुमेह को रोकने हेतु एक अच्छा उदाहरण है। हमें अपनी जनसंख्या में उन बीमार व्यक्तियों की संख्या की पहचान करनी है एवं ऐसे हल ढूढ़ने हैं जो कि हमारे लोगों हेतु उपयुक्त हों। यह बहुत महत्वपूर्ण है कि हम उच्च उत्पादकता वाली कंप्यूटर विज्ञान एवं सूचना प्रौद्योगिकी के तरूण मानव संसाधनों को परामर्श दिया जाए एवं उन पर एक अच्छे परामर्श कार्यक्रम द्वारा उन पर ध्यान दिया जाए जिससे कि बाद में इन्हें जीवन शैली से संबंधित यूरोलोजी के रोगों की समस्याएं न हो। उन कारणों जो कि प्रगामी गुर्दे की क्षति पहुँचाते हैं जैसे कि विषाक्ताओं लिपिड के उच्च स्तरों, कैल्शियम और फॉस्फेट की गुर्दे में उपस्थिति पर विशेष ध्यान दिया जाना चाहिए। मैं सुझाव देता हूँ कि भारतीय यूरोलोजी सोसाइटी और उनके वृक्क रोग विशेषज्ञ जोड़ीदार इस पर एक सामान्य जनता हेतु लेख तैयार करें।

निष्कर्ष

संभावित नवाचार, अनुसंधान और चिकित्सकीय पेशा साथ चलने वाली प्रक्रियाएं है। वे आपस में एक प्रक्रिया के बाद एक नहीं आती है। बस साथ चलने वाली प्रक्रियाएं हैं और अक्सर एक दूसरे के रास्ते में मिलती हैं। एक नया विकास एक स्थापित प्रक्रिया को लुप्त कर देती है। एक नई अनुसंधान की उपलब्धि एक स्थापित प्रक्रिया पर प्रश्नवाचक चिन्ह लगती है। नवाचार, अनुसंधान और चिकित्सकीय पेशे चिकित्सा के इतिहास में विकास के क्षण होते हैं।

अब मैं तीन सुझाव दे करके समाप्त करूंगा। मैं भारतीय यूरोलोजी सोसाइटी का आह्वाहन करूँगा कि चिकित्सकीय परिणामों के मूल्याकंन, स्वास्थ्य से संबंधित जीवन की गुणवत्ता, यूरोलोजी बीमारियों के ध्यान में संसाधनों का उपयोग बीमारियों के ध्यान में संसाधनों का उपयोग बीमारियों के ध्यान में संसाधनों का उपयोग और रोगी की तरजीहों पर शोध करें। यह आवश्यकता है कि शीघ्र ऐसे प्रणाली के विकास की आवश्यकता है जो ध्यान देने के स्थान निदान एवं उपचार मूत्र मार्ग संक्रमणों को चिकित्सकीय मूत्र सैम्पलों द्वारा करे। अन्त में यूरोलोजी एक बहुत अधिक प्रौद्योगिकी गहन पर तथा दक्षता पर आधारित है। उन्नत शल्य और हस्तक्षेप प्रौद्योगिकी केन्द्र यूरोलोजी में स्थापित किया जा सकता है जिससे कि शल्य चिकित्सकों को जो सूदुर रहते हैं उन्हें टेली-कॉन्फ्रेसिंग और टेली-सर्जरी द्वारा प्रशिक्षण प्राप्त होगा।

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ब्रोंकोइसोफिजीयल यूनीवर्स की यात्रा*

['प्रतिरोधी चिकित्सा व्यवसाय के क्षेत्र में यह अनुमान युगान्तकारी महत्व का होगा']

*पूर्व राष्ट्रपति डॉ. ए.पी.जे. अब्दुल कलाम***

मुझे उन्नीसवें ब्रोंकोलोजी एवं इंटरवेंशनल पलमोनोलोजी के वार्षिक सम्मेलन जो कि इंडियन एसोसिएशन ऑफ ब्रोंकोलोजी एवं जयपुर गोल्डन अस्पताल, सरोज अस्पताल तथा राजीव गांधी कैंसर अस्पताल एवं अनुसंधान केन्द्र के साथ सम्मिलित रुप में आयोजित किया जा रहा है, में भाग लेने में प्रसन्नता है। मुझे यह जानकर हर्ष हुआ है कि सम्मेलन में भारत और पड़ोसी सार्क देशों से कई प्रतिभागी भाग ले रहे हैं। यहाँ अमेरिका, जापान, कोरिया, जर्मनी, ब्रिटेन, सिंगापुर एवं हमारे देश के विभिन्न कोनों से विशेषज्ञ भाषण देंगे एवं अपने अनुभवों का आदान-प्रदान करेंगे। मैं आयोजकों तथा प्रतिभागियों को बधाई देता हूँ और इंडियन एसोसिएशन ऑफ ब्रोंकोलोजी के सदस्यों को शुभकामनायें देता हूँ।

परंपरागत तौर पर चिकित्सा विशेषज्ञताओं में प्रशिक्षण एक ऐसे गुरू जिनकी अधिक चिकित्सकीय व्यवहार (प्रैक्टिस) एवं उनके संरक्षण में शिष्य बन करके प्राप्त किया जाता है। अब इन्टरवेंशनल पलमोनोलोजी में फेलोशिप उपलब्ध हैं एवं विशेषज्ञों का एक अच्छा समूह बन गया है जिसने पिछले कुछ वर्षों में कई मील के पत्थर की उपलब्धियाँ हासिल की हैं। मैं सोच रहा था कि ब्रोंकोलोजी के चिकित्सा विशेषज्ञ जो कि आज की बैठक में उपस्थित हैं, को क्या संदेश दूँ?

पलमोनोलोजी आंतरिक चिकित्सा की एक उप विशेषज्ञता है, जो कि फेफड़ों और श्वसन नलियों के रोगों से संबंधित हैं जिसमें कि अक्सर उच्च श्वसन ट्रैक (नाक, ग्रसनी, गला) एवं हृदय का मूल्यांकन किया जाता है। आंकिक (डिजिटल) प्रकाशिकी के विकासों ने फेफड़ों के वायु के रास्तों को सीधे देखने की सुविधा प्रदान की है जिससे कि चिकित्सक रोग के बढ़ने की गति (बढ़ोत्तरी) स्वयं देख सकते हैं। नये विचार आ रहे हैं एवं हर माह नवीन प्रौद्योगिकीयाँ विकसित की जा रही है। ब्रोन्कोलोजी अब एक कई शाखाओं के वृक्ष जैसी उभर करके आ रही है। अतः मैंने विचार किया कि ब्रोन्कोलोजी और इन्टरवेंशनल पलमोनरी समुदाय के विशेषज्ञों हेतु एक नई दृष्टि **'ब्रोंकोइसोफिजीयल यूनीवर्स की यात्रा'** प्रस्तुत करूँ।

मैं चिकित्सकीय समुदाय हेतु एक शुभ समाचार से अपना व्याख्यान प्रारंभ करता हूँ। वर्ष 2013 में 10 ऐसी विज्ञान में उपलब्धियाँ हुई जो कि अंतर्राष्ट्रीय विज्ञान जर्नल में रिपोर्ट की गई हैं, जिनमें से दो उपलब्धियों का जिक्र करना चाहूँगा जो कि आपके चिकित्सा विज्ञान के डोमेन से संबंधित हैं।

चिकित्सा विज्ञान में 2013 की वैज्ञानिक उपलब्धियाँ

2013 में, कैंसर अनुसंधान के क्षेत्र में अनुसंधान तथा विकास में काफी परिवर्तन देखने को मिले। साइंस जनरल एडवान्समेन्ट ऑफ साइन्स के अनुसार कैंसर की प्रतिरोधी चिकित्सा के चिकित्सकीय परीक्षणों के जरिए नई आशा से ओत-प्रोत परिणाम देखने को मिले हैं जिसके उपचार में ट्यूमर के बजाए शरीर के प्रतिरोधी तंत्र को निशाना (लक्ष्य) बनाया जाता है। ये उपचार टी-कोशिकाओं और अन्य प्रतिरोधी कोशिकाओं को बाहर फेंकते हैं जिससे कि कैंसर रोग पर विजय प्राप्त होती है। अब तक यह प्रक्रिया कुछ कैंसरों और कुछ रोगियों पर ही कामयाब रही है। इसे सबसे महत्वपूर्ण उपलब्धि माना जाता है। यद्यपि रोग पर इसका अंतिम प्रभाव ज्ञात नहीं है। तथापि अब तक प्राप्त परिणाम इसकी सफलता को उजागर करते हैं। कुछ उपलब्धियों में निम्नलिखित हैं :

1. एक स्त्री जिसमें मेलानोमा से अंगूर के आकार का ट्यूमर था, 13 वर्ष बाद भी स्वस्थ और जीवित है।
2. 6 वर्ष का बालक जो कि ल्यूकेमिया, अब तृतीय ग्रेड और पुनः उभरने पर भी स्वस्थ है।
3. एक व्यक्ति जिन्हें मेटास्टेटिक गुर्दे का कैंसर है। यह रोग उपचार के बन्द होने के बाद भी कम होता गया।

मिनी अंग अब विकसित है। अब यह संभव है कि स्टेम कोशिकाओं को विशेष उत्तकों के रूप में उगाया जाये, जिसका अर्थ है कि अब यह चुनौती नहीं है कि कई स्टेम कोशिकाओं को रोक करके संगठित संरचनाओं के रूप में विकसित किया जाए। मिनी मनुष्य को अंगों के समूह की भाँति उगाने में उल्लेखनीय प्रगति 2013 में हुई है। अंगों के समूह जैसे कि जिगर, मिनी गुर्दा, छोटे आकार की बुद्धि और छोटे आकार के मनुष्यों के अंग मानव की रोग के लिये पशुओं से बेहतर मॉडल हो सकते हैं। प्रथम बार, यह आशा बँधी है कि फेफड़ों को भी उगाया जा सकेगा।

वंचितों की समस्या

दीर्घकालीन श्वसन रोग, फेफड़ों के वायु के रास्तों और

*21 फरवरी 2014 को होटल क्राउन प्लाजा रोहिणी में ब्रानकोलोजी एवं इंटरनेशनल पलमोनोजी के उन्नीसवें वार्षिक सम्मेलन पर आयोजित उद्घाटन सत्र में भारत के पूर्व राष्ट्रपति भारतरत्न डॉ. ए.पी.जे. अब्दुल कलाम द्वारा दिया गया उद्घाटन भाषण का हिन्दी अनुवाद। *अनुवादक – श्री घनश्याम तिवारी, वैज्ञानिक एफ, अपर निदेशक, राजभाषा निदेशालय, डीआरडीओ भवन, राजाजी मार्ग, नई दिल्ली-110011*

अन्य संरचनाओं को प्रभावित करते हैं और गंभीर रोगों के समूह को दर्शाते हैं। रोकी जा सकने वाली शीघ्रकालीन श्वसन रोगों में दमा और श्वसन एलर्जी, दीर्घकालीन प्रतिरोधक पलमोनरी रोग, व्यावसायिक फेफड़ों का रोग, कैंसर, नींद की अश्वसन (श्वास रोग) बीमारी और पलमोनरी उच्च रक्त चाप सम्मिलित हैं। ये विश्व के सभी देशों में गंभीर जन स्वास्थ्य समस्या को दर्शाते हैं एवं वंचित लोग इनसे सबसे अधिक पीड़ित होते हैं।

नवीनतम विश्व स्वास्थ्य संगठन के अनुमानों के अनुसार, वर्तमान में अभी 5000 लाख लोगों को दमा की बीमारी है। 3000 लाख लोगों को दीर्घकालीन प्रतिरोध श्वसन रोग है, जबकि कई लाख लोगों को एलर्जी नामक रोग है और अक्सर बिना निदान हुये दीर्घकालीन प्रतिरोधक श्वसन रोग है। इनमें से 50 प्रतिशत लोग निम्न और मध्यम आयु के देशों में हैं। जिन दीर्घकालीन श्वसन रोगों से बचाव किया जा सकता है उनकी संख्या सब जगह और विशेषकर बूढ़ों तथा बच्चों में बढ़ रही है एवं इसका प्रतिकूल प्रभाव जीवन की गुणवत्ता और प्रभावित व्यक्ति की विकलांगता से है। जिन दीर्घकालीन श्वसन रोगों से बचाव किया जा सकता है उनसे समय से पूर्व मृत्यु हो जाती है और उनसे दीर्घ प्रतिकूल आर्थिक विपन्नता व्यक्तियों, समुदायों और समाज को झेलनी पड़ती है।

कई दीर्घकालीन श्वसन रोगों के खतरे के कई कारणों में जैसे कि तंबाकू पीना और अन्य प्रकार का घर के अन्दर का प्रदूषण, प्रदूषण फैलाने वाले कण, एलर्जी फैलाने वाले कण, व्यावसायिक एजेन्ट, सिकल कोशिका-रोग और उच्च उतुंगता पर जीवन है।

कई प्रकार के अवरोध दीर्घकालीन श्वसन रोगों के प्रबंधन, उपलब्धता, समर्थता और उनकी जानकारी सब तक पहुँचने में कमी के कारण गरीबी, अल्प शिक्षा, निरक्षरता, सफाई की कमी और ढाँचों, बहुभाषिता, धार्मिक और सांस्कृतिक विश्वास और पोषण हैं। औषधियों और प्रणालियों की उपलब्धता तथा पहुँच सब तक बहुत अच्छी नहीं है। दीर्घकालीन श्वसन रोग के निदान हेतु संसाधनों की कमी, स्वास्थ्य प्रणालियाँ में भिन्नता, जो देखा जा रहा है उसको अमल में लाना प्रशिक्षित कार्मिकों की कमी है।

दो सक्षम बल

पुनर्जीवित करने वाली चिकित्सा और आणविक स्तर पर और रोबोटिक शल्य क्रिया और आवर्धन एन्डोस्कोपी प्रौद्योगिकीयाँ हमारे समय के दो बहुत सक्षम बल हैं जो कि श्वसन रोगों के इलाज हेतु ऐसे अवसर प्रदान करते हैं जो पहले उपलब्ध नहीं थे।

पुनर्जीवित करने वाली चिकित्सा

मानव की कोशिकाओं को बदलना अथवा उन्हें पुनर्जीवित करना जिससे कि वे सामान्य तौर पर प्रक्रियाएं कर सकें में ये अवसर मिलते हैं कि क्षतिग्रस्त ऊतकों और अंगों को पुनर्जीवित किया जाए और शरीर की अपने मरम्मत करने वाली प्रक्रियाओं को उद्धदीप्त करें जिससे कि वे पहले से क्षतिग्रस्त ऊतकों अथवा अंगों को स्वस्थ कर सकें। पुनर्जीवित करने वाली चिकित्सा में ऐसी नवाचार चिकित्साओं के उभरने की क्षमता है जो कि फेफड़े के रोगियों जिसमें दीर्घकालीन प्रतिरोधक पलमोनरी रोग, पलमोनरी फाइब्रोसिस, पलमोनरी धमनीय उच्च रक्तचाप सम्मिलित हैं, हेतु लाभप्रद होगीं। मैं सुझाव देता हूँ कि इंडियन एसोसिएशन ऑफ ब्रोंकोलोजी निम्नलिखित दो क्षेत्रों में अनुप्रयुक्त अनुसंधान करें।

फेफड़ों का खराब एवं क्षतिग्रस्त होना

कोशिकाओं का पुनर्जीवन

फेफड़ों की क्षतिग्रस्त करना जिनका उद्देश्य है कि विशेष रोगियों हेतु ऐसे फेफड़े बनाना जो कि प्रतिरोपण हेतु योग्य हो। फेफड़ों का विकोशीकरण में प्रदाता फेफड़ों से सारी कोशिकायें निकालने एवं एक ऊतक पीछे छोड़ देना जो कि रोगी के अपनी स्टेम कोशिकाओं से उत्पन्न कई समर्थ कोशिकाओं का पुनर्कोशिकरण है।

स्टेम कोशिका अभियांत्रिकी

स्टेम कोशिका अभियांत्रिकी जिससे प्रभावी और सतत तौर पर रोगी विशेष के लिये प्रेरित कई स्टेम कोशिकाओं का निर्माण जो कि ऐसे फेफड़े जो अंतिम अवस्था में है के लिये किया जाना चाहिए। ऐसे व्यक्ति जो अंतिम अवस्था फेफड़ों की बीमारी से ग्रस्त हैं के त्वचा फाइब्रोब्लास्ट से प्रेरित कई स्टेम कोशिकाओं के निर्माण हेतु चिकित्सकीय परीक्षण किये जाने चाहिए। यह माना जाता है कि प्रेरित कई स्टेम कोशिकाओं को रोगी विशेष की पलमोनरी एपीथिलिपयल कोशिकाओं से निकाला जा सके और बाद में कोशिका चिकित्सा द्वारा रोगी तक पहुँचाया जा सके।

रोबोटिक शल्य चिकित्सा

सामान्य वक्षीय शल्य चिकित्साएँ रोबोटिक शल्य चिकित्सा के अनुप्रयोग में काफी विकास हो रहे हैं। इसका कारण है कि ऐसोफीज रोबोट के थाइमस (बाल्य) ग्रंथि को निकालने, ऐसोफेजियल लियोम्योमा, ब्रॉकोजेनिक अथवा ऐसोफीजियल दुबारा हुई रसौली को निकालने एवं दुबारा हुई डायफ्राम को निकालने में है। एक बार जब सामान्य शल्य क्रिया करने वाले शल्य चिकित्सक रोबोट का प्रयोग करते हैं और उससे जब बेहतर तौर पर देख जाते हैं तो वे उसे अधिक से अधिक सीखना चाहते हैं।

मैंने विश्व चिकित्सा सम्मेलन जिसे 3 जनवरी 2014 को अहमदाबाद में भारतीय मूल के अमेरिका एसोसिएशन के चिकित्सकों ने आयोजित किया था में विचार विमर्श के दौरान पाया था कि कई प्रकाशित लेख है जो कि रोबोटिक पलमोनरी उच्छेदन जिसमें लोब का उच्छेदन, सेगमेन्ट का उच्छेदन की और पलमोनरी उच्छेदन प्रभावशीलता और सुरक्षा को दर्शाता है। कई रोबोट देश में

उपलब्ध हैं और मैं यह सलाह दूंगा कि इंडियन एसोसिएशन आफ ब्रोंकोलोजी उनका फेफड़ों के उच्छेदन में अनुप्रयोग हेतु पहल करें।

तीन नये विचार

चिकित्सा एक सतत् विकास करने वाला व्यवसाय (प्रैक्टिस) है। शायद यही कारण है कि इसे व्यवसाय कहा गया है। एक अच्छे चिकित्सा संस्थान को चिकित्सा विज्ञान का जैसे-जैसे विकास हो अपनाने हेतु तैयार रहना चाहिए। मैं तीन विचार आप लोगों के समक्ष रखूँगा जो कि आजकल परिचालन में है। वे हैं, कोशिका का शोथ जो कि सभी रोगों की जड़ है, प्रतिरोधकता का प्रबंधन एवं नाइट्रिक ऑक्साइड को बहुत सारी इन कोशिकाओं में प्रयोग जो कोशिकायें कार्य नहीं कर रही हैं।

शोथ : सभी रोगों की जड़ का कारण

भौतिकी की एकीकृत फील्ड के चिकित्सा वर्जन में, कई वैज्ञानिकों का यह विचार है कि सभी दीर्घकालीन रोगों का एक ही ट्रिगर शोथ है। उत्तेजनीय प्रक्रिया का संबंध हृदय पर द्वितीय प्रकार का मधुमेह, (एन.आई.डी.डी.एम.) एलजाएमर रोग, और कैंसर से भी है। जिन कारणों से शोथ उत्तेजित होता है वे है, पेट में बढ़ी हुई चर्बी, भोजन, व्यायाम की कमी, धूम्रपान और जबड़े के रोग जो कि यह दर्शाते हैं कि जीवन शैली से संबंधित रोग किस प्रकार महामारी के स्तर तक बढ़ रहे हैं। यह स्पष्ट तौर पर पाया गया है कि शोथ से समझ आता है कि किस प्रकार धमनियों में एथीरोमा चक्कता ऐथिरोक्लेरोसिस के रोगियों में रोग हेतु जिम्मेदार हैं। दीर्घकालीन शोथ का मधुमेह, उच्च रक्तचाप, नींद की एपनिया, दमा और कई अन्य बीमारियों से सीधा संबंध हैं। लैसेंट में प्रकाशित दो क्रांतिकारी अध्ययन एक विशेषिक शोथ मार्कर इन्टरल्यूकिन 6, जिसे आईएल-6 और हृदय रोग के खतरों को कारण और प्रभाव संबंध को दर्शाता है। यह खोज कई क्रांतिकारी चिकित्साओं को जन्म देगी।

प्रतिरोधात्मकता जो कि यथार्थ में सूक्ष्मजीवों का प्रबंधन है

प्रतिरोधात्मकता (इम्युनिटी) को संक्रात्मक रोगों की जटिल समस्या के संदर्भ में अध्ययन किया गया है और समझा गया है। हमारे स्वस्थ जीवाणुओं की प्रतिरोधकतात्मकता से जो अन्योन्य क्रिया हुई हैं का निरन्तर विकासशील ज्ञान जो कि कई लाभ पहुँचाता है, एक दूसरी विचारधारा को जन्म देता है। रोगाणुओं में प्रतिरक्षा के प्रक्रियाओं जिसका वृहद उद्देश्य हमारे स्वस्थ जीवाणुओं, परिस्थितिक समुदाय जो कि अन्य रोगाणुओं को बिना प्रभावित किये हुए और रोग उत्पन्न करने वाले सूक्ष्म जीव जो कि हमारे शरीर में रहते हैं। इस परिप्रेक्ष्य में अनुकूलनीय प्रतिरोधकता को एक लचीली प्रणाली के रूप में देखा जा सकता है जो कि साथ-साथ रोगाणुओं एवं सूक्ष्म जीवों के जन्म और प्रबन्धन हेतु जिम्मेदार हैं और रोगाणु और सूक्ष्म जीव आपस में एक दूसरे से जीवित रहने हेतु परस्पर निर्भर है। यह परिप्रेक्ष्य में से कई प्रेक्षणों की पुनः व्याख्या की जा सकती है और कई जीवाणु जो हमारे चारों तरफ स्थित हैं कि जटिल अन्योन्य क्रिया को समझा जा सकता है। प्रतिरोधात्मकता स्वस्थ होना लक्षण एक ऐसी बीमारी है जो कि एड्स अथवा दबी हुई प्रतिरोधकतात्मकता के रोगियों में देखी जाती है, जिसमें प्रतिरोधी तंत्र स्वस्थ होने लगता है परन्तु बाद में पिछले अवसरों से प्राप्त संक्रमण जो कि एक शोथ की अनुक्रिया के कारण संक्रमण के लक्षणों को और गंभीर कर देती है। अगर सीडी-4 की गणना एचआईवी के प्रभावी उपचार अथवा प्रतिरोधकता को दबाने वाले अन्य कारणों को हटा करके, शोध की अनुक्रिया में बढ़ोत्तरी होती है। वह कुछ अवैशेषिक लक्षणों जैसे कि ज्वर और कुछ मामलों में संक्रमित ऊतक में हुई क्षति को बढ़ा देता है। अभी हाल में **तसलीम अली सैयद** मुझसे मिले थे जो कि जैव विज्ञान के राष्ट्रीय संस्थान बेंगलुरू के निदेशक है और एक जैविक चिप के विकास के विषय में बता रहे थे जो परिस्थितियाँ जो कि प्रतिरोधकतात्मकता को आँकड़ों में परिवर्तित करेगी और उसका वास्तविक परिस्थितियों में मापन करेगी।

प्रोटीन का प्रोटीन ऊर्जा ग्लाइसेशन

यह भली भाँति समझा जा चुका है कि नाइट्रिक ऑक्साइड कई कैमोथेरेपी को ट्यूमर प्रतिरोधी क्रिया को बढ़ा देता है चूँकि यह एनडोथीलियल कोशिकाओं और कार्डियोम्यूनेसाइटस में ऑक्सीकरण तनाव द्वारा प्रेरित एपोपटोसिस से सुरक्षा प्रदान करती है। मनुष्यों में तीव्र फेफड़ों में क्षति और तीव्र श्वसन कष्ट की बीमारियों में ऑक्सीकरण तनाव होता है। ऑक्सीडेंड से संबंधित तीव्र फेफड़ों में क्षति को वायु के रास्तों में लीपोसैक्राइड अथवा आईजीजी प्रतिरोधी कॉम्पलेक्सों के जमा होने पर जिससे कि प्रवेश किये गए न्यूट्रोफिल और वहाँ पर पड़े मैक्रोफेजित के सक्रिय होने से, जिनके ऑक्सीडेन्ट और प्रोटीन ठीक हो सकने वाली तीव्र फेफड़ों की क्षति उत्पन्न करते हैं। औषधियों का सूंघने वाले रास्ते से बिना सुई लगाये जिससे कि पद्धतिबद्ध तरीके से पेपटाइड और प्रोटीन जिनका खाने से ठीक प्रकार से शरीर में अवशोषण नहीं होता है एक आकर्षक पद्धति है। दवा को फेफड़ों में सीधे पहुँचाये जाने से फेफड़े के विशेष रोगों जैसे कि पलमानरी संक्रमण और फेफड़ों के कैंसर में जिस स्थान पर क्रिया होनी चाहिए वहाँ हवा की सांद्रता बढ़ जाती है। हाल ही में हुए अध्ययनों से पता चलता है कि प्रोटीन ऊर्जा ग्लाइसेटिड पोली-लाइसिन ड्राइमर की फेफड़ों में पहुँचाने वाले एजेन्ट हैं, की उपयोगिता को दर्शाया है और विशेष तौर पर डेनड्रामर के आकार और सही दवा का पहुँचना (जो कि एक प्रभावी पद्धतिबद्ध पहुँचाने की प्रक्रिया है एवं अपेक्षाकृत फेफड़ों में अवशोषण प्रभावी पलमोनरी डिपो नियंत्रित स्थानीय तौर पर निकलने हेतु) बेहतर है।

इंडियन एसोसिएशन ऑफ ब्रोंकोलोजी पद्धतिबद्ध अध्ययन शुरू कर सकती है। जिससे यह सिद्ध हो कि किस प्रकार प्रोटीन ऊर्जा ग्लाइसेसिस प्रोटीन क्षतिग्रस्त नष्ट हुई कोशिकाओं के पुनर्जीवन में कार्य कर सकते हैं और हमसे उन रोगियों के लिये लाभ मिल

सकता है जो कि फेफड़ों के शोथ के कारण क्षतिग्रस्त फेफड़ों की बीमारी से ग्रसित हैं।

डीआरडीओ प्रयोगशालाओं के अनुभव

जब मैं रक्षा मंत्री का वैज्ञानिक सलाहकार था, तब मैंने पाया कि डीआरडीओ की एक प्रयोगशाला नाभिकीय औषधि तथा संबंधित विज्ञान संस्थान (इनमास) ने एक अभिनव युक्ति का विकास किया था जो कि संशोधित नेबुलाइजर है के द्वारा फेफड़ों में दवा नैनो कण के आकार में पहुँचाई जा सकती है। इसका अनुप्रयोग पलमोनरी वाहिका विस्फारक (वेसोडाइलेटर), फेफड़ा विस्फारक (ब्रोंकोडाइलेप्टर) को फेफड़ों के रोगों में फेफड़ों तक पहुँचाने हेतु किया जा सकता है। इस अभिनव उपकरण का आर्मी मेडिकल कोर के चिकित्सकों ने परीक्षण के द्वारा मूल्यांकित किया है और मैं समझता हूँ कि सिपला, एक मुख्य औषधि की कंपनी ने इस प्रौद्योगिकी को व्यापारिक स्तर पर स्थानान्तरण हेतु रूचि दिखाई है। नाभिकीय औषधि तथा संबंद्ध विज्ञान संस्थान ने भेषज-सिन्टोग्राफी का विकास किया है जो कि टेक्नीशियम-11 का प्रयोग को फेफड़ों में आप्लावन (परफ्यूजन) का मूल्यांकन करेगी। रैनवेक्सी ने नाभिकीय औषधि संबद्ध विज्ञान संस्थान के साथ एक समझौता ज्ञापन हस्ताक्षरित करके इसका अनुप्रयोग भेषज गतिक अध्ययनों हेतु कर रही है।

फुफ्फुसीय शोथ (पलमोनरी ओडिमा) जो सैनिक और हिम्मती लोग उच्च उतुंगता पर जाते हैं, में एक गंभीर चिकित्सकीय समस्या है। रक्षा शरीर क्रिया एवं संबद्ध विज्ञान संस्थान के शोधकर्ताओं ने **डॉ. विलियम सेल्वामूर्ति** के नेतृत्व में एक नवाचार पद्धति नाइट्रिक ऑक्साइड (15 पार्ट पर मिलियन) और ऑक्सीजन (50%) को सूँघने से है, विकसित की है सेनाओं में प्रचलित है इसको पलमोनरी नलियों के अन्तर्धमनीय कैथराइजेशन करके, उन्होंने एक उपकरण विकसित किया है जो कि इस गैस को सही सांद्रता में पहुँचा सकता है। उनके अध्ययनों के आधार पर सशस्त्र सेनाओं ने इस अभिनव पद्धति को उच्च तुंगता फुस्फुस शोफकरोगियों चिकित्सकीय प्रबंधन हेतु अपनाया है। इसका तीव्र श्वसन कष्ट बीमारी (एक्यूट रेस्पीरेटी डिसड्रेस सिन्ड्रोम) में भी प्रयोग किया जा सकता है। भारतीय वैज्ञानिकों एवं चिकित्सकीय शोधकर्ताओं को ऐसी अपरंपरागत हलों को पलमोनरी रोगों के निदान तथा चिकित्सा हेतु मिल करके ढूढ़ने चाहिए। इससे जो कि सामाजिक-आर्थिक प्रोफाईल की निम्न श्रेणी में जो लोग रहते हैं उन्हें ऐसी चिकित्सकीय सुविधा प्राप्त हो सकती है जो कि उनकी पहुँच तक है और जिसे वे लोग अपनी पहुँच के अनुसार खर्च करके प्राप्त कर सकते हैं। धूम्रपान और वायु प्रदूषण पर भी अगर उपयुक्त प्रकार से कानून के द्वारा अमल कराया जाए तो पलमोनरी बीमारियों के होने के आँकड़ों को काफी हद तक कम किया जा सकता है।

इस अवसर पर मैं इस सम्मेलन में भाग लेने वाले प्रतिनिधियों को समाह्वान करता हूँ कि वे पलमोनरी रोगों को रोकने, शीघ्र निदान, प्रभावी चिकित्सकीय प्रबंधन एवं बीमारी को पूर्णतया ठीक करने हेतु सभी पहलुओं पर एक टीम की भाँति कार्य करें। मुझे विश्वास है कि इंडियन एसोसिएशन ऑफ ब्रोंकोलोजी इस प्रकार की पलमोनरी रोगों हेतु **'जिनोम परियोजना'** की भाँति एक वैश्विक पहल करेगी।

निष्कर्ष

चिकित्सकीय प्रणाली का विज्ञान एवं प्रौद्योगिकी द्वारा अनुप्रेरण जन सुरक्षा के लक्ष्यों को प्राप्त करने हेतु सर्वोच्च प्राथमिकता होनी चाहिए। चिकित्सकीय संस्थाओं को इस विषय में कि क्या ठीक है और लोगों एवं हमारे हालातों में क्या उपयुक्त है पहचान करते हेतु पहल करनी चाहिए।

एक मिशन जो कि ब्रोनकियल रोगों की रोकथाम, उपचार एवं ठीक होने के मिशन को पुष्ट करने हेतु शिक्षा की सुविधा प्रदान करना एवं बढ़ाना, इंडियन एसोशिएशन ऑफ ब्रोंकोलोजी को चिकित्सकीय देखभाल, शिक्षा एवं अनुसंधान ब्रोंकोलोजी और इन्टरवेंशनल पलमोनरी के बढ़ते हुए क्षेत्रों में उत्कृष्टता प्रदान करनी है और एक मध्य स्तर के आकार के अस्पताल को इन्टरवेंशनल पलमोनोलोजी के उत्कृष्टता का केन्द्र बनाना चाहिए जिसका मिशन अंर्त क्षेत्रों एवं अंतर्राष्ट्रीय सहयोग, नये तरीकों और क्रियाओं के क्षेत्र में शोध है, जिससे कि फेफड़ों के कैंसर, टैकिया-ब्रोनकीनल रोगों, फेफड़ों को प्रक्रियाओं और अन्य रोगों के रोगियों को भी लाभ मिल सकते हैं।

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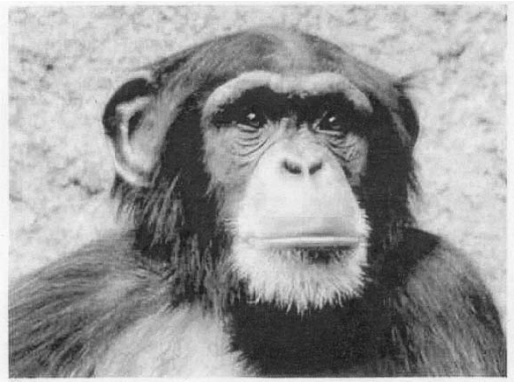
हम मानव का विकास कैसे हुआ?*

*डॉ. लालजी सिंह***

जब से हमारी सभ्यता का शुभारंभ हुआ, तभी से मनुष्य इसी प्रश्न में उलझा रहा है कि हम कौन हैं और कहाँ से आए हैं? प्रारंभ में जब हमारा ज्ञान सीमित था तब समस्त मानव जाति विश्वास किया करती थी कि आधुनिक मानव की उत्पत्ति ईश्वर की एक अनोखी देन है। सन् 1878 में पहली बार डार्विन को विश्व के जानवरों और पेड़-पौधों को देखकर एहसास हुआ कि बहुत सारे ऐसे जानवर हैं जो एक दूसरे से इस तरह मिलते-जुलते हैं जैसे कि उनकी उत्पत्ति एक दूसरे से हुई हो। इस तरह उन्होंने विश्व में पहली बार विकासक्रम सिद्धांत (Theory of evolution) का प्रस्ताव रखा और एक ग्रंथ लिखा, जिसका नाम था 'The Desent of Man and Selection in Relation to Sex' । इस ग्रंथ के अनुसार चिपैंजी और आधुनिक मानव की उत्पत्ति एक ही पूर्वज से हुई मानी जाती है। डार्विन के इस सिद्धांत ने पूरे विश्व को चौंका दिया था। जब तक वे जीवित रहे तब तक उनके इस सिद्धांत का विरोध होता रहा। लेकिन अब यह सर्वमान्य हो गया है कि जीवों की उत्पत्ति ओर विकास प्रकृति की देख-रेख में एक विकासक्रम में हुआ है न कि ईश्वर ने मनुष्य की अलग से संरचना की। अफ्रीका में पाए गए जीवाश्मों के आधार पर ऐसा अनुमान लगाया गया है कि मानव की उत्पत्ति 50 से 70 लाख वर्ष पूर्व एक ही पूर्वज से हुई। जब से चिंपैंजी और मानव एक ही पूर्वज से अलग-अलग विकसित होना शुरू हुए तभी से दोनों के आकार-प्रकार में कुछ महत्वपूर्ण परिवर्तन हुए हैं। उदाहरण के लिए मानव के पूरे शरीर से, केवल सिर को छोड़ कर, बाल झड़ गए। जबकि चिंपैंजी का शरीर अभी बालों से ढका होता है। आधुनिक मानव दो पैरों पर चलने लगा, जबकि चिंपैंजी अब भी चार पैंरों पर चलता है। सबसे बड़ा परिवर्तन है चिंपैंजी के मस्तिष्क से मानव के मस्तिष्क का बहुत बड़ा होना तथा उसकी बुद्धिमत्ता की क्षमता में असीमित विकास। केवल मानव ही इस पृथ्वी पर एक ऐसा जीव है, जिसमें बातचीत करने का गुण, संवेदनशीलता तथा सोचने की क्षमता मौजूद है।

आखिर यह सब संभव कैसे हुआ?

विश्वभर के वैज्ञानिकों में इस विचार पर अब लगभग सहमति हो गयी है कि आधुनिक मानव की उत्पत्ति 'होमोइरेक्टस' जैसे एक प्राणी से हुई। होमो-इरेक्टस की उत्पत्ति 109 लाख वर्ष पूर्व अफ्रीका में हुई। इसके बाद इस प्राणी के जीवाश्मों के उतने ही पुराने सबूत यूरोप और एशिया में मिलते हैं जितने कि अफ्रीका में। होमो-इरेक्टस से आधुनिक मानव से मिलती-जुलती एक और प्रजाति की उत्पत्ति 230 हजार वर्ष पहले हुई थी। इस प्रजाति के शरीर के जीवाश्म यूरोप में बर्फ में पाए गए। इनको होमो-नियण्डरथेलेंसिस कहा गया। ये करीब 30 से 40 हजार वर्ष पूर्व तक यूरोप में रहा करते थे। मानव से मिलती-जुलती छोटे शरीर वाली एक नई प्रजाति के जीवाश्म इन्डोनेशिया के जावा आईलैण्ड में फ्लोरेन्स जगह में पाए गए। इस प्रजाति को होमो-फ्लोरेन्सियेन्सिस नाम दिया गया। ये जीवाश्म 230 हजार वर्ष से भी पहले के माने गए हैं। ऐसा माना जाता है कि आधुनिक मानव की उत्पत्ति 160 हजार वर्ष पहले पूर्वी अफ्रीका में एक माता से हुई। इसका आधार मनुष्य की प्रत्येक कोशिका में पाया जाने वाला माइटोकॉड्रियल डीएनए है जो कि केवल माता से प्राप्त होता है।



चिपैंजी और मानव की उत्पत्ति एक ही पूर्वज से हुई

आधुनिक मानव तथा होमो-नियण्डरथेलेंसिस 30 से 40 हजार वर्ष पहले यूरोप में एक ही साथ रहा करते थे। पहले यह अनुमान लगाया गया था कि शायद यूरोप में पाई जाने वाली मानव जातियों की उत्पत्ति होमो-नियण्डरथेलेंसिस से हुई। लेकिन डीएनए का अध्ययन करने के बाद अब यह सिद्ध हो गया है कि आधुनिक मानव की उत्पत्ति में होमो-नियण्डरथेलेंसिस का कोई योगदान नहीं है। करीब 65 से 85 हजार वर्ष पूर्व तक आधुनिक मानव ने अफ्रीका के 'रेन-फॉरेस्ट' (वर्षावन), कालाहारी रेगिस्तान तथा अन्य भागों में प्रवास किया। इसके बाद अफ्रीका से निकलकर वह अन्य देशों की तरफ भी गया। पाश्चात्य देश के वैज्ञानिकों के अनुसार मानव जब अफ्रीका से निकला तब लाल सागर को पार करके 'मिडल ईस्ट' होते हुए, यूरोप, दक्षिणी-पूर्व एशिया और आस्ट्रेलिया पहुँचा। इसे 'नार्दर्न रूट आफ माइग्रेशन' यानी 'पलायन का उत्तरी मार्ग' कहा गया। लेकिन सीसीएमबी के वैज्ञानिकों ने भारत में पाए

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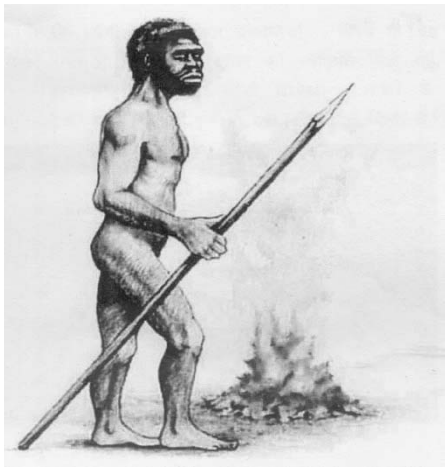
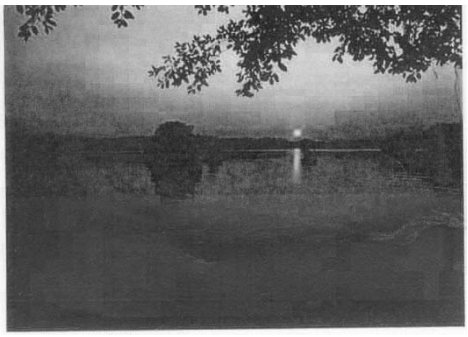
*साभार – ''जिज्ञासा-2008'' सी.सी.एम.बी., हैदराबाद

**पूर्व कुलपति, काशी हिन्दू विश्वविद्यालय, वाराणसी

जाने वाल आदिवासियों के डीएनए का अध्ययन करके, खास कर अंडमान निकोबार द्वीप में पाई जाने वाली निग्रेटो प्रजाति, ओंगी, जारवा तथा ग्रेट-अडमानियों पर किए गए अध्ययनों से सिद्ध कर दिखाया कि मानव जब अफ्रीका से निकला तो उत्तरी मार्ग न लेकर के दक्षिणी मार्ग से भारत होते हुए अंडमान निकोबार पहुँचा। क्योंकि अंडमान में पाई जाने वाली ओंगी, जारवा और ग्रेट-अंडमानी प्रजातियाँ अफ्रीका के बाहर पूरे विश्व में सबसे पुरानी हैं। इसलिए ऐसा अनुमान है कि 60 से 65 हजार वर्ष पूर्व ये प्रजातियाँ इस द्वीप पर पहुँची थीं। भारतवर्ष के मुख्य भागों में भी बहुत सारी ऐसी आदिवासी प्रजातियाँ हैं जो कि ज्यादा नहीं तो उतनी ही पुरानी हैं जितनी कि ओंगी और जारवा प्रजातियाँ। विश्व के वैज्ञानिक जगत में हमारी इस खोज को स्वीकृति मिल गई है। लंदन और अमेरिका जैसे पाश्चात्य देशों के वैज्ञानिकों ने भी अपने अध्ययनों से इसका समर्थन किया है।



होमो इरेक्ट्स



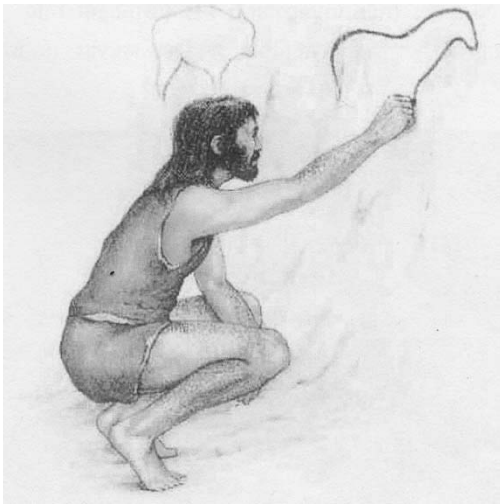
एमेजॉन जंगल

आखिर मानव ने अफ्रीका से प्रवास क्यों किया?

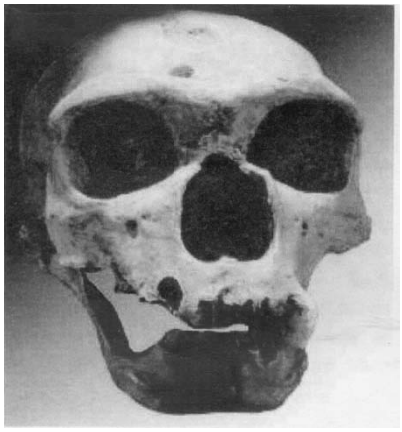
यह एक ऐसा प्रश्न है जो लगातार वैज्ञानिकों को परेशान करता रहा है। आर्कटिक टुंड्रा की भयंकर ठंडक से लेकर आस्ट्रेलिया के कुछ भागों में भीषण गर्मी वाले प्रांत तथा उमस भरे 'अमेजान जंगलों' तक हमारी मानवजाति (होमो सैपियनस) विश्व के हर कोने में पहुँच गयी है तथा अत्यंत प्रतिकूल वातावरण में भी सफलतापूर्वक बनी रहने में समर्थ हो गयी है। पर फिर क्या कारण है जिसकी वजह से उसने उस समय अफ्रीका छोड़ा? कौनसी परिस्थितियाँ थीं जिन्होंने आधुनिक मानव को अफ्रीका छोड़ने पर बाध्य किया और अपने देश की सीमाओं को लाँघकर विश्व के अन्य प्रांतों में प्रवास करने पर उसे मजबूर किया, जो अन्य किसी प्रजाति के संदर्भ में नहीं हुआ।

पूर्वी अफ्रीका में 135 से 175 हजार वर्ष पूर्व भयंकर सूखे के प्रमाण

पुरातत्व अध्ययनों से सन् 2007 में यह प्रमाण उभर कर सामने आया है कि 135 से 175 हजार वर्ष पूर्व 'मलावी तालाब' के पानी की सतह करीब 95% कम हो गई थी। शायद मनुष्य के अफ्रीका से पलायन का यह एक कारण हो सकता है। इसके बाद पानी के स्तर में विशाल वृद्धि हुई। करीब 70 हजार वर्ष पूर्व मानव विस्तार तथा और देशों की तरफ उनके प्रस्थान का कारण अनुकूल वातावरण की तलाश रहा होगा। पुरातत्व सर्वेक्षणों से मिले आनुवंशिक प्रमाण यह सिद्ध करते हैं कि मानव का एक ही सफलतापूर्वक विस्तारीकरण दक्षिण तथा दक्षिणपूर्वी एशिया से आस्ट्रेलिया, फिर वहाँ से यूरोप की तरफ हुआ। मानव के बनाए हुए जो औजार पश्चिमी भारतवर्ष में पैट्रिक में, दक्षिण भारत के ज्वालापुरम में और श्रीलंका के बाटाडोंबा-लीना में पाए गए हैं, वे पूर्वी तथा दक्षिणी अफ्रीका में पाए गए औजारों से मिलते-जुलते हैं। इस कारण से यह अनुमान लगाया जाता है कि ये औजार उस समय के होंगे जब 60 से 65 हजार वर्ष पूर्व मानव ने पहली बार अफ्रीका से बाहर जाने का प्रयास किया होगा। सन् 2007 में, दक्षिण भारत के ज्वालापुरम में जूरेरू नदी की घाटी में मिले पुरातत्व नमूनों के विश्लेषण सिद्ध करते हें कि आधुनिक मानव वहाँ पर करीब 75 हजार वर्ष पूर्व था। इससे आनुवंशिक आधार पर निकाले गए निष्कर्षों की भी पुष्टि होती है कि मानव दक्षिण के रास्ते से भारत होते हुए अन्य देशों में गया।



होमो सैपियनस



नियण्डरथैलेंसिस की खोपड़ी

आखिर किस तरह हमारे इन अनोखे मानवीय गुणों की उत्पत्ति हुई? किस प्रकार हमारी भाषा की क्षमता, सभ्यता तथा तार्किक क्षमता, हमारे जीनों में हमारे विकासक्रम के दौरान आई? चिंपैंजी तथा मानव जीनोम के तुलनात्मक अध्ययन के बाद यह पता लगा है कि मनुष्य में 'मायोसिन हैवीचेन जीन' (HYH16) में एक बेस-परिवर्तन हुआ जिसकी वजह से मानव के दोनों जबड़ों को जोड़ने वाली जो मांसपेशियाँ हैं उनकी लम्बाई चिंपैंजी और गोरिल्ला में पायी जाने वाली मांसपेशियों से बहुत कम हो गयी और जिसकी वजह से हमारी दाँतों से चबाने की शक्ति भी कम हुई। यही नहीं इस कारण से हमारी खोपड़ी को विस्तरित होने का अवसर मिला। यह उत्परिवर्तन केवल मनुष्य में ही पाया गया है, चिंपैंजी में नहीं। ऐसा अनुमान लगाया जाता है कि इसी से हमारी खोपड़ी के आकार में वृद्धि की शुरूआत हुई। इसलिए मायोसिन हैवीचेन जीन (HYH16) को मानव विकास के लिए बहुत ही महत्वपूर्ण माना जाता है।

एक और जीन जो कि मानव के विकासक्रम के लिए बहुत ही महत्वपूर्ण माना गया है– वह है प्रोडीमार्फिन (PDYN), जिससे बहुत सारी न्यूरोपेप्टाइड बनती हैं तथा जो हमारी सीखने की क्षमता, दर्द का एहसास, संवेदनशीलता, आचरण तथा याद्दाश्त के लिए जिम्मेदार है। चिंपैंजी, गोरिल्ला और ओराँगुटाँन में, इस जीन (PDYN) के 68 बेस पेयरों के प्रमोटर की सिर्फ एक प्रति ही पायी जाती है। मानव में इसकी चार प्रतियाँ होती हैं – जिनमें पाँच बेसांतरण (उत्परिवर्तन) पाए गये हैं जो अन्य नरवानरों (प्राइमेटों) में नहीं हैं। जब हम मानव के इस PDYN जीन के प्रमोटर का उपयोग मानव की तंत्रीय कोशिकाओं में करते हैं तो इस जीन की अभिव्यक्ति चिंपैंजी के प्रमोटर से 20% बढ़ जाती है। इस आधार पर यह कहा जा सकता है कि हमें मानव बनाने में यह परिवर्तन बहुत महत्वपूर्ण रहा होगा। अतः मानव के विकासक्रम में इस जीन का बहुत ही महत्वपूर्ण योगदान रहा है।

- **जीन FOX P_2 :** यह जीन एक प्रोटीन बनाता है जो मनुष्य की वाक्क्षमता तथा भाषा के लिए आवश्यक है। दूसरा अन्य कोई ऐसा जीव नहीं है जिसकी वाक्क्षमता की तुलना आधुनिक मानव की वाक्क्षमता से की जा सके।
- **जीन माइक्रोसिफेलिन (Microsyphalin) :** यह जीन मनुष्य के सेरिब्रल कार्टेक्स के विकास के लिए जिम्मेदार है।
- **जीन AHI_1 :** यह एक और जीन है जो कि हमारी न्यूरल-प्रणाली को नियंत्रित करता है।
- **जीन $SLC_{24}A5$:** यह जीन आधुनिक मानव के शरीर के रंग के लिए जिम्मेदार है। इसकी वजह से यूरोपियन लोगों का शरीर श्वेत पाया जाता है। इस जीन में दो बेस-उत्परिवर्तन होते हैं जबकि सभी अफ्रीकी तथा एशियाइयों में केवल एक बेस-परिवर्तन पाया गया है। इनमें से एक बेस-उत्परिवर्तन ऐसा है जो अफ्रीकन तथा एशियाइयों में मिलता है। दूसरा बेस-उत्परिवर्तन यूरोपियों में ही मिलता है जो एशियाईयों और अफ्रीकी लोगों में नहीं मिलता। इस जीन में बेस-उत्परिवर्तन के आधार पर मानव के शरीर के सभी रंगों की उत्पत्ति को समझा जा सकता है।

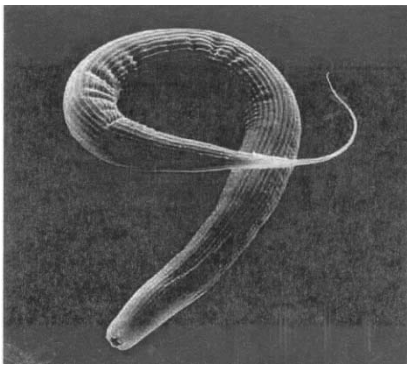
वह क्या है जो हमें मानव बनाता है?

मनुष्य के जीनोम में जो जीन तरह-तरह की प्रोटीन बनाते हैं उनकी संख्या 20 से 25 हजार तक है जो कि निमेटोड में पाए जाने वाले 19 हजार जीनों से मुश्किल से अधिक है। निमेटोड केवल 10,000 कोशिकाओं से बना होता है। लेकिन मनुष्य का शरीर, जो कि विभिन्न ढाँचों और अंगों का बना होता है करीब 100 लाख करोड़ कोशिकाओं से बनता है। आखिर, इतनी जटिलता से युक्त मानव शरीर को बनाने की सूचनाएं जीनोम में कहाँ होती है?

मानव तथा अन्य जीवों के जीनोम का अध्ययन करने के बाद वैज्ञानिक इस निष्कर्ष पर पहुँचे हैं कि मानव को विशिष्ट बनाने का राज प्रत्येक कोशिका में पाए जाने वाले संपूर्ण डीएनए में निहित होता है न कि केवल हमारे जीनों में, जिनकी संख्या 20 से 25 हजार है। वैज्ञानिक 98.8% मानव जीनोम को अब तक 'जंक' या अक्रिय कहते आए हैं। हम यह कह सकते हैं कि मानव अपने जीनोम में पाए जाने वाले जंक डीएनए की वजह से ही मानव है। इसलिए, जब तक हम मानव के संपूर्ण जीनोम के कार्य को समझ नहीं लेते तब तक हम यह पूर्णतः जानने में अक्षम रहेंगे कि वह क्या है जो हमें मानव बनाता है?

आधुनिक अध्ययन से ज्ञात हुआ है कि एसआईआरएनए, माइक्रोआरएनए तथा एसआरएनए जीन की अभिव्यक्ति को नियंत्रित करने में बहुत ही महत्वपूर्ण भूमिका निभाते हैं। इससे पूर्व इस बात की वैज्ञानिक जगत को खबर नहीं थी। आरएनए प्रोटीन नहीं बनाते हैं, लेकिन विशिष्ट जीन की अभिव्यक्ति का नियंत्रण अवश्य करते

हैं। ये प्रजाति-विशिष्ट होने के साथ-साथ अंग-विशिष्ट भी होते हैं। इस तरह ये समस्त जीन के कार्यकलापों को एकीकृत करते हैं। उदाहरण के लिए, मानव के मस्तिष्क में जो जीन प्रोटीन बनाते हैं उनकी अभिव्यक्ति चिंपैंजी की तुलना में चार गुना अधिक होती है, जबकि चिंपैंजी और मानव के जिगर में प्रोटीन बनाने वाले जीनों की अभिव्यक्ति समान होती है। मानव में जीन की अभिव्यक्ति के तौर-तरीकों में कुछ ऐसे तरीके उभर कर सामने आए हैं जो कि मनुष्य के शरीर के जटिलता को कुछ हद तक समझने के लिए समर्थ हैं, जैसे कि 'ऑल्टर्नेटिव स्प्लाइसिंग'। मानव में जीन छोटे-छोटे टुकड़ों में बँटे रहते हैं जिनको 'एक्सॉन' कहते हैं। इन टुकड़ों के बीच के डीएनए को 'इंट्रॉन' कहते हैं। जब जीन से आरएनए बनता है तब उसमें सभी 'एक्सॉन' और 'इंट्रॉन' सम्मिलित होते हैं। आरएनए से प्रोटीन बनने से पहले जितने भी इंट्रॉनिक आरएनए हैं, वे काटकर निकाल दिए जाते हैं और सभी एक्सॉनिक आरएनए जोड़ दिए जाते हैं। इस प्रक्रिया को 'ऑल्टनैटिव स्प्लाइसिंग' कहा जाता है। मानव का हर एक जीन औसतन तीन भिन्न-भिन्न प्रोटीनों को 'ऑल्टर्नेटिव स्प्लाइसिंग' द्वारा बनाता है। इनका कार्य बिल्कुल अलग होता है यद्यपि इनमें एमिनो अम्ल की बड़ी समानता होती है। इस तरह 25 हजार जीन मानव में कम से कम 75 हजार या इससे अधिक भिन्न-भिन्न प्रोटीनों को बनाने में समर्थ होते हैं।



निमेटोड

क्या जंक डीएनए वास्तव में 'जंक' ही है?

हम लोगों के अध्ययन से यह सिद्ध हो गया है कि मायोसिन-बाइंडिंग सी-3 जीन (MYBPC3) में एक्सॉन-32 और एक्सॉन-33 के बीच के इंट्रॉन के 25 बेस पेयरों का डिलिशन होने के कारण उस जीन से जो प्रोटीन बनता है वह एक्सॉन-33 प्रोटीन बनाने की प्रक्रिया से बाहर हो जाता है। इसकी वजह से पूरे जीन से जो प्रोटीन बनता है वह सामान्य प्रोटीन से छोटा होता है। इसके कारण भारतीय रोगियों में आनुवांशिक कॉर्डियो मायोपैथी पाया जाता है। जिन लोगों में यह डिलिशन मिलता है उनकी मृत्यु कम आयु में ही हो जाती है। इस तरह पहली बार हम लोगों ने यह दिखाया है कि 'इंट्रॉन' जो कि अभी तक जीन का बेकार भाग माना जाता था, वास्तव में बहुत ही महत्वपूर्ण भूमिका निभाता है। इस इंट्रॉन में खराबी के कारण हृदय रोग जैसी बीमारियाँ होती हैं जो आगे चलकर घातक साबित होती हैं।

कंजर्व्ड नॉन-कोडिंग जीन (CNG)

मानव जीनोम में वो जीन जो प्रोटीन बनाते हैं उनमें कुछ ऐसे डीएनए अनुक्रम भी होते हैं जो प्रोटीन नहीं बनाते हैं और उनके करीब 200 बेस-पेयर, मछली से लेकर मानव तक के जीनों में एक समान होते हैं और उनमें एक बेस-पेयर का भी अंतर नहीं होता है। मानव के जीनोम में प्रोटीन बनाने वाले जीनों की तुलना में नॉन-कोडिंग (CNG) जीन कहीं अधिक संरक्षित (कंजर्व्ड) होते हैं। ये खासतौर पर उन जीनों से लगे होते हैं जिनका प्रकार्य विकासात्मक होता है। इनके कार्य की पूरी जानकारी नहीं हो पायी है। इसे समझने के लिए सीसीएमबी के वैज्ञानिक डॉ. राकेश मिश्रा एवं उनके साथियों ने एक बहुत ही महत्वपूर्ण प्रयोग किया है जो इस प्रकार है :

सीसीएमबी वैज्ञानिकों की इस टीम ने ग्रीन फ्लोरोसेंट जीन को उसके प्रमोटर के साथ लेकर अंदरूनी कोशिका-पंक्ति के अंदर स्थानांतरित किया है। जीएफपी प्रोटीन (GFP) की सभी कोशिकाओं में अभिव्यक्ति के कारण उनमें फ्लोरोसेंस देखा जा सकता है। दूसरे प्रयोग में जब वैज्ञानिकों ने जीएफपी प्रोटीन के प्रमोटर के पहले हाक्स डी (HOX D) जीन के कंजर्व्ड नॉन-कोडिंग डीएनए अनुक्रम (सीआर-3) को जोड़कर स्थानांतरित किया तब कोशिकाओं में ग्रीन फ्लोरोसेंस समाप्त हो गया। तीसरे प्रयोग में जब सीआर-3 को निकाल दिया गया तो फ्लोरोसेंस फिर से दिखाई देने लगा। इससे यह सिद्ध हो जाता है कि यह संरक्षित नॉन-कोडिंग अनुक्रमण एक स्विच की तरह काम करता है और जो इससे जुड़े हुए सभी जीनों की अभिव्यक्ति को बंद कर देता है। इस तरह यह संरक्षित नॉन-कोडिंग अनुक्रमण यद्यपि प्रोटीन तो नहीं बनाता परन्तु उससे भी अधिक महत्वपूर्ण कार्य वह इससे जुड़े हुए जीन की अभिव्यक्ति को संचालित करने में करता है।

मानवता के लिए जिम्मेदार जीन की पहचान

हमारे जीनोम में जीन के अलावा जो अन्य डीएनए अनुक्रमण हैं – जिन्हें वैज्ञानिक अब तक 'जंक' कहते आ रहे हैं और जो प्रोटीन नहीं बनाते हैं- वे त्वरित गति से विकसित हो रहे हैं। शायद हमारे मानव होने का रहस्य इनमें ही छिपा हो। जीन HAR1F (Human Acceleration Regions) कोई प्रोटीन नहीं बनाता है। लेकिन इससे मस्तिष्क की Cajal-Retzius कोशिका में आरएनए बनता है। यह आरएनए निर्धारित करता है कि किस तरह मस्तिष्क के कॉर्टेक्स में विकास के दौरान 6 परतें बनती हैं। यह 'रीलिन' नामक प्रोटीन के साथ मिलकर इन 6 परतों के बनने में बहुत महत्वपूर्ण भूमिका निभाता है। HAR1F की लंबाई 118 बेस-पेयर होती है, जिसमें विकास क्रम के दौरान बहुत तीव्र गति से परिवर्तन हुआ है। जब आधुनिक मानव और चिंपैंजी का उनके

पूर्वजों से अलगाव हुआ, तभी से मानव में 18 बेस स्थानांतरण पाए गए हैं जबकि इस 118 बेस-पेयर में चिंपैंजी और मुर्गी के बीच केवल 2 बेस-पेयरों के स्थानांतरण पाए गए हैं। इससे यह सिद्ध होता है कि 3100 हजार वर्ष पूर्व हमारे पूर्वजों में यह जीन मौजूद था। यह जीन मेढक, मछली तथा कशेरूकी (इंनवर्टिब्रेट) में नहीं पाया जाता है। इससे यह पता चलता है कि लगभग 4000 लाख वर्ष पूर्व इस जीन की उत्पत्ति हुई। यह मानव-क्रोमोसोम संख्या 20 में पाया जाता है। पृथ्वी पर मौजूद सभी मनुष्यों में यह परिवर्तन पाया जाता है। चूहे में एक उत्परिवर्तन पाया जाता है जिसमें रीलिंग प्रोटीन नहीं बनती जिसकी वजह से कॉर्टेक्स में पाए जाने वाली 6 परतों का उचित चयन नहीं हो पाता है। इससे यह सिद्ध होता है कि मनुष्य के मस्तिष्क के विकास में इस जीन की बहुत ही अहम भूमिका रही है।

बाऊँड्री घटक

जीनोम में कुछ ऐसे डीएनए अनुक्रमण होते हैं जो कि क्रोमेटिन डोमेन को निर्धारित करते हैं। सीसीएमबी के वैज्ञानिकों ने साँप के डीएनए से प्राप्त एक ऐसे जंक डीएनए का अध्ययन किया है जो कि 4 बेस-पेयर (GATA) का रिपीट है। ये यूकैरियोट वर्ग के सभी प्राणियों में पाया जाता है। मनुष्य, चिंपैंजी तथा चूहे के जीनोम में इसकी दस से बारह प्रतियाँ लगातार एक के बाद एक, बिना किसी बाधा के पाई गई है। इससे जुड़े अनुक्रमण में न्यूक्लियर मैट्रिक्स जुड़ने के लिए सिग्नल अनुक्रमण होते हैं। इनका क्या कार्य है अभी तक पता नहीं था। सीसीएमबी के वैज्ञानिक डॉ. राकेश मिश्रा एवं उनके सहयोगियों ने फलमक्खी (ड्रोसोफिला) में GATA रिपीट तथा उससे जुड़े अनुक्रमणों को लेकर ट्रांसजेनिक ड्रोसोफिला बनाकर दिखाया है कि इस अनुक्रमण को 'एनहांसर' और 'रिपोर्टर' जीन के बीच डालने से रिपोर्टर जीन की अभिव्यक्ति समाप्त हो जाती है। इससे सिद्ध होता है कि यह अनुक्रमण बाऊँड्री घटकों का कार्य करता है। जब इस अनुक्रमण का ट्रांसजनिक मक्खी में दो अलग-अलग क्रोमोसोमों में समाकलन किया जाता है तब इंटरफेज न्यूक्लिआई में दोनों क्रोमोसोम एक साथ पाए जाते हैं। जब इस अनुक्रमण को निकाल दिया जाता है तब दोनों क्रोमोसोम अलग हो जाते हैं। इससे पहली बार यह दिखाने में सफलता मिली है कि GATA रिपीट तथा इससे जुड़े हुए अनुक्रमण बड़े पैमाने पर क्रोमेटिन-संश्लेषण में भूमिका अदा करते हैं – जिसके आधार पर कोशिका की ट्रांसक्रिप्शन प्रणाली जीन को ट्रांसक्राइब करने में समर्थ होती है। अतः जंक डीएनए की वास्तव में बहुत महत्वपूर्ण भूमिका होती है, जिसने मानव को मानव बनाने में संभवतः बहुत बड़ा योगदान दिया होगा।

ट्रांस्प्लाइसिंग

सीसीएमबी के वैज्ञानिकों ने यह प्रदर्शित किया है कि मानव के Y क्रोमोसोम में पाए जाने वाले 'जंक' डीएनए, जिसे अन्य वैज्ञानिकों ने अब तक निष्क्रिय माना है, से भी आरएनए बनता है। विश्व में यह पहली बार दिखाया गया है कि यह आरएनए क्रोमोसोम नं. 1 में पाए जाने वाले एक जीन की अभिव्यक्ति को नियंत्रित करता है।

एपिजेनेटिक वंशानुगति

हमारे जीनोम में 'कोर-हिस्टोन-ऑक्टामर' होता है जिसके ऊपर डीएनए लिपटा होता है। इस हिस्टोन की पूँछ बाहर निकली होती है जिसको कि परिवर्तित किया जा सकता है। इस हिस्टोन को मेथिलेट करने से क्रोमेटिन कंपैक्ट और निष्क्रिय हो जाता है। इसके एसिटिलेशन से क्रोमेटिन डीकांपैक्ट और सक्रिय हो जाता है। यह परिवर्तन वातावरणी (Environmental) प्रभाव की वजह से होता है। उदाहरण के लिए यह हमारे खान-पान पर भी निर्भर करता है। यद्यपि इन परिवर्तनों की वजह से जीन पूर्णतः ठीक होने पर भी अगली पीढ़ी में काम नहीं करता है, जिसकी वजह से सीजोफ्रेनिया जैसी बीमारियाँ हो जाती हैं। उदाहरण के लिए रीलिन एक ग्लाइकोप्रोटीन है, जो विकास के दौरान तथा वयस्कों में 'गाबा कंटेनिंग न्यूरॉन' (GABA) की अभिव्यक्ति करता है और मस्तिष्क के विकास में न्यूरॉन के अवस्थितीकरण (पोजीशनिंग) के लिए महत्वपूर्ण होता है। सीजोफ्रेनिया के मरीजों के मस्तिष्क के कई भागों में इस रीलिन जीन की अभिव्यक्ति बहुत कम हो जाती है। जब चिकित्सक ऐसे मरीजों को 'मिथायोनिन' दवा देते हैं – तो इस जीन का प्रमोटर-हाइपर-मेथिलेटेडे हो जाता है। ऐसे मरीजों को जब 5-aza-2 डीऑक्सीसाइटीडिन दिया जाता है तो रीलिन जीन की अभिव्यक्ति बढ़ जाती है और सीजोफ्रेनिया के लक्षण नियंत्रित हो जाते हैं। इस तरह एपिजेनेटिक वंशानुगति का सही पता लगाने पर उसके द्वारा उत्पन्न बीमारियों को ठीक किया जा सकता है।

क्या मनुष्य का विकासक्रम अब भी जारी है?

कुछ वैज्ञानिकों का कहना है कि मानव का विकासक्रम रूक गया है और कुछ कहते हैं कि वह जारी है और पहले से तेजगति से हो रहा है। बहुत कारणों की वजह से यह विश्वास किया जा सकता है कि विकासक्रम अब भी जारी है। इससे बहुत सारे प्रश्न उठते हैं। इनमें कुछ ऐसे प्रश्न भी हैं जो बहुत ही जटिल है। उदाहरण के तौर पर अगर हम यह पाते हैं कि जो अलग-अलग जातियाँ और प्रजातियाँ हैं, यदि वे जैविक रूप से एक जैसी नहीं है तो क्या अब भी मनुष्य के विकासक्रम में वे उतनी ही सार्थक नहीं हैं? जबकि हमारा अस्तित्व आज जीन के अलावा अधिकतम तकनीकी ज्ञान पर निर्भर है। हमारा बदलता हुआ जीनोम किस हद तक हमारी बदलती हुई प्रकृति, जैसे कि बुद्धिमत्ता के लिए जिम्मेदार है? आधुनिक मानव एक हजार वर्ष बाद किस तरह तरह होगा और कैसा दिखेगा? मानव का आधुनिक विकासक्रम एक 'बारूदी सुरंग' (माइन फील्ड) की तरह है जिसकी उपेक्षा नहीं की जा सकती है। एक प्रत्यक्ष उदाहरण है– ऐसा जीव जो कि उभरती हुई बीमारियों के

प्रति बचने की क्षमता को प्रदान करता है। कुछ लोगों में CCR5-Δ32 नाम का एक जीन पाया जाता है, जो कि त्वरित गति से बढ़ रहे HIV-1 से बचने के लिए कुछ हद तक सुरक्षा प्रदान करता है। आजकल मनुष्य में बच्चे 'सीजेरियन' प्रक्रिया की मदद से पैदा किए जाते हैं। प्रत्येक प्रजाति में बच्चे का आकार और वजन जीन द्वारा निर्धारित रहता है। यदि कोई बच्चा निर्धारित आकार से बड़ा होता है तो प्राकृतिक ढंग से उसका जन्म नहीं हो पाता है और जन्म के समय बच्चे और उसकी माँ को खतरा हो जाता है। इसके साथ उस जीन की भी समाप्ति हो जाती है जिसके कारण वह बच्चा बड़ा पैदा हुआ। 'सीजेरियन सेक्शन' से बच्चा पैदा करने से हम लोग ऐसे जीन को चुन रहे होंगे जिसके कारण बच्चे सामान्य आकार में बड़े होते हैं। प्रौद्योगिकी और औषधियों के कारण लगभग सभी को बच्चे हो सकते हैं। इस कारण से, व्युत्क्रम-विकास हो रहा होगा– क्योंकि वह अयोग्य जीन उस समुदाय से समाप्त नहीं हो पाता। वर्तमान में सबसे प्रमुख चयन-प्रेशर हमारे मस्तिष्क के ऊपर है।

आधुनिक मानव

अब से एक हजार वर्ष बाद लोग बहुत अधिक सुंदर, बुद्धिमान, समतुल्य, स्वस्थ और मानसिक रूप से दृढ़ होंगे। यह 40 पीढ़ियों तक आनुवंशिक परीक्षणों से संभव हो सकेगा। तरह-तरह की पुनरोत्पादक तकनीकें, जैसे – काँट्रासेप्शन तथा चुनिंदा साथी (पार्टनर) मानव विकासक्रम पर अत्यधिक प्रभाव डाल रहे हैं। आज 'शुक्राणु' (sperm) तथा 'डिम्ब' (egg) दाताओं की संख्या बढ़ती जा रही है। ऐसा अंदाजा लगाया जा रहा है कि अगली सहस्राब्दि तक हम अपने जीनोम में फेरबदल करने में इतने समर्थ हो जाएँगे कि मानव का विकासक्रम बहुत सारे ऐसे नए नियमों के अनुरूप निर्धारित होगा कि जिनका अंदाजा डार्विन को भी नहीं रहा होगा। कुछ पीढ़ियों के बाद ही मार्केट-आधारित जेनेटिक टेक्नोलॉजी इतनी सामान्य हो जाएगी कि लोग अपनी इच्छानुसार गुणों से युक्त बच्चों को पैदा करने में समर्थ हो जाएँगे, जो अंततः मानव विकासक्रम के लिए महत्वपूर्ण साबित होगी।

यदि हम किसी दूसरे ग्रह में बसने गए तो हमारा विकासक्रम बहुत ही अद्‌भुत ढंग से हो सकेगा। जो लोग दूसरे ग्रह पर जाएंगे, उनके साथ ले जाए गए जानवर तथा पौधों में विकासक्रम के बदलाव उस ग्रह के अनुसार स्थापित होंगे। यदि उनका पृथ्वी के लोगों से प्रजनन नहीं हुआ तो संभव है कि अन्य ग्रहों पर जाने वालों की एक अलग ही जाति बन जाए। अंततः हम इस निष्कर्ष पर पहुँच सकते हैं कि मनुष्य में आज भी विकास जारी है और वह भी बहुत त्वरित गति से। शायद अन्य सभी प्रजातियाँ भी इसी तरह विकासात्मकता की ओर अग्रसर है। विकासक्रम की दिशा की भविष्यवाणी करना एक निरर्थक प्रयास होगा। क्योंकि विकासक्रम एक ऐसा विज्ञान है जिसकी भविष्यवाणी नहीं की जा सकती है। हम जिस ओर अग्रसर हैं शायद वह हमारी पसंद का न हो। ऐसा लगता है हम अपने इस भूतल को इतना प्रदूषित कर देंगे कि शायद कोई ऐसा मनुष्य ही बच पाएगा, जो मानव जाति का कोई बचा-खुचा अंश बनकर कीड़े-मकोड़े खाकर गुफा में रह सकेगा। हम चाहे जहाँ भी जाएं और मानव विकास हमें जहाँ भी ले जाएं, यह तय है कि हमारे विकासक्रम की कहानी की यह मात्र शुरूआत ही है।

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क्या ब्रह्माण्ड का फैलाव हो रहा है?*

*प्रो. जयन्त वी. नार्लीकर***

रेल स्टेशन से लौटते समय नानाजी ने देखा कि बच्चे शांत और विचारमग्न लग रहे थे। आखिर उनसे चुप न रहा गया।

''नानाजी आपके साथ रेलगाड़ियाँ देखने में मजा आया।'' शरद बोला।

''रेलमार्ग पर के पुल पर से गाड़ियाँ आते-जाते कितनी लुभावनी लगती हैं। लेकिन नानाजी आज हमें इंजिनों की सीटियाँ सुनने को क्यों कहते थे?'' मल्लिका ने पूछा।

''बताता हूँ। पर ये बताओ सीटी के आवाज में क्या खासियत नज़र आई तुम्हें?'' नानाजी ने पूछा। बच्चे सोचने लगे। आखिर मल्लिका ने अनुमान किया ''जब इंजिन हमारी तरफ आ रहा था मुझे लगा कि सीटी ऊँचे स्वर में थी। जैसे ही गाड़ी पुल के नीचे से गुजरकर हमसे दूर जाने लगी, सीटी का स्वर गिरकर निचला हुआ।''

शरद और कल्पना ने सहमति दर्शक अपने सिर हिलाये।

''बिल्कुल सही। इस परिणाम को डॉप्लर इफेक्ट कहते हैं, जिसकी खोज डॉप्लर नाम वैज्ञानिक ने की। जब ध्वनि का स्रोत सुनने वाले की ओर आता है तब उसे ध्वनि का स्वर चढ़ा हुआ लगता है। उलटे जब स्रोत दूर भागता हो उसकी ध्वनि का स्वर गिर जाता है। और यह चढ़त या गिरावट स्रोत की गति के अनुपात में होती है।'' नानाजी ने कहा।

''पर इसे नापा कैसे जाता है?'' कल्पना ने पूछा।

''जब आवाज किसी माध्यम से गुजरती है, उस माध्यम में कंप शुरु होता है यानी माध्यम के हवा के कण दोलन करते हैं। एक सेकेण्ड में कितने दोलन होते हैं। उसे उस आवाज की फ्रीक्वेंसी कहते हैं। तार स्वर की फ्रीक्वेंसी निचले स्वर की फ्रीक्वेंसी से अधिक होती है। मल्लिका जरा गाकर दिखाना सा रे ग म....!''

मल्लिका ने सुनाया – सा... रे... ग... म... प... ध... नी... सा।''

''बहुत खूब'' नानाजी बोले। ''अब इसमें पहला 'सा' निचले स्वर का तो दूसरा 'सा' ऊँचे स्वर का था। याने पहले 'सा' की फ्रीक्वेंसी दूसरे 'सा' के मुकाबले कम, केवल आधी थी।

''अब समझी मैं डॉप्लर इफेक्ट क्या होता है।'' कल्पना बोली। ''पर नानाजी आसमान के सितारों के बजाय आप जमीन पर की रेलगाड़ियों की बात क्यों कर रहे हैं?''

नानाजी ठहाका मारकर हँसे और बोले ''अभी मैं सितारों पर आता हूँ। जैसे ध्वनि अपने माध्यम के कंप से उठी लहरों द्वारा इधर से उधर जाती है, प्रकाश किरणें भी लहरों के रूप में चलती हैं।'' ''इनका माध्यम क्या होता है?'' शरद ने पूछा।

''प्रकाश लहरें बिना माध्यम जाती हैं – निर्वात 'व्हॅक्यूम' से भी। पर इनके आने जाने से विद्युत और चुंबकीय क्षेत्रों में कंप पैदा होता है। उसी की फ्रीक्वेंसी डॉप्लर इफेक्ट जताती है।'' नानाजी बोले।

''तो प्रकाश के जो सात रंग हैं उनकी फ्रीक्वेंसियाँ अलग-अलग होती हैं?'' मल्लिका ने पूछा।

''इनके आँकड़े मुझे याद नहीं है बेटी! पर इतना बता सकता हूँ बैगनी रंग की फ्रीक्वेंसी लाल रंग की फ्रीक्वेंसी की लगभग दुगुनी होती है।'' नानाजी बोले।

''याने बैगनी रंग की फ्रीक्वेंसी इन सात रंगों में सबसे ज्यादा तो लाल की सबसे कम?'' मल्लिका ने पूछा।

''सही बात! और अब मैं अंतरिक्ष की ओर मुड़ता हूँ। जब हम सूर्यप्रकाश को एक शीशे के प्रिज्म में से भेजते है तब उसका इन सात रंगों में बँटवारा हो जाता है। इसी तरह के प्रयोग हम तारों के प्रकाश को स्पेक्ट्रोस्कोप द्वारा बाँटकर कर सकते हैं। स्पेक्ट्रोस्कोप प्रिज्म की सुधारित आवृत्ति है। इसके द्वारा उसमें से गुजरने वाले प्रकाश को विभिन्न फ्रीक्वेंसी वाले हिस्सों में बाँटा जाता है।''

''जब तारों के प्रकाश की इस तरह जाँच की जाती है तो उसमें डॉप्लर इफेक्ट पाया जाता है। कुछ तारे हमारी ओर आते दिखाई देते हैं तो कुछ तारे हमसे दूर जाते दिखाई देते हैं। पर सन् 1914 से खगोल निरीक्षकों ने तारों के समूहों के प्रकाश की जाँच करनी शुरु की तो उन्हें दिखाई दिया कि डॉप्लर इफेक्ट के अनुसार वे समूह हमसे दूर जा रहे हैं। एक दो अपवाद छोड़कर यह नतीजा सभी तारकासमूहोंपर लागू होता है।

''एडविन हबल तथा मिल्टन हमसन (जो हबल के सहकारी थे) इन दोनों ने 1929 तक अनेक तारकासमूहों के प्रकाश की जाँच की। उसके आधार पर हबल ने यह नतीजा निकाला कि कोई भी तारकासमूह हमारी आकाश गंगा से दूर भाग रहा है और भागने का वेग हमारी आकाश गंगा से उसकी जो दूरी है उसके अनुपात में होता है। इसे हबल का नियम कहते हैं। जब 1929 में इस नियम को हबल ने जाहिर किया तब इस खोज ने खगोल जगत में खलबली बचा दी।

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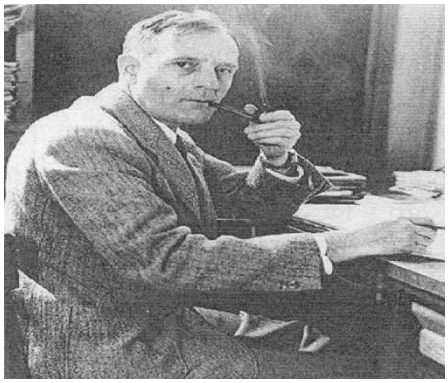
*साभार – प्रो. जयन्त वी. नार्लीकर ''अनोखा अंतरिक्ष'' छत्तिसगढ़ राज्य हिन्दी ग्रन्थ एकादमी द्वारा प्रकाशित।

**इमेरिटस प्रोफेसर, अंतर-विश्वविद्यालय केंद्र : खगोलविज्ञान और खगोलभौतिकी, पूना-411007.



एडविन हबल (1889-1953)

मिल्टन हमसन (1891-1972)

मिल्टन हमसन : ठेकेदार से खगोल निरीक्षक

मिल्टर हमसन शुरु में खच्चरों का ठेकेदार था। जब माउंट विल्सन वेधशाला के लिये 100 इंच व्यास की तब की विश्व की सबसे बड़ी दूरबीन बन रही थी तब ईंट, पत्थर आदि 5000 फुट ऊँचाई तक पहुँचाने के लिये उसने अपने खच्चर ठेके पर दिये। तब उसे कौतूहल था कि ये खगोल निरीक्षक ऐसी ऊँचाई पर जाकर देखते क्या हैं? जब दूरबीन बनी तब उसने वहाँ रखवाली करने का काम लिया। रात को वह निरीक्षकों के साथ वेधकार्य भी करने लगा। उसकी रूचि और कुशलता देखकर निरीक्षकों ने वेधों की पूरी जिम्मेदारी उस पर सौंपना शुरू किया। ये जिम्मेदारी हमसन ने अच्छी तरह से निभाई। आखिर उसे वेधशाला का एक निरीक्षक बनाया गया। इसी काम पर लगे हमसन की वेध कुशलता देखकर हबल ने उसे अपना सहकारी चुना। आगे चलकर यह अमेरिका का एक जाना-माना खगोलनिरीक्षक बना।

नानाजी के इस वक्तव्य पर शरद ने पूछा, ''लेकिन क्या इस खोज से यह नहीं सिद्ध होता है कि हमारी आकाशगंगा एक खास स्थान रखती है इस ब्रह्माण्ड में! हमारे सभी पड़ोसी हम से दूर भागे यह बात गर्व करने लायक भले ही न हो, खास तो है?''

''नहीं बेटा!'' नानाजी बोले ''प्राचीन काल से हम मानव अपने को खास मानते आये – पर वास्तविकता कुछ और निकली। कोपर्निकस के जमाने तक पूरे ब्रह्माण्ड को पृथ्वी पर केन्द्रित माना जाता था और पृथ्वी को स्थिर। अब हम जानते हैं कि पृथ्वी सूरज की परिक्रमा करती है। फिर यह धारणा रही कि हमारा सूरज आकाशगंगा के केन्द्र में याने महत्व के स्थान पर है। यह भी गलत निकली। सूरज केन्द्र से दूर उसकी परिक्रमा करता है। तब खगोलशास्त्रियों ने सोचा, खैर हमारी आकाशगंगा ब्रह्माण्ड की अनूठी एकमेव है। लेकिन यह अरबों तारकासमूहों में से एक है : और 1929 के हबल के नियम से भले ही पहले पहल ऐसा प्रतीत हुआ कि हमारी आकाशगंगा खास है। लेकिन इस नियम की जाँच से यही नतीजा निकलता है कि यदि हम किसी भी अन्य तारकासमूह पर जाकर निरीक्षण करें तो वहाँ से ब्रह्माण्ड का वही दर्शन होगा जो हमारी आकाशगंगा से होता है। वहाँ से बाकी तारकासमूह दूर भागते दिखाई देंगे। याने ब्रह्माण्ड के सभी तारकासमूह एक ही दर्जे के हैं – इनमें कोई एक खास दर्जेवाला नहीं। हम कह सकते हैं कि किसी प्रजातंत्र में सभी देशवासी समान हकवाले होते हैं। उसी तरह ब्रह्माण्ड के सभी तारकासमूह एक प्रजातंत्रीय स्तर के हैं।

''तो हबल के नियम का परिणाम क्या है? इससे ब्रह्माण्ड की क्या जानकारी मिलती है?'' शरद ने पूछा।

''मैं वही बताने जा रहा था। मानो एक गुब्बारे पर छोटे-छोटे बटन चिपकाए गये हैं। जब गुब्बारा फुलाया जाता है, तब सभी बटन एक दूसरे से दूर भागते दिखाई देंगे। ऐसी हालत में किसी एक बटन का कोई खास स्थान नहीं होता। ब्रह्माण्ड की हालत वैसी ही है। वह फूलता जा रहा है और उसमें स्थित तारकासमूह एक दूसरे से दूर जा रहे हैं। ऐसे ब्रह्माण्ड को प्रसरणशील ब्रह्माण्ड (Expanding Universe) कहते हैं।

''अब इसके बारे में कल बात करेंगे।''

जब बच्चे वहाँ से निकले तो मल्लिका को ऐसा लगा कि हमारी सूर्यमाला से शुरु हुई दास्तान का 'क्लाइमॅक्स' अब निकट आ गया है।

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पूर्वी उत्तर प्रदेश में उगाई जाने वाली धान की उन्नतशील प्रजातियाँ, लगने वाले प्रमुख रोग, कीट एवं उनका उचित निदान

प्रो. रवि प्रताप सिंह, प्रकाश सिंह**, मुकेश कुमार सिंह*** एवं रवीश कुमार सिंह*****

धान संसार की एक प्रमुख खाद्य फसल के रूप में पहचान रखता हैं जो लगभग 80 प्रतिशत वैश्विक आबादी का भरण पोषण करता है। विश्व में कुल 7302 लाख टन धान का उत्पादन लगभग 1570 लाख हे0 भू-भाग (2012-13) से होता है एवं यह संसार के कुल खाद्य भण्डार का एक अहम हिस्सा है। भारत एक कृषि प्रधान देश है इसकी 70 प्रतिशत से अधिक जनसंख्या गांवों मे रहती हैं एवं पूर्णतयाः कृषि पर निर्भर है। देश के कुल खाद्यान्न उत्पादन में धान का 43 प्रतिशत योगदान है। धान की खेती तीन प्रमुख पारितंत्रों : वर्षाश्रित ऊपरभूमि (16 प्रतिशत), सिंचित मध्यम भूमि (45 प्रतिशत) तथा वर्षाश्रित निचलीभूमि (39 प्रतिशत), के अंतर्गत विभिन्न प्रकार की मिट्टियों एवं जलवायु दशाओं में पूरे वर्ष लगभग 445 लाख हैक्टर क्षेत्र में की जाती है एवं प्रतिवर्ष 104 लाख टन से ज्यादा उत्पादन होता है। धान भारत की एक प्रमुख खाद्य फसल है परन्तु इसकी उत्पादकता वृद्धि दर की तुलना में केवल कम ही नहीं है अपितु लगभग तीन गुना कम है। अतः भविष्य में चावल उत्पादकता की सुनिश्चितता के लिए नई पद्धतियाँ जैसे कि संकर धान उत्पादन तकनिकी, अधिक उपज देने वाली उन्नतशील, जो कि अन्य प्रजातियों की तुलना में 1 से 2 टन ज्यादा उत्पादक होती है, यह एक उच्च उपज क्षमता युक्त, औसतन 6-8 टन/हे0 पैदावार देने वाली ओजस्वी किस्में होती है। अतः इसका त्वरित दोहन कुल उत्पादन वृद्धि में प्रमुख भूमिका निभा सकता है।

पूर्वी उत्तर प्रदेश में धान उत्पादन का 22 प्रतिशत क्षेत्र वर्षा पर आधारित है। पूर्वी उत्तर प्रदेश में जल भराव, सूखे की स्थिति, खरपतवार, कीट एवं रोग धान के उत्पादन को कम करने वाले प्रमुख कारण हैं। जलभराव वाले क्षेत्रों मे धान की उत्पादकता 1.7 से 2.25 टन प्रति हेक्टेयर है जो सिंचित धान की तुलना मे लगभग एक तिहाई है। धान की अधिक उत्पादकता के लिये विभिन्न परिस्थितियों के अनुसार जैसे, सूखा, बाढ़ग्रस्त, उसरीली व सिंचित दशाओं आदि के लिये विभिन्न प्रजातियों का विकास किया जाता है। इन बिन्दुओ को ध्यान मे रखते हुए भारत ने फिलिपिन्स के सहयोग से कई उन्नतशील प्रजातियों का विकास किया है। जो विभिन्न प्रकार के क्षेत्रों में अच्छी उपज दे रही है, उनका विवरण तालिका 1 एवं 2 में दर्शाया गया है।

बीज का चुनाव एवं बीज दर

किसानों को सदैव शुद्ध एवम् स्वस्थ बीज का ही प्रयोग करना चाहिये। बीज प्रमाणित संस्थाओं व कृषि विश्व विद्यालयों से ही लेना चाहिये। बुवाई अथवा पौध डालने से पहले बीज का उपचार करना अति आवश्यक है। रोपाई के लिये 20-25 किग्रा. तथा सीधी बुआई के लिए 80-100 किग्रा. बीज की मात्रा प्रति हेक्टेयर उपयुक्त होती है।

बीज शोधन

धान के बीज को 10 प्रतिशत नमक के घोल में (100 ग्राम नमक 1 लीटर पानी) डालकर हिलायें खराब बीज ऊपर सतह पर तैरने लगेंगे जिनको निकाल कर फेंक दें। नीचे बैठे हुऐ स्वस्थ बीज को साफ पानी से धोकर छाया में सुखा लें तथा बीज शोधन नर्सरी डालने से पूर्व बीज को कार्बेन्डाजिम-50 के चूर्ण (बेविस्टिन या डेरोसाल या एग्रोजिम) 2 ग्राम अथवा 1 ग्राम थीरम प्रति किलोग्राम बीज की दर से उपचारित कर लेना चाहिये। उपचार के लिये आवश्यक बीज व शोधक को मिट्टी के घड़े में डालकर अच्छी तरह मिला लें तदोपरान्त आवश्यकतानुसार सीधी बुवाई या नर्सरी के लिये प्रयोग करें।

छिटकवाँ विधि से बुवाई

पूर्वी उत्तर प्रदेश में जल भराव, सूखे की स्थिति वाले क्षेत्रों में गर्मी के दिनों में मिट्टी पलटने वाले हल से दो-तीन जुताई अवश्य कर दें जिससे खरपतवार एवं कीट नष्ट हो जायें। धान की बुवाई/ रोपाई जलभराव, सूखे की स्थिति आदि पर निर्भर करती है। गहरे व अति गहरे क्षेत्रों में गर्मी की जुताई के कुछ समय पश्चात् सूखे खेत में शोधित बीज की छिटकवाँ विधि से बुवाई मई के अन्तिम सप्ताह तक अवश्य कर दें। सीधी बुवाई वाले क्षेत्रों में 60 किग्रा. फॉस्फोरस तत्त्व के रूप में (3.5-4 कुन्तल सिंगिल सुपर फॉस्फेट) प्रति हेक्टेयर की दर से जुताई के समय अवश्य मिला दें। ऐसा करने से धान के पौधे स्वस्थ होते है और उनकी बाढ़ व सूखा सहन करने की क्षमता बढ़ जाती है।

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तालिका 1: पूर्वी उत्तर प्रदेश कि लिये उगाई जाने वाली धान की उन्नतशील/ अधिक उपज देने वाली प्रमुख प्रजातियॉ हैं -

क्र. सं.	प्रजाति का नाम	पकने की अवधि दिनों में	उपज कुं/ हे0	चावल की विशेषता
1.	नरेन्द्र -97	95-100 दिन	40-45 कुं/हे0	महीन लम्बा
2.	मालवीय 3022	110-115 दिन	50-55 कुं/हे0	महीन लम्बा
3.	वन्दना	100-105 दिन	40-45 कुं/हे0	महीन मध्यम
4.	जीरा	100-105 दिन	40-45 कुं/हे0	महीन मध्यम
5.	तुलसी	100-105 दिन	40-45 कुं/हे0	महीन मध्यम
6.	गोविन्द	105-110 दिन	40-45 कुं/हे0	महीन लम्बा
7.	अश्विनी	100-110 दिन	40-45 कुं/हे0	छोटा मोटा
8.	नरेन्द्र-118	95-100 दिन	45-50 कुं/हे0	महीन लम्बा
9.	मालवीय 2-1	120-125 दिन	50-55 कुं/हे0	महीन लम्बा
10.	मालवीय सुगन्ध 105	130-135 दिन	65-70 कुं/हे0	महीन मध्यम
11.	मालवीय 4-3	135-140 दिन	60-65 कुं/हे0	महीन मध्यम
12.	नरेन्द्र-359	130-135 दिन	55-60 कुं/हे0	लम्बा मोटा
13.	प्रो. एग्रो. 6444 संकर	135-140 दिन	60-65 कुं/हे0	लम्बा मोटा
14.	प्रो. एग्रो. 6201 संकर	135-140 दिन	60-65 कुं/हे0	लम्बा मोटा
15.	पी. एच. बी - 71 संकर	135-140 दिन	60-65 कुं/हे0	मध्यम मोटा
16.	के. आर. एच. - 2 संकर	135-140 दिन	60-65 कुं/हे0	लम्बा मोटा
17.	पी. आर. एच. 10	120-125 दिन	50-55 कुं/हे0	सु लम्बा पतला
18.	पूसा बासमती 1	130-135 दिन	40-42 कुं/हे0	सु लम्बा पतला
19.	बासमती - 360	135-140 दिन	40-42 कुं/हे0	सु लम्बा पतला
20.	तरावरी बासमती	132-135 दिन	35-40 कुं/हे0	सु लम्बा पतला
21.	सुगन्ध 3	120-125 दिन	45-50 कुं/हे0	सु लम्बा पतला
22.	सरजू-52	132-135 दिन	50-55 कुं/हे0	मध्यम मोटा
23.	स्वर्णा/एम. टी. यू. 7029	145 दिन	40 कुं/हे0	सु. छोटा पतला
24.	साम्भा महसूरी/बी.पी.टी. 5204	145 दिन	65 कुं/हे0	सु. छोटा पतला
25.	नरेन्द्र- 2026	150 दिन	40-42 कुं/हे0	सु. मध्यम पतला
26.	सोना मंसूरी	155 दिन	40-42 कुं/हे0	सु. मध्यम पतला
27.	टाइप-9	150 दिन	30-35 कुं/हे0	महीन नोक नारंगी
28.	टाइप-23	135-145 दिन	30-35 कुं/हे0	लम्बा पतला
29.	टाइप-100	140-150 दिन	30-35 कुं/हे0	मोटा नोक पीला
30.	क्रास-116	150 दिन	35-40 कुं/हे0	लम्बा भूरा
31.	जी. आर. 32	160 दिन	40 कुं/हे0	सु. छोटा पतला
32.	बादशाहभोग	160 दिन	40 कुं/हे0	सु. छोटा पतला
33.	कालानमक	155-160 दिन	40-42 कुं/हे0	सु. मध्यम पतला
34.	गोविन्द भोग	160 दिन	40-42 कुं/हे0	सु. मध्यम पतला
35.	जूही बंगाल	140-150 दिन	40-42 कुं/हे0	सु. मध्यम पतला
36.	धनिया	150 दिन	40 कुं/हे0	सु. छोटा मोटा
37.	अजवाइन	145-150 दिन	40-42 कुं/हे0	सु. छोटा पतला

इसके अलावा धान की किस्मों को जलवायु तथा मृदा की परिस्थितियों के आधार पर भी कई वर्गों में विभाजित कर सकते हैं जो कि निम्नलिखित हैं।

तालिका 2: पूर्वी उत्तर प्रदेश में सीधी बुवाई, रोपाई के लिये, उसरीली भूमि, निचले एवं जल भराव वाले क्षेत्रों, एक मीटर से अधिक गहराई के लिये, बाढ़ ग्रस्त क्षेत्रों के लिये, संकर धान की उन्नत किस्में एवं कुछ स्थानीय सुगन्धित प्रजातियाँः

क्र. सं.	सीधी बुवाई	रोपाई के लिये	उसरीली भूमि में उगाई जाने प्रजातियॉ	निचले एवं जल भराव वाले क्षेत्रों के लिये	एक मीटर से अधिक गहराई के लिये	बाढ़ ग्रस्त क्षेत्रों के लिये	संकर धान की उन्नत किस्में	स्थानीय सुगन्धित प्रजातियों
1.	नरेन्द्र -118	गोविन्द	नरेन्द्र उसर धान-1	स्वर्णा या एम. टी. यू. 7029	नरेन्द्र -8002	आइ. आर. -64 सब1	पी. एच. बी. - 71	जी. आर. 32
2.	नरेन्द्र-97	नरेन्द्र -80	नरेन्द्र उसर धान -2	सोना महसूरी	महसूरी	चकिया-59	प्रो. एग्रो. - 6444	बादशाहभोग
3.	गोविन्द	स्वर्णा या एम. टी. यू. 7029	सी एस आर - 10	नरेन्द्र धान - 2008	जल लहरी	जलप्रिया	प्रो. एग्रो. - 6201	कालानमक
4.	वरानी दीप	साम्भा महसूरी या बी. पी. टी. 5204	सी एस आर - 13,30		नरेन्द्र नारायणी	जल निधि	पूसा आर. एच. -10	गोविन्द भोग
5.	हीरा	नरेन्द्र लालमती	सोना महसूरी		नरेन्द्र जल पुष्प	जल मग्न	नरेन्द्र उसर संकर धान -3	जूही बंगाल
6.	शुष्क सम्राट	नरेन्द्र-97	नरेन्द्र उसर धान-3		नरेन्द्र मयंक	मधुकर	जे. के. आर. एच. 401	धनिया
7.	मालवीय सुगन्ध धान - 105	मालवीय सुगन्ध 105			क्रास-116	बाढ़ अवरोधी	के. आर. एच. -2	अजवाइन
8.	मलवीय धान-3022	मालवीय धान 4-3			टा-100	स्वर्णा सब 1		स्थानीय बासमती
9.	गोविन्द	मालवीय धान 2-1				पी. आर. एच. -2		मालवीय सुगन्ध 105
10.	जीरा	मालवीय बासमती धान 10-9				जल लहरी		मालवीय धान 10-9

चित्र 1(क): वैज्ञानिक विधि से मनुष्य शक्ति द्वारा धान के प्रजनक बीज उत्पादन करने की तकनीकी

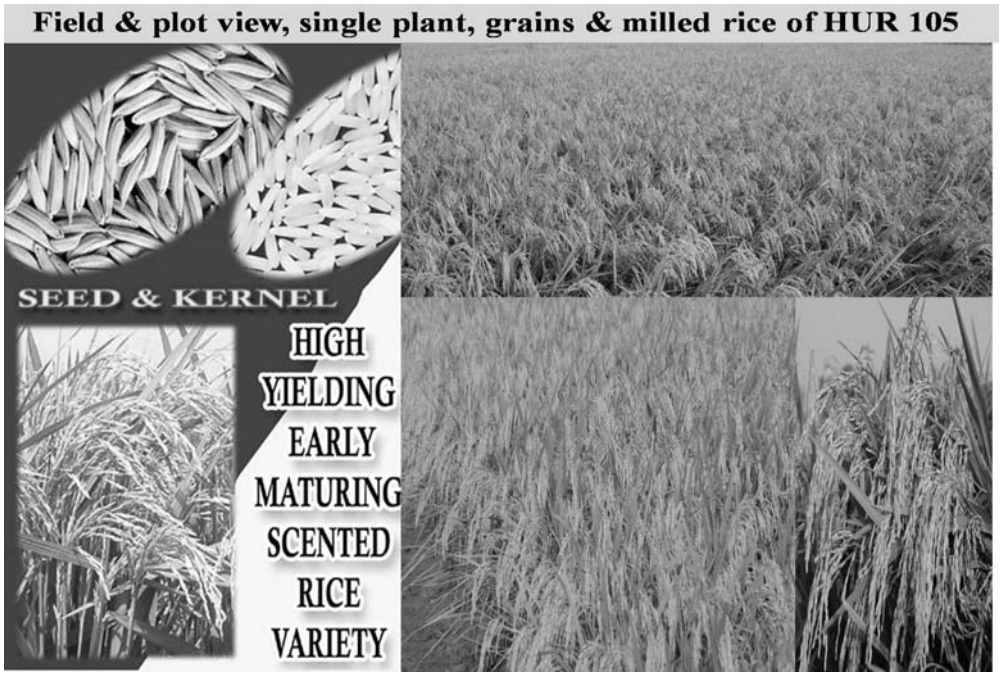
चित्र -1 (ख): धान की उन्नतशील/अधिक उपज देने वाली काशी हिन्दू विश्वविद्यालय द्वारा विकसित प्रजातिया

चित्र - 1 (ग): धान की उन्नतशील/अधिक उपज देने वाली काशी हिन्दू विश्वविद्यालय द्वारा विकसित प्रजातियाँ

नर्सरी अथवा पौध तैयार करना

नर्सरी में पौधों के स्वास्थ्य का ध्यान रखना आवश्यक है। जलभराव वाले क्षेत्रों में रोपाई के बाद पौधों के मरने की आशंका भी रहती है। अतः रोपाई के लिये स्वस्थ पौधे तैयार करने के लिये निम्न बातों पर ध्यान अवश्य दे:

- नर्सरी में बीज की दर 40-50 ग्राम प्रति वर्ग मीटर से अधिक न रखे।
- बीज की बुआई से 10-15 दिन पहले 1 किग्रा. गोबर की सड़ी खाद प्रति वर्गमीटर (10 टन प्रति हेक्टेयर) की दर से मिट्टी मे अच्छी तरह से मिला दें अथवा फैला दें।
- बुवाई के एक दिन पहले 130 किग्रा. यूरिया, 250 किग्रा.सिंगिल सुपर फॉस्फेट व 20 किग्रा. जिंक सल्फेट प्रति हेक्टेयर की दर से नर्सरी के खेत में अच्छी तरह से मिला दें।
- नर्सरी के खेत में पलेवा करके पाटा चला दें तथा कुछ समय



चित्र - 1 (घ): धान की उन्नतशील/अधिक उपज देने वाली काशी हिन्दू विश्वविद्यालय द्वारा विकसित प्रजातियाँ

बाद बीज की बुवाई करें। इस प्रकार बीज के ऊपर मिट्टी की केवल पतली पर्त ही रहेगी जिससे अंकुर सही होगा और पौध आसानी से उखड़ेगी।

- रोपाई से पहले नर्सरी में नत्रजन उर्वरक का प्रयोग नहीं करना चाहिये अन्यथा रोपाई के बाद यदि खेत में जल भराव हो गया हो तो पौधे मर जायेंगे।
- नर्सरी के खेत में फॉस्फोरस का प्रयोग अवश्य करें जिससे फसल की बाढ़ सहनशीलता बढ़ जाती है।

पौधे रोपण एवं गैप फिलिंग

धान की रोपाई जुलाई के प्रथम सप्ताह तक अवश्य कर दें, रोपाई के पहले के पहले संस्तुत नत्रजन की आधी मात्रा, फॉस्फोरस, पोटाश व जिंक सल्फेट की पूरी मात्रा खेत में पलेवा करते समय मिला दें। रोपाई के लिये 20-25 दिन की पौध 20-15 सेंटीमीटर (20 सेमी. पंक्ति से पंक्ति एवं 15 सेमी. पौधे से पौधे की दूरी) की दूरी पर लगाना उपयुक्त होता है। रोपाई के एक सप्ताह के बाद मरे हुऐ पौधों के स्थान पर नये पौधों को तुरन्त लगा दें ताकि प्रति इकाई पौधों की संख्या कम न होने पाये। अच्छी उपज के लिए प्रति वर्ग मीटर 35 से 40 पौधे अथवा 250-350 बालियाँ अवश्य होनी चाहिये।

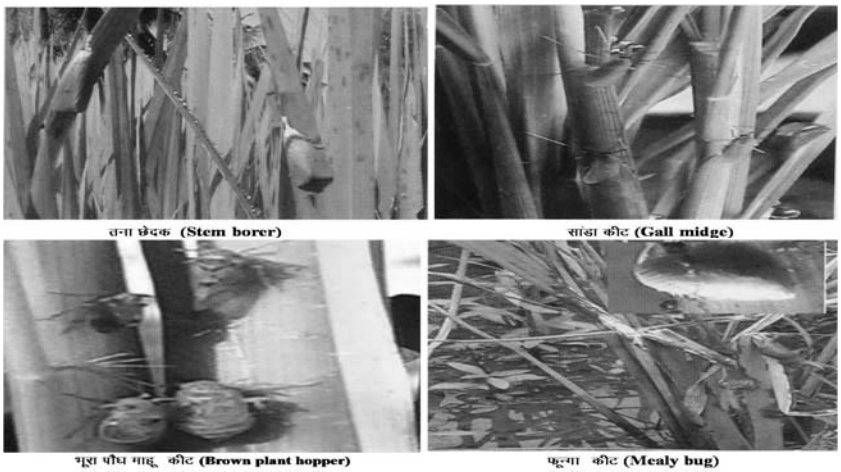
खतपतवार नियन्त्रण

सीधी बुवाई वाले धान के खेतों में बुवाई के 30-35 दिन बाद जब पौधे 20 से 30 सेमी. के हो जाँऐं तब निकाई करके खरपतवारों को नष्ट कर देना चाहिये। यह कार्य खरपतवार विनाशक रसायनों द्वारा भी किया जा सकता है। रोपाई वाले धान के खेतों में घास जाति एवं चौड़ी पत्ती वाले खरपतवारों के नियन्त्रण हेतु ब्यूटाक्लोर (5 प्रतिशत ग्रेन्यूल) 30-40 किग्रा. अथवा बेन्थियोकार्ब (10 प्रतिशत ग्रेन्यूल) 15 किग्रा. या बेन्थियोकार्ब (50 ई. सी.) 3 लीटर या एनीलोफास (30 ई. सी.) 3 लीटर प्रति हेक्टेयर की दर से रोपाई के 3-4 दिन के अन्दर प्रयोग/छिड़काव करना उचित होता है। ब्यूटाक्लोर का प्रयोग 3-4 सेमी. पानी में एवं बेन्थियोकार्ब का प्रयोग अच्छी नमी होने पर ही किया जाना चाहिये। केवल चौड़ी पत्ती वाले खरपतवारों के नियन्त्रण हेतु 2, 4- डी. सोडियम साल्ट को 625 ग्राम प्रति हेक्टेयर की दर से 400-600 लीटर पानी में घोल कर छिड़काव रोपाई के एक सप्ताह बाद ही करना चाहिये। रसायनों द्वारा खरपतवार की रोकथाम के लिये यह अति आवश्यक है कि दानेदार रसायनों का प्रयोग करते समय खेत में 4-5 सेमी. पानी भरा होना चाहिये।

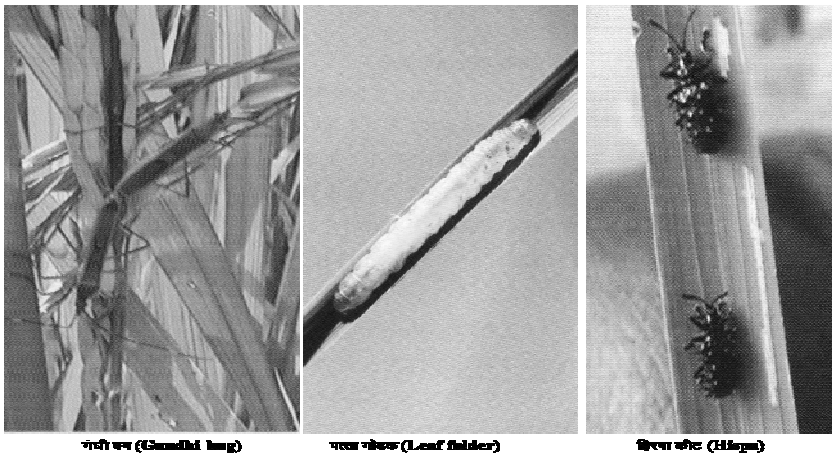
रोगिंग

धान का शुद्ध व गुणवत्तायुक्त बीज पैदा करने हेतु धान के खेत में रोगिंग अति आवश्यक है।

- पहली बार कल्ले बनते समय जो पौधे अलग प्रजाति के दिखाई दें उन्हें तुरन्त खेत से बाहर निकाल देना चाहिये।
- दूसरी बार फूल आते समय जिन पौधों में साथ-साथ फूल न आ रहे हों उन्हें निकाल देना चाहिये।
- तीसरी बार धान के पकने के समय जो पौधे साथ-साथ न पक रहे हों तथा दिखने मे भिन्न हो या पहली व दूसरी बार



चित्र-2 (क): धान में लगने वाले प्रमुख कीट एवं उनकी पहचान



चित्र-2 (ख): धान में लगने वाले कीट गंधी बग (Gundhi bug), पत्ता मोढक (Leaf folder), हिस्पा कीट (Hispa) एवं उनकी पहचान

चित्र-3 (क): धान में लगने वाला प्रघ्वन्श रोग (Symptom of Blast disease) एवं उनके लक्षण

के रोगिंग में छूट गये हों उन्हें भी निकाल देना चाहिये। ताकि, बीज की शुद्ध व गुणवत्ता सुनिश्चित रहे।

पूर्वी उत्तर प्रदेश मे धान में लगने वाले प्रमुख कीट एवं रोग

धान की उपज को क्षति पहुंचाने वाले कारकों में रोगों एवं कीटों का प्रमुख स्थान है। अभी तक रोगों एवं कीटों से निपटने के लिए रसायनों का ही सहारा लिया जाता रहा है। यह रसायन खर्चीले होने के साथ-साथ वातावरण को प्रदूषित करते है। रसायनों के निरंतर प्रयोग से रोगों एवं कीटों में उनके विरूद्ध अवरोध पैदा हो जाता है। साथ ही साथ पौधों को स्वस्थ बनाये रखने वाले मित्र कीटों व जीवाणुओं की संख्या में कमी हो जाती है, जिससे पर्यावरण का संतुलन बिगड़ जाता है। समस्याओं के प्रभावी निदान एवं उपयुक्त बचाव के लिए समेकित रोग प्रबंध करना चाहिए, जिससे रोग का धनत्व सीमित रहे और उनसे आर्थिक क्षति भी न पहुंच सके।

धान के प्रमुख कीट

भारत में धान की फसल में लगभग 537 प्रकार की नाशककीटों का आक्रमण होता है जिसमें से 385 प्रजातियों के नाशककीटों, 51 प्रजातियों के सूत्रकृमियॉ तथा 21 प्रजातियों के घुन कीटें है जिससे उपज को क्षति होती है। इनमें से जिन प्रमुख नाशककीटों के कारण आर्थिक क्षतियॉ होती हैं वे निम्न हैंः

धान का हिस्पा कीट

वयस्क भौंरा नीले काले रंग का होता है और उसके ऊपर काँटे होते हैं इसकी इल्लियाँ हल्का पीलापन लिये हुऐ होती हैं और उनकी बाहरी चमड़ी की चरतों के बीच सुरंग होती है।

क्षति व उसके लक्षण - इसकी गिडार तथा वयस्क पत्तियों को खुरचकर उसके हरे भाग को खाते है जिसस पत्तियाँ सूखकर नष्ट हो जाती है (चित्र-2)

धान का टिड्डा

इस कीट का प्रकोप जुलाई से सितम्बर तक होता है। यह कीट हरा पीलापन लिये हुऐ 3-5 सेमी. लम्बा होता है।

क्षति व उसके लक्षण - इसके वक्ष के किनारे काली धारियाँ होती है। निम्फ का रंग पीला तथा इसके बड़े हो जाने पर पंख पर धब्बे बन जाते हैं। इस कीट के निम्फ तथा प्रोढ़ दोनों ही फसल को काफी क्षति पहुँचाते हैं। ये पत्तियाँ एवं कोमल तनों को काट कर खा जाते हैं।

तना छेदक - यह भारत के सभी भागो मे पाया जाता है।

क्षति व उसके लक्षण - प्रौढ़ मादा पत्ती के उपरी सतह पर समूह में अंण्डे देती है। तत्पश्चात इन अंण्डो से 5-8 दिन बाद लार्वा निकलता है। जो 2-3 दिन तक पत्ति के हरे ऊतक को खा जाता है। इसके बाद तने के अन्दर ऊतको को काटते वदाते हुए उपर बढ़ता है (चित्र-2)। जिससे जड़ से तने में उपर तक छानिय एव जल प्रवाह रूक जाता है। जिसके कारण पौधो का बीज वाला भाग सूख जाता है। जिसे सफेद बाली कहते है। यदि इसका प्रकोप प्रारंभिक अवस्था में हो जाता है तो बाली नही बनने पाती हैं तथा बाली के बाद प्रकोप होने पर बाली पूरी तरह से सूख जाती है।

धान का भुनगा

मुख्यतः तीन प्रकार के भुनगो का प्रकोप होता है, भूरा, सफेद, एवं हरा। यह कीट जहाँ आर्द्रता ज्यादा होती है वहाँ ज्यादा नुकसान पहुचाते है। इनका प्रकोप सबसे अधिक (अक्टूबर-नवम्बर) महीने में होता है क्योंकि इस महीने में आर्द्रता अधिक होती है। अधिक जल भराव एवं नत्रजन का अधिक मात्रा में प्रयोग इसकी वृद्धि एवं विकास के लिये बहुत अनुकूल परिस्थितियो को पैदा करता है।

क्षति व उसके लक्षण - भूरे भूनगे के शिशु व वयस्क दोनों ही पौधो के आधारिय भाग पर जल की सतह से ऊपर एकत्र होकर रस चूसते है जबकि हरे भूनगे के शिशु व वयस्क दोनों ही पत्तियों से रस चूसते हैं। रस की कमी होने के कारण पौधे/पत्तियों पीली पड़ जाती है। और बाद में भूरी होते हुए सूख जाती है (चित्र-2)। इनके आक्रमण होने पर खेत में छोटे सूखे क्षेत्र दिखाई देते हैं जो बाद में पूरे खेत में फैल जाते है। ये भूनगे कई अन्य विषाणु जनित रोगों को फलाने में वाहक का काम करते है।

पत्ति लपेटक

इसका प्रकोप मुख्यतः सभी क्षेत्रों तथा सभी अवस्था में देखा गया है परन्तु उच्च आर्द्रता एवं सामान्य ताप पर पौधों के विकास की अन्तिम अवस्था मे ज्यादा होता है।

क्षति व उसके लक्षण - इसका लार्वा ही ज्यादा नुकसान करता है। जो पत्तियों के दानों किनारों को मोड़कर सटा देना हैं। तथा अन्दर छिपकर ऊतकों को खरोच कर खा जाता है। जिससे पत्ति पर जाली रूपी सफेद सफेद धब्बे दिखायी देते है (चित्र-2)। जिससे प्रकाश संश्लेषण की प्रक्रिया बाधित होती है। और उपज कम हो जाती है।

गंधी बग

यह हरे या भूरे रंग का उदर स्थित गंध ग्रन्थि द्वारा बदबुदार गंध छोड़ता है। इस कारण इसको गंधी बग कहते है। शिशु एवं प्रोड दोनों ही पौधों से रस चूसते है। तथा वर्षा के अन्त मे भारी संख्या में दिखायी देते है।

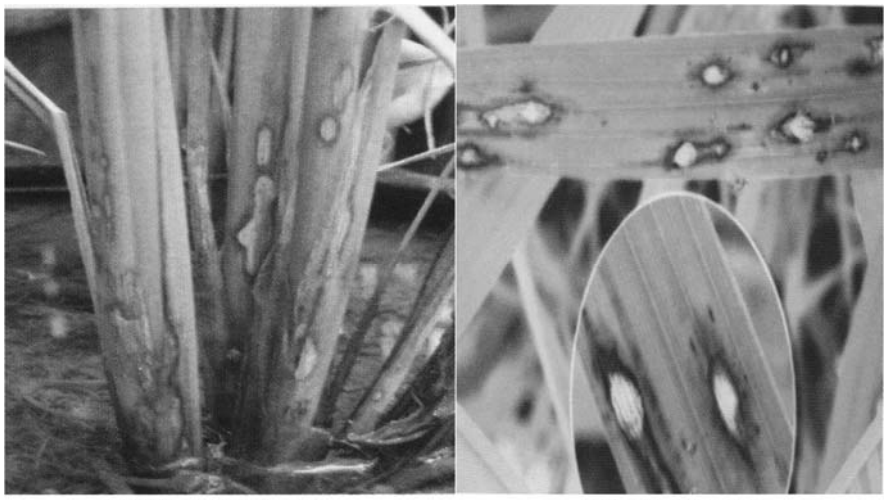
क्षति व उसके लक्षण - पौधो मे बाली लगने व दानों में दूध भराव के समय इसके शिशु और प्रौड़ दोनों ही पौधों से रस चूसते

जीवाणु अंगमारी **(Symptom of Bacterial blight)** के लक्षण

चित्र-3 (ख): धान में लगने वाला जीवाणु अंगमारी (Symptom of Bacterial blight) रोग एवं उनके लक्षण

आभासी कंड रोग **(Symptom of False smut)** के लक्षण

चित्र-3 (ग): धान में लगने वाला आभासी कंड रोग (Symptom of False smut) रोग एवं उनके लक्षण



आक्षद अंगमारी **(Sheath blight)** भूरा धब्बा **(Brown spot)**

चित्र-3 (घ): धान में लगने वाला आक्षद अंगमारी (Sheath blight), भूरा धब्बा (Brown spot) रोग एवं उनके लक्षण

हैं (चित्र-2)। जिसके कारण पौधों के बालियों के दानों में आंशिक भराव ही हो पाता है। और कुछ पुर्णतयः खाली रह जाती है। जिससे उपज कम हो जाती है।

गालमिज

क्षति व उसके लक्षण - गालमिज का आक्रमण नर्सरी से शुरू होकर कल्ले बनने की अवस्था तक होता है। मानसून की शुरूआत में यह कीट सक्रिय होता है। प्रौढ़ मादा पत्ति की निचली सतह पर अंण्डे देती है। अंण्डो से निकले शिशु मेरिस्टैमैटिक ऊतक को खाते है (चित्र-2)। तने में सुजन हो जाती है। और तना रजव प्ररोह जैसा बन जाता है। पत्ति बाद में हल्के पीले रंग की चमकती हुई दिखायी देती है और उपज कम हो जाती है।

धान में लगने वाले प्रमुख रोग एवं उनकी पहचान

(1) धान का झुलसा रोग

इस रोग से 20-35 प्रतिशत तक फसल की उपज कम हो जाती है। इस रोग के लक्षण मुख्यतः पत्तियों पर दिखायी पड़ते है। इसका प्रकोप पुष्पक्रम, गांठों एवं दानों के छिलकों पर भी होता है। रोग के प्रारम्भ की अवस्था में पौधें की निचली पत्तियों पर हल्के बैंगनी रंग के धब्बे बनते है जो धीरे-धीरे बढ़कर आंख के आकार के हो जाते है। इन धब्बों के बीच का रंग राख के रंग का व परिधि गहरे भूरे रंग की हो जाती है। पुष्पपुंज के नीचले डण्ठल में घूसर बदामी रंग के धब्बे पड़ने से वहां सड़न पैदा हो जाती है, जिसे ''ग्रीवा विगलन'' कहा जाता है।

(2) धान का भूरा धब्बा रोग

यह रोग धान का एक प्रमुख रोग है, जिससे लगभग 20-30 प्रतिशत तक उपज की हानि हो जाती है। इस रोग के लक्षण पत्तियों एवं बालियों पर दिखायी पड़ते हैं। प्रभावित भागों पर अण्डाकार गहरे से भूरे रंग के धब्बे बनते है। प्रायः इन धब्बों की चारों ओर पीलापन लिए गंदा सफेद या घूसर रंग का वृत्त दिखायी देता है। जो इस रोग की एक खास पहचान है। बाद में धब्बों का रंग गहरा भूरा होकर, आपस में मिलकर पत्तियों को सूखा देता है। दानों के उपर एवं ठूड पर छोटे-छोटे काले रंग के धब्बे बनते है। रोग की आक्रमकता बढ़ने पर बालियां ठीक से नही निकल पाती है।

(3) जीवाणु झुलसा रोग

इसमें पत्तियों के नोंक अथवा किनारे से एकदम सूखने लगती है। सूखे हुए किनारे अनियमित एवं टेढ़े-मेढ़े होते है। रोग ग्रसित पौधे कमजोर हो जाते है, उनमें कल्ले कम निकलते हैं। दाने पूरी तरह नहीं भरते है। इस रोग की दूसरी अवस्था म्लानि की है जिसे क्रिसक अवस्था भी कहा जाता है। इसमें ग्रसित पौधों की सबसे नयी पत्ती हल्के मटमैले रंग की होती है। पत्तियां आपस में लिपटकर तथा नीचे से झुलसकर पीली या भूरी हो जाती है और पूरा पौधा मर जाता है। इसका अधिक प्रकोप होने पर यह फसल को 50 प्रतिशत से भी अधिक नष्ट कर देता है।

(4) जीवाणु पर्णधारी रोग

इस रोग के कारण उपज में 20-30 प्रतिशत तक कमी पायी जाती है। इस रोग के लक्षण मुख्यतः पत्तियों की नसों के बीच में गहरी हरी होती हैं तथा बाद में नारंगी - कत्थई रंग में बदल जाती है। रोग की उग्रता बढ़ने पर धारियां आपस में मिलकर चकतों का रूप ले लेती है एवं पूरी पत्तियां समय से पहले सूख जाती है।

(5) शीथ झुलसा रोग

यह रोग धान का सबसे खतरनाक रोग समझा जाता है, जिसके प्रकोप से कभी-कभी 100 प्रतिशत अर्थात पूरी फसल भी नष्ट हो जाती है। इसके प्रमुख लक्षण पत्तियों एवं छंद पर हल्के भूरे, मटमैले रंग के धब्बे बनते हैं। उग्र अवस्था में तने के चारों ओर अनियमित आकार के गहरे भूरे धब्बे बनते है। रोगग्रस्त पौधों में दाने पूर्ण रूप से नहीं भर पाते है।

(6) खैरा रोग

यह रोग जस्ते की कमी के कारण होता है। इसमें पत्तियां पीली पड़ जाते है। उपज में कमी रोग की व्यापकता पर निर्भर करती है। इस रोग की वजह से कभी-कभी पूरे-पूरे खेत नष्ट हो जाते है। मुख्यतः 10-70 प्रतिशत तक उपज में कमी पायी जाती है।

(7) सफेदा रोग

यह रोग लौह तत्व की अनुपलब्धता के कारण नर्सरी में अधिक लगता है। नई पत्ती सफेद रंग की निकलती है तथा बाद में फट जाती है। रोग ग्रस्त पौधे कमजोर और बौने रह जाते है।

(8) आभासी कंड

यह रोग बहुत कम लगता है परन्तु जब वातावरण में काफी नमी होती है तब इस रोग का प्रकोप अधिक होता है। बालियों के निकलने पर रोग के लक्षण प्रकट होते है। प्रभावित दानों के अंदर रोगजनक फफूंद अण्डाशय को एक बड़े कटुरूप में बदल देती है जो बाद में जैतूनी हरे रंग के हो जाते हैं । इस प्रकार दाने कम बनते हैं तथा उपज में हानि होती है। जिसके कारण उपज में 5-20 प्रतिशत तक कमी आ जाती है।

(9) बंट रोग

यह रोग भी आभासी कंड की तरह ही फैलता है। इस रोग में भी बालियां निकलने के बाद ही दोनों के उपर काले रंग के धब्बे दिखायी देते हैं। रोगी बालियों के कुछ ही दाने इस रोग से प्रभावित होते हैं तथा दोनों का कुछ भाग प्रभावित होता है। रोग की उग्रता बढ़ने पर संपूर्ण बालियां एवं दाने प्रभावित हो जाते है तथा अंगूठे

और अंगुलियों के बीच में दानों को दबाने पर काले रंग का चूर्ण बाहर निकलता है। जिसकी वजह से फसल की उपज घट जाती है।

धान के प्रमुख कीटों एवं रोगों का समेकित प्रबंधन

समेकित रोग एवं कीट प्रबंध अर्थात एक ऐसा प्रभावी निदान/रोकथाम/प्रबंधन, जिससें लाभदायक पौधों को स्वस्थ बनाये रखने वाले मित्र कीटाणुओं की संख्या में कोई कमी न हो। पर्यावरण और मृदा पर इसका कोई विपरीत प्रभाव न पड़ता हो, जिसमें रसायनों का सीमित प्रयोग हो ताकि, रोग एवं कीट का धनत्व सीमित रहे और फसल उत्पादन को आर्थिक क्षति न पहुंच सके।

उपरोक्त बीमारियों एवं कीटों के प्रभावी समेकित प्रबंध के लिए निम्नलिखित उपाय अपनाने चाहिए-

1. रोग जनक जीवाणु/बीजाणु फसल की अनुपस्थिति में पौधो के अवशेष एवं कुछ खरपतवार आदि पर आगामी फसल आने तक उसी पर जीवित रहते हैं इसलिए धान की कटाई के तुरंत बाद रोग ग्रस्त अवशेषों को एकत्र कर जला देना चाहिए।
2. उचित फसलचक्र अपनायें, जिस खेत में धान की रोपाई व बुआई करना हो तो ग्रीष्मकालीन गहरी जुताई करनी चाहिए ताकि निष्क्रिय पड़े बीजाणु धूप से मर जाये। उचित रोपाई का समय एवं खेत में पाटा लगाने के बाद अनावश्यक पानी बाहर निकाल देना चाहिए। समयानुसार सिंचाई करते रहना चाहिए।
3. रोग रहित, कीट के प्रति प्रतिरोधक एवं सहनशील प्रजातियों का प्रमाणित बीज ही बोना चाहिए।
4. बीज उपचारिक करके उचित समय पर सघन रोपाई करना चाहिए। बीजोपचार थाइरम ₹ कार्बेन्डाजिम (2:1) 3 ग्राम प्रति कि.ग्रा. बीज दर से करना चाहिए।
5. प्रकाश प्रपेच लगाकर प्रौढ़ कीटों को एकत्र कर नष्ट कर देना चाहिए। फेरोमोन प्रपेच का प्रयोग कर नर कीटों को आकर्षित करके तथा एकत्र कर के नष्ट कर देना चाहिए।
6. प्रमुख परजीवों जैसे बायोचिकम एवं प्राकृतिक शत्रुओं का प्रयोग करना चाहिए।
7. जीवाणु झुलसा वाले क्षेत्रों में 25 कि.ग्रा. बीज को, 4 ग्राम स्ट्रेप्टोसाइक्लिन या 40 ग्राम प्लान्टोमाइसिन को 45 लीटर पानी में घोलकर बीज को रातभर के लिए भिगो दे। दूसरे दिन निकालकर अतिरिक्त पानी निकल जाने के बाद छाया में अंकुरित करके नर्सरी डाले।
8. संतुलित मात्रा में उर्वरकों को प्रयोग करना चाहिए नत्रजनयुक्त खादों का प्रयोग अधिक मात्रा में नही करना चाहिए।
9. रोगरोधी एवं सहनशील किस्में जैसे, एच. यू. आर. 3022, एच. यू. आर. 4-3, एच. यू. बी. आर. 2-1, एच. यू. आर. 105, एच. यू. आर. पी. बी. 1 एस. 97, मालवीय धान-36, सरजू 52, कस्तूरी, कास-116, जलनिधि, जलप्रिया, बाढ़ अवरोधी, नरेन्द्र ऊसर धान - 2 एवं 3, आदि किस्में बोना चाहिए।
10. खैरा रोग की रोकथाम के लिए पौधे की जड़ो को रोपाई से पहले 2 प्रतिशत जिंक आक्साइड के पानी के घोल में 1-2 मिनट तक उपचारित करे, तथा रोग आक्रमकता एवं सम्भावना को ध्यान में रखकर जिंक सल्फेट 20-25 कि.ग्रा. /हैक्टर की दर से करना चाहिए। यदि ऐसा करने के बाद खड़ी फसल में इस रोग के लक्षण दिखाई दे तो 5 कि.ग्रा. जिंक सल्फेट एवं 2.5 कि. ग्रा. बुझे हुए चने को 1000 लीटर पानी में घोलकर प्रति हैक्टर की दर से छिड़काव करना चाहिए।
11. सफेदा रोग की रोकथाम के लिए आवश्यकतानुसार 5 कि.ग्रा. फेरस सल्फेट एवं 20 कि.ग्रा. यूरिया को 1000 लीटर पानी में घोल बनाकर एक हैक्टर खेत में छिड़काव करना चाहिए।
12. इन सभी क्रियाओं को करने के बाद यदि बीमारियों का उचित प्रबंध न हो सके तो आवश्यकतानुसार निम्नलिखित दवाओं जैसे, कार्बेन्डाजिम (0.1 प्रतिशत, डाइथेन एम - 45 (0.25 प्रतिशत), टिल्ट (0.1 प्रतिशत), हिनोसन (0.1 प्रतिशत), अथवा कोन्टाफ (0.2 प्रतिशत), में से किसी एक दवा का 10-12 दिन के अंतराल पर 2-3 छिड़काव करना चाहिए।
13. जीवाणु झुलसा एवं जीवाणु पर्णधारी रोग की रोकथाम के लिए 65 ग्राम एग्रीमाइसिन/80 ग्राम स्ट्रेप्टोसाइक्लिन - 100 औस एवं 500 ग्राम कापर आक्सीक्लोराइड जैसे ब्लाइटाक्स, फाइटोलान, फ्यूग्राविट आदि दवा को 500 लीटर पानी में मिलाकर एक हैक्टर में 2-3 छिड़काव 10-14 दिन के अंतराल पर करना चाहिए।
14. कार्बोफूरान 1 किग्रा/हे0, कारटॉप हाइड्रो क्लोराइड 4 जी 2.5 किग्रा/हे0 या फिप्रोलिन 0.3 जी की 12.5 किग्रा/हे0 का प्रयोग करने से तना छेदक का प्रकोप रोका जा सकता है। साडा कीट का प्रकोप रोकने के लिये कार्बारिल या डाइमेयोएट 0.03 प्रतिशत का प्रयोग रोपाई के 20-25 दिन अन्दर करना चाहिये।
15. कारटॉप हाइड्रो क्लोराइड 50 एस. जी. 1 किग्रा/हे0 या फिप्रोनिश 5 एस. जी. की 1 किग्रा/हे0 की दर से 200 लीटर पानी मे मिलाकर छिड़काव करने से तना छेदक एवं पत्ती लपेटक से रोकथाम होती है।

16. भूनगा से बचाव के लिये इमिडाक्लोप्रिड 20 एस. एल. 1.2 लीटर/ हे0 की दर से 200 लीटर पानी में मिलाकर छिड़काव करें।
17. गंधी बग के प्रकोप को कम करने के लिये क्लोरोपाइरीफास एवं सुपर मेथ्रिन का प्रयोग एक लीटर/हे0 की दर से 200 ली. पानी मे मिलाकर छिड़काव करें।
18. गालमिज से बचाव से बचाव के लिये कार्बोफ्यूरान 3 जी का 25 किग्रा/हे0 या फिप्रोनिल 0.3 जी का 15 किग्रा/हे0 की दर से प्रयोग करें।
19. हिस्पा कीट के लिये पौधों की जड़ को 0.02 प्रतिशत क्लोरोपाइरीफास एवं 0.5 प्रतिशत यूरिया के घोल मे 3-4 घंटे डुबाकर रोपित करें तथा खडी फसल में क्यूनालफास 25 ई. जी. 1.25 लीटर/हे0 की दर से छिड़काव करें।
20. चूहों से बचाव के लिये जिंक फास्फाइड या फोरेट का प्रयोग करना चाहिये।

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शैली विज्ञान : साहित्य-विवेचन की वैज्ञानिक पद्धति

*डॉ. श्रीनिवास पाण्डेय**

शैली विज्ञान साहित्य के अध्ययन एवं विवेचन की महत्वपूर्ण वैज्ञानिक पद्धति है। इसे आलोचना की तर्कसंगत वस्तुनिष्ठ पद्धति भी कहा जाता है। इस वैज्ञानिक पद्धति द्वारा किसी साहित्यिक कृति का पूर्वाग्रह से मुक्त होकर, राग-द्वेष से ऊपर उठकर, किसी कृति का वस्तुनिष्ठ दृष्टि से विवेचन एवं मूल्यांकन किया जाता है। समाजशास्त्रीय या मनोविश्लेषणवादी समीक्षा पद्धतियों में प्रायः पक्षपात एवं राग-द्वेष का असर देखा जाता है, अतः इन पद्धतियों में रचना से अधिक महत्व रचनाकार के परिवेश, वर्गीयचेतना एवं मनोविकारों को दिया जाता है, जो किसी रचना के निष्पक्ष एवं तटस्थ मूल्यांकन में बाधक सिद्ध होते हैं। आज के वैज्ञानिक युग एवं तर्क प्रधान बौद्धिक समाज में साहित्य के विवेचन का आधार भी वैज्ञानिक दृष्टि से सम्पन्न होना चाहिए तभी आज का प्रबुद्ध पाठक इसके निष्कर्षों से सहमत हो सकेगा। इस संदर्भ में प्रो. कृष्ण कुमार शर्मा का कथन सत्य है– *''किसी कृति के संघटनात्मक तत्वों और उनकी आन्तरिक अन्विति के विश्लेषण से उसके कथ्य तक वस्तुपरक प्रविधि से पहुँचा जा सकता है। वस्तुतः आलोचना को वैज्ञानिक बनाने का अर्थ इस प्रविधि को ही वैज्ञानिक बनाना है।''*[1]

शैली विज्ञान वस्तुतः भाषा विज्ञान की एक महत्वपूर्ण व्यावहारिक शाखा है, जिसमें किसी साहित्यिक कृति के सर्जनात्मक अवयवों का उद्घाटन किया जाता है। भाषा विज्ञान के विवेचन के केन्द्र में प्रायः सामान्य भाषा एवं बोली होती है, जबकि शैली-विज्ञान के केन्द्र में कोई साहित्यिक कृति (कविता, नाटक, कहानी, उपन्यास एवं निबंध आदि) होती है। वस्तुतः कोई भी साहित्यिक कृति भाषा की ही एक विशिष्ट संरचना होती है, अतः भाषा के तर्कसंगत एवं सुव्यवस्थित विवेचन द्वारा उसके मूल अर्थ तक पहुँचा जा सकता है। अतः डॉ. राघव प्रकाश का कथन सत्य है कि *''शैली भाषा में ही रमती है, अतः भाषा वैज्ञानिक विवेचन की अपेक्षा रखती है। शैली भाषा में निहित सौन्दर्यधर्मी शक्तियों का सामंजस्य है, इसलिए उसके अध्ययन के लिए भाषा का सौन्दर्यशास्त्रीय विश्लेषण आवश्यक होता है। इस प्रकार शैली विज्ञान भाषा का सौन्दर्यशास्त्रीय भाषा विज्ञान है।''*[2]

कोई भी साहित्यिक कृति मूलतः भाषा की ही एक विशिष्ट संरचना है, अतः उसके विवेचन का मूलाधार भाषा ही होनी चाहिए। भाषा के ही विभिन्न उपादानों एवं अवयवों के विवेचन द्वारा उसमें निहित कवि के अभिप्रेत भाव एवं उसके कथ्य का उद्घाटन करना वैज्ञानिक विधि है। यही किसी साहित्यिक कृति के विवेचन की वैज्ञानिक पद्धति है क्योंकि भाषा की व्यवस्था का वस्तुनिष्ठ ढंग से किया गया विश्लेषण ही तार्किक एवं वैज्ञानिक है। इस प्रक्रिया को प्रो. कृष्ण कुमार शर्मा ने निम्न शब्दों में व्यक्त किया है– *''जब काव्य को एक कृति के रूप में स्वतंत्र अस्तित्व के रूप में ग्रहण कर उसकी सभी कथ्य छटाओं के उद्घाटन का प्रश्न उठता है तो उसकी भाषा को आधार बनाना ही पड़ता है। जो कुछ है, भाषा के रूप में ही है, अतः भाषा की व्यवस्था ही विश्लेषण का मूल बिन्दु सिद्ध होता है।''*[3] स्पष्ट है कि शर्मा जी भाषा व्यवस्था के विवेचन द्वारा ही कथ्य की विविध छटाओं के उद्घाटन का सुझाव देते हैं। इस पद्धति को और अधिक स्पष्ट करते हुए डॉ. भोलानाथ तिवारी किसी रचना की सर्जनात्मक क्षमता का भाषा वैज्ञानिक पद्धति द्वारा विश्लेषण करने का परामर्श देते हैं – *''इसमें (शैली विज्ञान में) भाषा के सर्जनात्मक प्रयोगों का भाषा वैज्ञानिक विश्लेषण किया जाता है।''*[4]

शैली विज्ञान के स्वरूप निर्धारण में भाषा विज्ञान के अध्ययन की वर्णनात्मक एवं विश्लेषणात्मक पद्धति तथा साहित्यिक समीक्षा की विभिन्न प्रणालियों का योगदान होता है। भाषा विज्ञान उसे तार्किक शक्ति प्रदान करता है तो समीक्षा प्रणालियां उसे मर्मस्पर्शी एवं संवेदनात्मक आवेगों को आयत्त करने की समझ देती हैं। इसका संतुलित स्वरूप तभी निखरता है, जब इसे भाषा विज्ञान के गणितीय, सूत्रात्मकता एवं अतिरेकी शुष्क विवेचन से मुक्त रखा जाय। समीक्षा प्रणालियों में प्रचलित पूर्वाग्रह एवं पक्षपात से ऊपर उठकर ही शैली विज्ञान के स्वस्थ स्वरूप का निर्माण किया जा सकता है। इस संदर्भ में प्रसिद्ध शैली वैज्ञानिक रविन्द्र नाथ श्रीवास्तव का कथन सत्य है कि– *''शैली कलात्मक सौन्दर्य की अभिव्यंजक भाषिक संरचना है।''*[5]

शैली विज्ञान द्वारा काव्य भाषा की विशिष्टता का विवेचन एवं उसमें निहित सौन्दर्यमूलक तत्वों का उद्घाटन मुख्यतः निम्नलिखित मानदण्डों द्वारा किया जाता है –

1. विचलन (Deviation)
2. चयन (Choice)
3. समानान्तरता (Parallelism)
4. अप्रस्तुत विधान (Non-Contextuality)
5. बिम्ब (Image)
6. प्रतीक (Symbol)

1. विचलन (Deviation)

विचलन का अर्थ है भाषा के सामान्य नियमों से अलग हटना। प्रायः गद्य भाषा में व्याकरण के मानक नियमों का पालन किया जाता है। इसमें प्रयुक्त वाक्य संरचना कर्ता, कर्म एवं क्रिया

*प्रोफेसर, हिन्दी विभाग एवं सम्पादक, 'प्रज्ञा' जर्नल, काशी हिन्दू विश्वविद्यालय

के अनुक्रम में रहती है और क्रियाओं का प्रयोग वचन एवं लिंग के अनुरूप होता है, लेकिन कविता में कवि अपने भावों के प्रबल आवेगों एवं संवेदना के प्रवाह में इन नियमों का अतिक्रमण करता है। यह अतिक्रमण यदि केवल कौतूहल या चमत्कार के लिए है तो वह निंदनीय है, लेकिन कवि के भावों की विशिष्टता के उद्घाटन के लिए है तो वह वंदनीय है। इसलिए इसे साभिप्राय विचलन कहा जाता है। कवि द्वारा प्रयुक्त भाषा में जो विशिष्टता आती है उसे कुन्तक ने 'वक्रोक्ति' कहा है। आचार्य कुन्तक के अनुसार–

''शब्दार्थौ सहितौ वक्रकविव्यापारशालिनि
बन्धे व्यवस्थितौ काव्यं तद्विदाह्लादकारिणि''[6]

आचार्य कुन्तक ने कवि व्यापार के सन्दर्भ में वक्रोक्ति को छः प्रकारों में विभाजित कर उनका सोदाहरण स्पष्ट विवेचन किया है– वर्णविन्यासवक्रता, पदपूर्वार्द्धवक्रता, प्रत्ययवक्रता, वाक्यवक्रता, प्रकरणवक्रता एवं प्रबंधवक्रता। ये विवेचन मूलतः भाषा केन्द्रित हैं।

विचलन के स्वरूप को मुकरोफ्रस्की ने इन शब्दों में स्पष्ट किया है – *"The violation of the norm of the standard, its sistematic violation, is what makes possible the poetic utilization of language without this possibility these would be no poetry."*[7] अर्थात् कवि द्वारा रचित काव्य भाषा की व्यवस्था को त्याग कर ही रची जाती है। सामान्य भाषा में साभिप्राय विचलन द्वारा काव्य भाषा का सृजन संभव है। इस विचलन (वक्रता) के अभाव में उच्चकोटि की कविता संभव नहीं है। इसी प्रकार ए.ई. डर्बीशायर भी मानते हैं कि कविता की श्रेष्ठता उसके साभिप्राय विचलन की क्षमता पर निर्भर है। इनका स्पष्ट कथन है कि – *"Style is always a deviation from the norm."*[8]

विचलन ध्वनि, शब्द, पद, वाक्य एवं अर्थ आदि भाषा के विविध अंगों एवं अनेक व्याकरण कोटियों (लिंग एवं वचन आदि) में संभव है। यहाँ विस्तार भय से बचते हुए कुछ उदाहरणों द्वारा विचलन के काव्यात्मक प्रयोग के स्वरूप का उद्घाटन किया गया है। ध्वनि विचलन का प्रभावकारी प्रयोग गोस्वामी तुलसीदास द्वारा रचित *'श्रीरामचरितमानस'* के लंका काण्ड में किया गया है, जहाँ युद्ध की विभीषिका एवं भयंकरता को ध्वनि विचलन द्वारा अभिव्यक्त किया गया है –

''बोल्लहिं जो जय जय मुंड रुंड प्रचंड सिर बिनु धावहीं।
खप्परिन्ह खग्ग अलुज्झि जुज्झहिं सुभट भटन्ह ढहावहीं।।''[9]

लिंग विचलन का बड़ा ही व्यंजक प्रयोग महाकवि निराला ने वसंत ऋतु के वर्णन के प्रसंग में किया है – **'आज प्रथम *गाई पिक पंचम'*** यहाँ पिक एवं पंचम पुलिंग हैं, अतः व्याकरण के नियमानुसार ***गाई*** के स्थान पर ***गाया*** का प्रयोग होना चाहिए, लेकिन वसन्त ऋतु की मधुरता, रागात्मकता एवं कोमलता को व्यंजित करने के अभिप्राय से निराला ने स्त्रीलिंग का प्रयोग किया है। इसी प्रकार गोस्वामी तुलसीदास ने सीता की वाणी में कठोरता, तीव्रता, परुषता एवं मर्म भेदी क्षमता आदि की व्यंजना के लिए स्त्रीलिंग की क्रिया के स्थान पर पुलिंग क्रिया का प्रयोग किया है–

''मरम बचन जब सीता बोला। हरि प्रेरित लछिमन मन डोला।।''[10]

इस प्रसंग में वाल्मीकीय रामायण उल्लेखनीय है। राम के ऊपर आये संकट से घबरा कर सीता जी ने लक्ष्मण के प्रति अति कठोर वचन एवं अशोभनीय बाते कहीं है। मर्यादावादी तुलसी ने उन सबका विशद वर्णन न करके सांकेतिक ढंग से व्यंजित किया है।

कविवर धूमिल ने आजादी की निरर्थकता एवं खोखलेपन को व्यंजित करने के लिए क्रिया विचलन का प्रयोग किया है –**'क्या आजादी सिर्फ तीन थके हुए रंगों का नाम है'** (संसद से सड़क तक)

इसी प्रकार उनकी दूसरी लोकप्रिय पंक्ति है —

''मेरा डर मुझे चर रहा है''

विचलन के और उदाहरण द्रष्टव्य हैं– परशुराम-लक्ष्मण संवाद में परशुराम लक्ष्मण को हँसते हुए देखकर क्रोधित होकर राम से कहते हैं कि—

''हँसत देखि नख सिख रिस ब्यापी।
राम तोर भ्राता बड़ पापी।।''

यहाँ पापी का अर्थ – उद्दण्ड, घमण्डी अथवा कटुवादी होगा।

''मधुर मधुर गरजइ घन घोरा।''[12]

'मधुर' में मधुर का अर्थ मीठा न होकर मन्द-मन्द (धीरे-धीरे) होगा।

इसी प्रकार सीता जी द्वारा लक्ष्मण के प्रति कही गयी निम्न पंक्तियाँ भी विचारणीय हैं—

''हा लछिमन तुम्हार नहिं दोसा।
सो फलु पायउँ कीन्हेउँ रोसा।।''[13]

यहाँ पर अर्थ विचलन है। फल का अर्थ सुफल नहीं अपितु कुफल है जिसे ठीक से न समझने के कारण कुछ लोग अर्थ का अनर्थ कर डालते हैं।

सोद्देश्य चयन कौशल

कवि जब अपनी प्रबल अनुभूतियों को व्यक्त करने के लिए प्रयत्नशील होता है, तब वह उसे सम्यक् रूप से पाठकों में सम्प्रेषित करने हेतु उपयुक्त शब्दों का चयन करता है। वह किसी शब्द के अनेक पर्यायों या प्रचलित रूपों में से किसी एक का चयन करता है जो उसके भावों को सर्वोत्तम ढंग से व्यक्त करें। फिर उन चुने हुए शब्दों को वह एक विशेष क्रम में रखता है, जिससे उसकी अनुभूतियाँ पाठकों में प्रभावशाली ढंग से सम्प्रेषित हो सकें और

पाठक के मर्म को स्पर्श कर सके। इसे शब्द चयन एवं पद संयोजन कौशल कहते हैं। इस प्रक्रिया को भामह ने एक मालाकर (माली) द्वारा एक सुन्दर माला के निर्माण प्रक्रिया द्वारा स्पष्ट किया है। जैसे एक कुशल माली उपवन में जाकर अवसरानुकूल (जन्म उत्सव, वैवाहिक समारोह, शादी की वर्षगाँठ या शोक सभा आदि) रंग-बिरंगे अथवा सफेद पुष्पों का चयन करता है और उन्हें किसी विशेष क्रम में रखकर धागा में गूँथ कर एक सुन्दर माला का निर्माण करता है; वैसे ही रचनाकार अपने मनोभावों के अनुकूल सटीक शब्दों का चयन कर, उन्हें किसी विशेष क्रम में सजाकर लय रूपी धागा में पिरोकर एक सुन्दर कृति का निर्माण करता है। ऐसी माला में प्रत्येक फूलों के रूप, रस, गंध एवं रंग का महत्व होता है और साथ ही समग्र माला से समन्वित आभा भी फूटती है। उसी प्रकार कविता में प्रत्येक वर्ण, ध्वनि, शब्द, पद, वाक्य आदि का सौन्दर्य होता है और साथ ही लय में बद्ध समग्र कविता का चमत्कार/प्रभाव भी व्यंजित होता है। इस प्रक्रिया को भामह ने निम्न श्लोक में स्पष्ट किया है—

''एतद् ग्राह्यं सुरभि कुसुमं ग्राम्यमेतन्निधेयं
धत्ते शोभां विरचितमिदं स्थानमस्यैतदस्य।
मालाकारो रचयति यथा साधु विज्ञाय मालां
योज्यं काव्येष्ववन्वहितधिया तद्वदेवाऽभिधानम्॥''[14]

इसे और अधिक व्याख्यायित करते हुए वामन ने 'शब्द-पाक' की परिकल्पना की है। जिसमें कवि उत्तम शब्द का चयन और निम्न शब्द का परित्याग करता रहता है। यह प्रक्रिया तब तक चलती रहती है जब तक वह पूर्णतः संतुष्ट नहीं हो जाता कि वह अपने मनोभावों को सर्वोत्तम शब्दों में व्यक्त कर चुका है। इस अवस्था को वामन ने 'शब्दपरिपाक' कहा है—

''आधानोद्धरणे तावद् यावद्दोलयते मनः।
पदस्य स्थापिते स्थैर्यं हन्त सिद्धा सरस्वती॥
यत्पदानि त्यजन्त्येव परिवृत्तिसहिष्णुताम्।
तं शब्दन्यासनिष्णाताः शब्दपाकं प्रचक्षते॥''[15]

आचार्य कुंतक के यहाँ चयन एवं संयोजन का स्वरूप और भी अधिक स्पष्ट है। उनके अनुसार अनेक पर्यायवाची शब्दों में से जो विलक्षण रूप से अर्थ को व्यक्त कर सके वही शब्द काव्य मार्ग में वास्तविक (व्यंजक) शब्द है—

''शब्दो विविक्षितार्थैकवाचकोऽन्येषु सत्स्वपि।
अर्थः सहृदयाह्लादकारिस्वस्पन्दसुन्दरः॥''[16]

चयन भाषा के विविध अंगों (ध्वनि, शब्द, पद, वाक्य एवं अर्थ) के स्तर पर संभव है। यहाँ चयन के स्वरूप कुछ उदाहरणों द्वारा स्पष्ट किया गया है। कोमल, मधुर एवं रागात्मक भावों की अभिव्यक्ति में कोमल ध्वनियों एवं अनुनाद का प्रयोग प्रभावशाली होता है। इसका उत्तम उदाहरण 'रामचरितमानस' के पुष्पवाटिका प्रसंग में मिलता है—

''कंकन किंकिनि नूपुर धुनि सुनि।
कहत लखन सन रामु हृदयँ गुनि॥''[17]

वीर, भयानक एवं कठोर भावों के अभिव्यक्ति के समय परुष एवं कठोर (सघोष महाप्राण) ध्वनियों का चयन भावानुकूल प्रभाव डालने में सक्षम होता है। रामचरितमानस के लंकाकाण्ड में कुम्भकर्ण के भयानक एवं पराक्रमी व्यक्तित्व के परिचय के समय सबल ध्वनियों (थ, भ, ध) का चयन किया गया है—

''नाथ भूधराकार सरीरा। कुंभकरन आवत रनधीरा॥''[18]

भावानुकूल ध्वनि एवं शब्द चयन की दृष्टि से निराला की 'राम की शक्ति पूजा' उत्तम कोटि की रचना है। रावण के भयानक अत्याचार को प्रकृति के जिस भयावह चित्र द्वारा व्यक्त किया गया है वह अत्यंत प्रशंसनीय है—

''है अमानिशा उगलता गगन घन अन्धकार;
खो रहा दिशा का ज्ञान; स्तब्ध है पवन चार;
अप्रतिहत गरज रहा पीछे अम्बुधि विशाल
भूधर ज्यों ध्यान-मग्न; केवल जलती मशाल।''

यहाँ पर अप्रतिहत गरजने वाली उद्दाम तरंगों के सामने 'भूधर' का चयन किया गया है जिसमें दो सघोष महाप्राण ध्वनियाँ (भ, ध) एक साथ हैं। अन्य पर्यायवाची शब्दों पर्वत, गिरि आदि का प्रयोग यहाँ अनुपयुक्त होता। महादेवी का दीपक (मधुर-मधुर मेरे दीपक जल) यहाँ उपयुक्त नहीं होता अपितु 'मशाल' का चयन ही उपयुक्त एवं काव्यात्मक है।

जयशंकर प्रसाद की 'लहर' कविता भी चयन कौशल की दृष्टि से उत्तम कोटि का है। छोटी-छोटी लहरों के लिए प्रसाद की मधुर ध्वनि एवं लघु शब्द योजना प्रशंसनीय है—

''उठ उठ री लघु लघु लोल लहर!
करुणा की नव अँगराई-सी,
मलयानिल की परछाई-सी,
इस सूखे तट पर छिटक छहर!
शीतल कोमल चिर कम्पन-सी,
दुर्ललित हठीले बचपन-सी,
तू लौट कहाँ जाती है री–
यह खेल-खेल ले ठहर ठहर!''[19]

स्पष्ट है कि निराला ने प्रकृति के भयानक, रौद्र एवं प्रचण्ड रूप के वर्णन में कठोर ध्वनियों का साभिप्राय चयन किया और जयशंकर प्रसाद ने प्रकृति के कोमल एवं मधुर रूप के चित्रण के समय कोमल ध्वनियों (उ, ल, ह, र, आदि) का प्रयोग कर उसे अपेक्षित काव्यात्मक सौन्दर्य प्रदान किया।

समानान्तरता

समानान्तरता में भाषा के अंगों का समानान्तर इकाईयों प्रयोग किया जाता है। अर्थात् भाषा में किसी एक या एक से अधिक इकाईयों का कई बार प्रयोग कर उनकी पुनरावृत्ति की जाती है। इससे भाषा में संगीतात्मकता एवं लयात्मकता के साथ-साथ सहज स्मरणीयता के गुण का भी समावेश हो जाता है। अर्थ गाम्भीर्य की दृष्टि से भी यह प्रतिमान अत्यन्त महत्वपूर्ण है। जिस प्रकार दो समानान्तर दर्पणों के मध्य रखी किसी वस्तु के अनगिनत बिम्ब-प्रतिबिम्ब बन जाते हैं, वैसे ही भाषा की किसी इकाई के समानान्तर प्रयोगों से उनमें जो अर्थ की गूँज या अनुगूँज की शृंखला प्रस्फुटित होती है, उससे अर्थ के कई स्तर भी खुलने लगते हैं। विचलन में जहाँ मानक भाषा नियमों की त्याग की चेष्टा की जाती है वहीं समानान्तरता में भाषिक नियमों का सायास अधिक प्रयोग किया जाता है। समानान्तरता मुख्यतः दो प्रकार की होती है— साम्य मूलक एवं वैषम्य मूलक। साम्य मूलक समानान्तरता में भाषा की इकाईयों का समान (अनुकूल) प्रयोग किया जाता है, जबकि वैषम्य मूलक समानान्तरता में भाषा की विरोधमूलक (प्रतिकूल) इकाईयों का प्रयोग किया जाता है। इसे लीच ने अग्रप्रस्तुति (Foregrounding) के रूप में महत्वपूर्ण भाषिक उपादान माना है— *".... a type of foregrounding which is in a sense the opposite of deviation, for it consists in the introduction of extra regularities, not irregularities into the language, This is PARALLELISM in the widest sense of the word."*[20]

भारतीय साहित्य शास्त्र में छन्द विवेचन के सन्दर्भ में इसकी चर्चा की गयी है। छंद की मूल संकल्पना में ही संगीतात्मकता एवं लययोजना है। आक्षरिक, वर्णिक एवं मात्रिक छंदों की कल्पना के मूल में समानान्तरता की महत्वपूर्ण भूमिका होती है। अनुप्रास एवं यमक जैसे अलंकार समानान्तरता के उत्तम उदाहरण है। समानान्तरता भाषा की सभी इकाईयों— ध्वनि, शब्द, पद, वाक्य एवं अर्थ में होती है। समानान्तरता का प्रयोग सहज सम्प्रेषणीयता, माधुर्य, चित्र योजना, नाद सौन्दर्य, सहज एवं चिर स्मरणीयता तथा प्रभावात्मकता के लिए किया जाता है। ध्वनि समानान्तरता की दृष्टि से नरेश मेहता की निम्न काव्य पंक्तियाँ उल्लेखनीय है—

''मेरी भाषा/मेरे शब्द और/मेरी रचना
इन्हें मैं समय को वैसे ही दे देना चाहता हूँ
जैसे कि वृक्ष फूलों को अनाम दे देते हैं।''[21]

यहाँ ए ध्वनि की बारह बार आवृत्ति की गयी है। 'प्रवाद पर्व' में नरेश मेहता ने राम के मन के उद्वेलन, बेचैनी एवं चिन्ता को अत्यन्त सार्थक ढंग से शब्द समानान्तरता के द्वारा व्यक्त किया है—

''यह क्या है?/ यह महालीला/ यह विधान

यह खेल/यह प्रारब्ध/ यह सब क्या है?''[22]

समानान्तरता की दृष्टि से नागार्जुन की अकाल पर लिखी अत्यन्त लोकप्रिय कविता उल्लेखनीय है—

''बहुत दिनों तक चुल्हा रोया चक्की रही उदास
बहुत दिनों तक कानी कुतिया सोई उसके पास
बहुत दिनों तक लगी न भीत पर छिपकलियों की गस्त
बहुत दिनों तक चूहों की भी हालत रही सिकस्त''

इसमें अकाल और उसके बाद की कारुणिक स्थिति की गहरी व्यंजना की गयी है। बाद के अवतरण में 'बहुत दिनों के बाद' पद बंध को पंक्ति के अन्त में देकर कवि ने इसे और अधिक प्रभावशाली एवं मर्मस्पर्शी बना दिया। समानान्तरता की दृष्टि से यह उत्तम कोटि का उदाहरण है।

समानान्तरता की दृष्टि से 'रामचरितमानस' के अयोध्याकाण्ड में वर्णित महाराज दशरथ के स्वर्गवासी होने के दृश्य को अत्यन्त कारुणिक, मार्मिक एवं राममय बना दिया गया है—

''राम राम कहि राम कह राम राम कहि राम।
तनु परिहरि रघुबर बिरहँ राउ गयउ सुरधाम॥''[23]

यहाँ ध्वनि एवं शब्द दोनों स्तर पर समानान्तरता का उत्तम प्रयोग किया गया है।

अप्रस्तुत विधान

कविता के निर्माण में अप्रस्तुत विधान की बड़ी महत्वपूर्ण भूमिका होती है। कवि अपने भावों (प्रस्तुत) को जीव-जगत के अन्य उपादानों (अप्रस्तुत) के माध्यम से व्यक्त करता है। यह अत्यन्त प्राचीन एवं बहुप्रचलित पद्धति है। इस आधार पर भी किसी कविता का वैज्ञानिक विवेचन किया जा सकता है कि किसी कवि ने प्रस्तुत के समानान्तर किस प्रकार के अप्रस्तुत का प्रयोग किया है? वह किस सीमा तक कवि के अभिप्रेत भाव (प्रस्तुत) को पाठक तक सम्प्रेषित कर सका है। अप्रस्तुत विधान प्रायः प्रभाव साम्य, गुण साम्य अथवा आकार साम्य के आधार पर किये जाते हैं। साहित्य में प्रायः चार प्रकार के अप्रस्तुत विधान मिलते हैं— स्थूल के लिए सूक्ष्म, सूक्ष्म के लिए स्थूल, स्थूल के लिए स्थूल एवं सूक्ष्म के लिए सूक्ष्म। यही कारण है कि सादृश्य मूलक अलंकारों (उपमा, रूपक एवं उत्प्रेक्षा आदि) का बहुतायत से प्रयोग कविता के आदिकाल से ही देखा जाता है। यह एक अत्यन्त सफल एवं लोकप्रिय पद्धति है।

स्थूल प्रस्तुत के लिए सूक्ष्म अप्रस्तुत के प्रयोग की दृष्टि से जयशंकर प्रसाद की प्रसिद्ध कविता 'लहर' उल्लेखनीय है जहाँ उन्होंने लहर जैसी स्थूल एवं दृष्टिगोचर प्रस्तुत के लिए 'मलयानिल की परछाँई', 'कोमल चिर कम्पन' एवं 'करुणा की नव अँगराई' जैसे अत्यन्त सूक्ष्म अप्रस्तुतों की योजना की है।

सूक्ष्म प्रस्तुत के लिए स्थूल अप्रस्तुत की दृष्टि से जयशंकर

प्रसाद का कामायनी में लज्जा का वर्णन उल्लेखनीय है जहाँ लज्जा जैसे अत्यन्त सूक्ष्म मनोभाव को मूर्तमान स्वरूप प्रदान कर दिया है—

''लाली बन सरस कपोलो में आँखों में अंजन सी लगती,
कुंचित अलकों सी घुँघराली मन की मरोर बनकर जगती,
x x x x
मैं वह हलकी सी मसलन हूँ जो बनती कानों की लाली।''[24]

अप्रस्तुत विधान की दृष्टि 'रामचरितमानस' के अयोध्याकाण्ड का धनुष यज्ञ प्रसंग अत्यन्त महत्वपूर्ण है जहाँ राम के लिए मूर्त, अमूर्त दोनों प्रकार के अप्रस्तुतों का प्रयोग किया गया है। जनक सभा के दर्शकों के मनोवृत्ति के अनुकूल राम किसी को रनधीरा, किसी को नरभूषण, किसी को विराट मय, किसी को शिशु रूप, किसी को परमतत्त्वमय एवं किसी को काल स्वरूप प्रतीत होते हैं—

''जाकी रही भावना जैसी/प्रभु मूरति देखी तिन्ह तैसी॥
हरि भगतह्न देखे दोउ भ्राता। इष्ट देव इव सब सुख दाता॥''[25]

अमूर्त प्रस्तुत के लिए अमूर्त अप्रस्तुत का प्रयोग कम मिलता है क्योंकि सम्प्रेषणीय दृष्टि से यह विधान कम सफल पाया जाता है फिर भी महान कवि इस योजना द्वारा भी सफल कविता का निर्माण कर सके हैं। तुलसीदास की निम्न पंक्तियाँ इस दृष्टि से उल्लेखनीय है—

''पवन निसान घोर रव बाजहिं।
प्रलय समय के घन जनु गाजहिं॥''[26]

'बिम्ब' एवं 'प्रतीक' को कुछ विद्वानों ने अप्रस्तुत विधान के अन्तर्गत माना है जहाँ अप्रस्तुत में चित्र योजना की प्रधानता होती है वहाँ बिम्ब और जहाँ अप्रस्तुत में व्यंजना एवं गहरी अर्थवत्ता की प्रधानता होती है वहाँ प्रतीक की योजना की जाती है। विस्तार भय से इसका विवेचन यहाँ नहीं किया जा रहा है।

समग्रतः 'शैली विज्ञान' साहित्य को वैज्ञानिक पद्धति द्वारा विवेचित करता है। वह किसी रचनात्मक कृति की विशिष्ट भाषिक संरचना के निर्धारक तत्वों की काव्यात्मक शक्ति एवं उनके आन्तरिक समायोजन की व्यंजना शक्ति का उद्घाटन कर सुव्यवस्थित ढंग से पाठकों को उस रचना का आस्वादन कराता है। रचना केन्द्रित यह वैज्ञानिक पद्धति रचनाकार के व्यक्तिगत जीवन, उसके परिवेश, उसकी विचारधारा एवं मनोवृत्तियों को उसी सीमा तक उद्घाटित करती है जितनी कि रचना में उसका भाषिक रूपान्तरण हो सकता है। यह वैज्ञानिक पद्धति रचना से इतर प्रसंगों के छान बीन में नहीं जुटती है, अतः यह पद्धति राग-द्वेष से मुक्त एवं पूर्वाग्रह तथा पक्षपात से रहित वस्तुनिष्ठ पद्धति है, जिसकी आज के वैज्ञानिक युग एवं बौद्धिक परिवेश में अत्यन्त सार्थकता है। यह पद्धति आज के तर्कप्रधान बौद्धिक वर्ग को भी संतुष्ट करने में सक्षम है।

सन्दर्भ

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नैनो प्रौद्योगिकी : सूचना प्रौद्योगिकी के नये आयाम

*घनश्याम तिवारी**

प्रारम्भ से ही मनुष्य अपनी विद्या एवं ज्ञान के द्वारा सुख सुविधा के नये साधन इजाद करता रहा है। भर्तृहरि ने लिखा है—

''येषाम् न विद्याम् न तपो न दानम्
न ज्ञानम् न शीलम् न गुणो न धर्मः
ते मृत्युलोक भूवि भारभूताः
मनुष्यरूपेण मृगाश्च चरन्ति''।

जिसका अर्थ है जिसमें न विद्या है, न तप है, न ज्ञान है, न दान है, न शील है, न गुण है, न धर्म है। वे पृथ्वी के ऊपर भारस्वरूप ही है और मनुष्य के शरीर में पशुओं की भाँति जीवनयापन करते हैं। मनुष्य एक चिन्तनशील प्राणी है। वह सतत् चिन्तन, अनुसंधान के द्वारा अपने को उठाता है और अपने जीवन को सुखमय बनाता है। पहले मनुष्य पत्थरों को रगड़-रगड़ करके आग को पैदा करता था। आज आविष्कारों द्वारा मानव जीवन पहले से अधिक सुखमय हो गया है। आज मोबाईल और ई-मेल गाँव-गाँव पहुँची हुई है। इससे डिजिटल क्रांति आई है। इस लेख में नैनो प्रौद्योगिकी एवं सूचना प्रौद्योगिकी जिसने मानव जीवन के सभी पहलुओं को प्रभावित किया है, का विवेचन किया गया है। सूचना प्रौद्योगिकी भी विकासों से अछूता नहीं है।

मानव को बुद्धि प्रदान की गई है। बुद्धि से ही वह अपना उद्धार कर सकता है एवं बुद्धि के दुरूपयोग से अपने को पतन में डाल सकता है। भगवद्गीता के छठें अध्याय के पाँचवे श्लोक में लिखा है—

''उद्धरेआत्मन आत्मानो मा अवसादयेत,
आत्मैव हि आत्मनो बन्धुरैव रिपुरात्मन।''

अर्थात् मनुष्य को अपने प्रयासों के द्वारा ही अपने को ऊपर उठाना चाहिए एवं अपने को कभी अवसाद में नहीं डालना चाहिए। मनुष्य स्वयं अपना मित्र है और स्वयं ही अपना शत्रु है।

मनुष्य को सतत् विकास के नये-नये अवसर तलाशने चाहिए। शैक्सपीयर ने भी लिखा है — *"The man who take the opportunities by the forelock is the man who succeds"* अर्थात् जो मनुष्य अवसर का लाभ उठाता है, वह अवश्य सफल होता है।

पहले मनुष्य वृक्ष की छालों से अपने को ढँकता था। उसके उपरान्त पत्थरों के रगड़ने से आग जलाता था। धीरे-धीरे ज्ञान में बढ़ोत्तरी हुई और मनुष्य अपने जीवन को और आरामदायक बनाने का प्रयास करने लगा। इस लेख में नैनो प्रौद्योगिकी, जो सूचना क्रांति में नये आयाम खोल रही है, का विवेचन किया जाएगा।

प्रौद्योगिकी

आम बोल-चाल की भाषा में प्रौद्योगिकी को युक्ति कहा जाता है। शब्दकोश व्यावहारिक (प्रैक्टिकल) लक्ष्यों की प्राप्ति हेतु ज्ञान के क्रमबद्ध अनुप्रयोग को प्रौद्योगिकी कहते हैं। उन सभी मान्य विधियों का समूह, जिसमें कि मानव समाज का कोई घटक अपनी भौतिक आवश्यकताओं की पूर्ति करता है। प्रौद्योगिकी विषय के परिप्रेक्ष्य में नैनो प्रौद्योगिकी का अद्भुत समन्वय है। सबसे पहले सूचना प्रौद्योगिकी आई। उसके उपरान्त जैव प्रौद्योगिकी आई। अब नैनो प्रौद्योगिकी आई है। इस विचित्र ब्रह्माण्ड में अनेक अद्भुत विशेषताएं हैं। इन विशेषताओं के विचित्रताओं और घटनाओं के बल पर देर-सबेर हमारे लिये उपयोगी साधनों का आविष्कार होता है, जिससे कि जीवन सुखमय होता है।

नैनो प्रौद्योगिकी

नैनो प्रौद्योगिकी पदार्थ का परमाणु, आणविक और सुप्राआणविक स्तर पर कार्य किया जाता है। शुरू में, प्रचलित नैनो प्रौद्योगिकी का विकरण अणुओं और परमाणुओं को सूक्ष्म तौर पर क्रमबद्ध करना है जिससे कि मैक्रो आकार के उत्पाद बन सके। एक सामान्यकीकृत परिभाषा है कि पदार्थ जिसका आकार 1 से 100 नैनोमीटर में होता है। इस परिभाषा से यह समझ में आता है कि क्वांटम यांत्रिकी प्रभाव महत्वपूर्ण हो जाता है।

नैनो शब्द ग्रीक भाषा के नैनोज शब्द से निकला है, जिसका अर्थ होता बौना (Dwarf) होता है परन्तु अंतर्राष्ट्रीय प्रणाली में नैनो का अर्थ मीटर का अरबवां हिस्सा है। नैनो प्रौद्योगिकी में नैनोमीटर के पैमाने (10 मीटर यानि कि एक मीटर का अरबवां हिस्सा) पर प्रणालियों का अध्ययन तथा अभिकल्पन (डिजाइन) तैयार किया जाता है। अर्थात् परमाणुओं और अणुओं के स्तर पर कार्य किया जाता है। एक अलपिन की घुंडी पर कार्य किया जाता है। एक अलपीन की घुंडी के दस लाखवें हिस्से को नैनोमीटर जितने आकार का माना जा सकता है।

नैनो प्रौद्योगिकी के सूचना प्रौद्योगिकी में विकास

नैनो स्तर पर वैद्युत चालकता का क्वांटीवृत होना यह दर्शाता है कि इस स्तर पर क्वाटेंटम प्रभावों को पूरी तरह से अलग नहीं

*वैज्ञा. एफ (अपर निदेशक), राजभाषा एवं संगठन पद्धति निदेशालय, डीआरडीओ मुख्यालय, डीआरडीओ भवन, राजाजी मार्ग, नई दिल्ली

किया जा सकता। सूक्ष्म चालकों से प्रवाहित होने वाले इलैक्ट्रॉन प्लेन तरंग (वेव) सदृश व्यवहार का प्रदर्शन करते हैं और जब किसी नैनो युक्ति के निवेश (इनपुट) से निर्गम (आउटपुट) तक इलैक्ट्रॉनों के ये तरंगवत (वेव-लाइक) गुणधर्म अपनी संसक्तता बनाये रखते हैं तो इस तरह के क्वांटम प्रभावों की सृष्टि होती है।

वर्ष 1960 में ट्राँजिस्टर के आविष्कार से माइक्रोइलेक्ट्रानिकी की शुरूआत हुई थी। धीरे-धीरे माइक्रोचिप में लगने वाले इलेक्ट्रानिक संघटकों का आकार छोटा होता गया। वैज्ञानिकों का अनुमान है कि नैनोप्रौद्योगिकी के चलते वह दिन दूर नहीं जब ट्राँजिस्टरों का आकार घटकर 20 नैनोमीटर मात्र रह जाएगा। समय के साथ-साथ प्रौद्योगिकी में परिवर्तन होते रहते हैं। परिवर्तन, प्रकृति का नियम है। इर्ल ऑफ रोचेस्टर ने कहा है— *"Since it is nature's law to change constancy alone is strange"* चूँकि परिवर्तन जीवन का नियम है। अतः स्थिरता आश्चर्यजनक है। कोई भी प्रौद्योगिकी उपयोग में आने वाले मूलभूत पदार्थों पर निर्भर करती है। यह कहा जा सकता है कि नैनो प्रौद्योगिकी हमारे दैनिक जीवन में आने वाली अगली क्रांति है। शायद ही जीवन को कोई ऐसा पहलू होगा जो कि नैनो प्रौद्योगिकी से अछूता हो। जब ट्राँजिस्टर का आविष्कार हुआ था तो भौतिकी के नोबल पुरस्कार अध्यक्ष कह रहे थे — "Shared equally is the challenge of a new territory seen for the first time calling for a new scientific attack" अर्थात् एक ऐसे वैज्ञानिक क्षेत्र की पहचान की गई है जिसे एक नई वैज्ञानिक चुनौती की आवश्यकता है। उनका इशारा नैनो प्रौद्योगिकी की ओर ही था।

नैनो प्रौद्योगिकी से संबंधित कुछ महत्वपूर्ण संकल्पनाएं प्रथम बार नोबल पुरस्कार विजेता और प्रसिद्ध भौतिकीविद् रिचर्ड पी. फाईमैन ने 29 दिसम्बर 1959 को कैलीफोर्निया इंस्टीट्यूट ऑफ टेक्नोली अमेरिकी भौतिकी सोसाइटी की एक बैठक के दौरान दिए गए *'देयर इज प्लेंटी ऑफ एम एट बाटम'* शीर्षक वाले अपने उद्‌बोधन में दी। गहराई से विचार किया जाए तो फाइनैमन का आशय यह था कि काफी सूक्ष्म स्तर या नैनो स्तर पर पदार्थों पर शोध अध्ययन की आवश्यकता होती है। फाइनैमन ने कहा अधिकतर कोशिकाएं बहुत सूक्ष्म होती है, परन्तु वे बेहद सक्रिय (एक्टिव) होती है। वे कई पदार्थों का निर्माण करती है और इधर-उधर घूमने में समर्थ होती है। अन्य कोशिकाओं की पहचान करती है और कई विलक्षण कार्य करती है। वे सूचना का संग्रह ही नहीं करते हैं, वरन् प्रतिक्रिया (अनुक्रिया) का भी प्रदर्शन करती है। फाइनैमन ने यह भी बताया था कि भौतिकी के सिद्धान्त वस्तुओं को परमाणु स्तर पर प्रबंध करने का विरोध नहीं करते।

नैनो इन्वोवेशन के क्षेत्र में नैनो आकार की आविष्कार और खोजों को क्रियान्वित किया जाता है जिनमें नई प्रौद्योगिकीयाँ और अनुप्रयोग जिनमें नैनो स्तर की संरचनाएं तथा प्रक्रियायें सम्मिलित हैं। नैनो प्रौद्योगिकी के क्षेत्र में नवीन नवाचार जिसमें कि द्विआयामी पदार्थ एक परमाणु मोटाई के जैसे कि ग्रैफीन, सिलिकन और स्टेफीन सम्मिलित हैं। नैनो परिरथ एवं नैनो पदार्थ कंप्यूटरों की नई श्रेणी का निर्माण कर रहे हैं।

नैनोइलेक्ट्रॉनिकी के सूचना क्षेत्र में अनुप्रयोग

नैनो प्रौद्योगिकी कंप्यूटर क्षेत्र पर क्रांतिकारी (क्रिटिकल) प्रभाव डालेगी। इन संरचनाओं का आकार और पैमाना छोटा है, अतः इससे विश्लेषण (Analysis) में असाधारण शुद्धता प्राप्त की जा सकती है। भविष्य में इनका आकार और कार्य करने का समय स्वचिंग आवृत्ति दस गुना घट जाएगी। आज जितने भी तीव्रगामी कंप्यूटर उपलब्ध हैं उनमें प्रयोग किये जाने वाले माइक्रोप्रोसेसर, माइक्रोमीटर आकार के होते हैं परन्तु यदि हम इस आकार को 10,000 गुना कम कर दें तो माइक्रोप्रोसेसर का आकार नैनोमीटर पैमाने में पहुँच जाएगा जिसका तात्पर्य होगा कि हम आज की तुलना में अरबों गुना तीव्र गति से काम करने वलो कंप्यूटर बना सकेंगे।

निष्कर्ष

इस लेख में नैनो प्रौद्योगिकी के सूचना प्रौद्योगिकी में अनप्रयोगों का संक्षिप्त विश्लेषण किया गया है। प्रसिद्ध वैज्ञानिक अलबर्ट आइन्सटाइन ने लिखा है —

"How strange is the lot of mortals each of us here is for a brief sojourn for what purpose he knows not. But with deeper reflection one knows that man exists for others, firstly on smiles & well-beings to which our own happiness is dependent & then to the million others to whose destinies we are tied by bonds of sympathy. A hundred times every day I reminded myself that my outer & inner life is based on the labour of such men both living & dead & I must exert myself in the same measure in which I have received & an still receiving."

इसका हिन्दी अनुवाद है कितना अनोखा हम नश्वरों का संसार है। हममें से प्रत्येक यहाँ पर यह न जानते हुए कि वह किसलिए है, कुछ समय के लिये है। गहराई से विचार करने पर यह समझ में आता है कि मनुष्य दूसरों के लिए जीता है, प्रथम में असंख्य, जिनकी खुशियों और मुस्कराहटों में हमारी अपनी खुशियां निहित है और दूसरे वे असंख्य जिनके भाग्यों से हम सहानुभूति की डोरियों से बंधे हैं। मैं प्रत्येक दिन अपने को याद दिलाता हूँ कि मेरा आन्तरिक और बाह्य जीवन से असंख्य ऐसे जीवित और मृत लोगों के श्रम से बना है और मुझे भी उसी मात्रा में श्रम करना होगा, जिस मात्रा में मैंने प्राप्त किया है और कर रहा हूँ।

सन्दर्भ

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प्राकृतिक रसायनों द्वारा पादप कीटों का प्रबंधन

अभिषेक कुमार द्विवेदी[1], आकाश केडिया[2], प्रशांत कुमार मिश्र[3] एवं प्रो0 नवल किशोर दूबे[4]

विश्व की लगातार बढ़ती जनसंख्या के सामने सबसे बड़ी चुनौती उसे पर्याप्त मात्रा में खाद्यान्न उपलब्ध कराना है। जिन विकासशील देशों में माँग के विपरीत खाद्यान्न उत्पादन की दर धीमी होती है, वहां की अर्थव्यवस्था की वृद्धि कृषि आधारित होती है। शीतोष्ण कटिबंधीय क्षेत्रों की तुलना में ऊष्ण एवं उपोष्ण कटिबंधीय क्षेत्रों में खाद्यान्न की क्षमता अधिक होती है, किन्तु इन प्रदेशों की जलवायु कीटों एवं कवकों के अनुकूल भी होती है। भारी वर्षा और नमी की उपलब्धता इन क्षेत्रों को कीटों एवं कवकों की वृद्धि के अनुकूल बनाती है जो कि भारी मात्रा में खाद्यान्नों को नष्ट करते हैं। लाख प्रयास करने के बावजूद प्रतिवर्ष लगभग एक तिहाई खाद्यान्न कीटों एवं कवकों के द्वारा नष्ट कर दिए जाते है।[1] जो कभी-कभी घनी आबादी वाले देशों में अकाल का कारण भी बनते हैं। ऐसे देश जहाँ पर भंडारण की आधुनिक सुविधाएँ उपलब्ध नहीं हैं, वहां पर फफूँद और कीट खाद्यान्नों को सर्वाधिक नुकसान पहुँचाते हैं[2] खाद्यान्नों को नुकसान पहुँचाने वाले अनेक फंफूद माइकोटॉक्सिन का निर्माण करते हैं, जिसकी वजह से खाद्यान्नों का प्रबंधन और कठिन हो जाता है। दुनिया की लगभग साढ़े चार अरब जनसंख्या के ऊपर माइकोटॉक्सिन से होने वाले नुकसान का खतरा मंडरा रहा है। विश्व स्वास्थ्य संगठन ने एफ्लाटॉक्सिन (जो की एक तरह का माइकोटॉक्सिन है) को स्वास्थ्य के लिए दस सर्वाधिक खतरों में छठें नंबर पर रखा है, अतः इन खाद्यान्नों को इन कीटों, फंफूदों और माइकोटॉक्सिन से पूरी तरह बचा कर ही हम इनकी गुणवत्ता एवं सुरक्षा को सुनिश्चित कर सकते हैं।

कृत्रिम कीटनाशी एवं पादप कीटों का नियंत्रण

कीटों एवं फंफूदों की रोकथाम के लिए कृत्रिम कीटनाशियों का इस्तेमाल लम्बे समय से होता चला आ रहा है। 1940 और इसके बाद का दशक अनेक महत्वपूर्ण कृत्रिम कीटनाशियों जैसे- डी.डी.टी., बी.एच.सी., क्लोरिनेटेड साइक्लोडाईन, ऑर्गेनोफॉस्फेट और कार्बामेट की खोज के लिए जाना जाता है। एक तरफ इन कीटनाशियों ने अनेक देशों में हरित क्रांति को सफल बनाने में मदद की दूसरी और इन्होंने अनेकों पर्यावरण एवं स्वास्थ्य सम्बन्धी समस्यायों को भी जन्म दिया जिनमें प्रमुख रूप से हार्मोन का असंतुलन[3], भूमिगत जल का विषैला होना, उपयोगकर्ता एवं जीव जंतुओं के ऊपर जहर का असर और कीटनाशियों का खाद्यान्नों में अवशेष के रूप में बचा होना सम्मिलित है। कीटनाशी फास्फीन ओज़ोन परत का क्षरण भी करता है और साथ ही साथ कुछ कीटों में कीटनाशियों के प्रति प्रतिरोधी क्षमता का भी विकास करता है। अनेक रोगकारी फंफूदों में प्रतिरोधी क्षमता विकसित होने की वजह से इनके ऊपर कार्बेडाजाइम, बेनोमिल और थायोफेनेट मेथिल जैसे कीटनाशी अप्रभावी हो गए हैं। अतः हमें तत्काल इन कृत्रिम कीटनाशियों का ऐसा विकल्प खोजने की आवश्यकता है जो पर्यावरण एवं मानव स्वास्थ्य को बिना कोई क्षति पहुँचाये खाद्यान्नों के भण्डारण में सहायक हो सके।

पादप कीटनाशियों द्वारा कृषि सम्बन्धी कीटों का प्रबंधन

आजकल अनेक पादप उत्पादों को कीटनाशियों के रूप में प्रयोग करने पर ध्यान दिया जा रहा है, क्योंकि ये न केवल बायोडिग्रेडेबल होते है बल्कि ये पौधों के लिए फायदेमंद भी होते हैं। इन पादप उत्पादों में अनेकों प्रकार के सेकेण्डरी मेटाबोलाइट आते हैं जिनमें मुख्य रूप से फेनॉलिक्स, सैपोनिन, फ्लैवेनॉयड, क्विनोन, टैनिन, एल्कलॉयड, स्टेरॉल एवं सुगन्धित तेल इत्यादि हैं। इन सेकेण्डरी मेटाबोलाइट की वजह से पौधों को कीटों एवं चरने वाले जानवरों से सुरक्षा मिलती है अतः इन उत्पादों का उपयोग नए कीटनाशियों के विकास में किया जा सकता है।

1940 के दशक तक इन प्राकृतिक कीटनाशियों का उपयोग बहुतायत में किया जाता था किन्तु इसके बाद इनका स्थान कृत्रिम कीटनाशियों ने ले लिया, क्योंकि कृत्रिम कीटनाशी आसानी से बनाये जा सकते थे और लम्बे समय तक विघटित नहीं होते, इसके विपरीत प्राकृतिक कीटनाशी अत्यंत कम समय में विघटित हो जाते है और इनका असर समाप्त हो जाता है। किन्तु आजकल लोग कृत्रिम कीटनाशियों की हानियों की वजह से जागरूक हुए है और खाद्यान्नों के संरक्षण में प्राकृतिक कीटनाशियों का प्रयोग बढ़ा है।

वर्तमान समय में प्रयोग होने वाले प्राकृतिक कीटनाशी

पाइरेथ्रम

पाइरेथ्रम सबसे पुराने प्राकृतिक कीटनाशियों में से एक है। सर्वप्रथम इसे कीनिया और इक्वाडोर में गुलदाउदी के फूलों से निकाला गया। नेपोलियन के समय, युद्ध के दौरान गुलदाउदी के सूखे फूलों का प्रयोग शरीर को जुओं से बचाने में किया जाता था। पाइरेथ्रम चार यौगिकों का मिश्रण होता है, पाइरेथ्रिन और एवसि-

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नेरिन, जिसमें पाइरेथ्रिन स्तनधारियों के लिए हल्का जहरीला होता है। चूहों के लिए इसकी एल.डी. फिफ्टी का मान 132 मिग्रा/किग्रा होता है।

पाइरेथ्रम की कार्यप्रणाली डी.डी.टी. के सामान ही होती है। यह कीटों के तंत्रिका तंत्र पर असर डालता है। यह तंत्रिका कोशिकाओं के एक्जॉन वाले भाग में विद्युत तरंगों के प्रवाह को अवरुद्ध कर देता है, जिससे कीट लकवाग्रस्त हो जाते है। कम तापमान पर पाइरेथ्रम अधिक प्रभावशाली रूप से कार्य करता है। कई बार लकवाग्रस्त कीटों पर से पाइरेथ्रम का असर खत्म हो जाता है और वे पुनः स्वस्थ हो जाते हैं, इससे बचने के लिए पाइरेथ्रम के साथ सासाफ्रास नामक पौधे से प्राप्त होने वाले यौगिक पिपरेनिल ब्यूटॉक्साइड को 1:4 के अनुपात में मिलाया जाता है।[4]

रोटेनॉन

रोटेनॉन दक्षिण अमेरिका में मिलने वाले लोंकोकार्पस और डोरिस नामक पौधों की जड़ों से बनाया जाता है। सदियों से इसका प्रयोग पत्ती खाने वाली इल्लियों की रोकथाम के लिए होता आ रहा है। शुरुआत में रोटेनॉन का इस्तेमाल मछलियों को लकवाग्रस्त करने में किया जाता था, जिसके फलस्वरूप वो सतह पर आ जाती थी और उन्हें पकड़ना आसान हो जाता था। शुद्ध रोटेनॉन कृत्रिम कीटनाशियों जैसा की जहरीला होता है। चूहे पर इसके एल.डी. फिफ्टी का मान 132 मिग्रा/किग्रा होता है। रोटेनॉन का प्रभाव श्वशन तंत्र पर पड़ता है यह NAD^+ और कोएंजाइम Q के बीच इलेक्ट्रान के प्रवाह के अवरुद्ध कर देता है जिससे श्वशन प्रणाली ध्वस्त हो जाती है और जीव मर जाता है।[4]

लिमोनिन

लिमोनिन पादप कीटनाशियों में सबसे आधुनिक है और यह सिट्रस समूह के फलों के छिलकों से निकाला जाता है। संतरे के छिलकों से निकलने वाले तेल का लगभग 18 फीसदी लिमोनिन ही होता हैं। लिमोनिन वास्तव में सुगन्धित पौधों से निकलने वाले यौगिकों का एक समूह है। यह बाह्य परजीवियों जैसे जुओं, पिस्सुओं के विरूद्ध अत्यंत प्रभावशाली रूप से कार्य करता है और साथ ही साथ स्तनधारियों के लिए हानिकारक भी नहीं होता। लिमोनिन की कार्यप्रणाली पाइरेथ्रम के समान ही होती है। यह तंत्रिका तंत्र पर असर डालता है।

नीम

भारतीय उपमहाद्वीप में प्राचीन काल से ही नीम का उपयोग होता चला आ रहा है, इसका प्रयोग मुख्यतः भण्डारण के दौरान अथवा कभी-कभी खड़ी फसलों के ऊपर भी किया जाता है। नीम का मुख्य घटक एज़ाडिरैक्टिन होता है जो कि एक प्रकार का ऑक्सीकृत ट्राईटरपीनॉइड होता है किन्तु इसके अलावा नीम में सैलानिन, निम्बिन, निम्बिडीन और मेलिएन्ट्राइऑल अन्य घटकों के रूप में मौजूद होते है। इन सभी घटकों का इस्तेमाल अलग-अलग कीटनाशियों एवं दवाओं में होता है। एज़ाडिरैक्टिन नमी एवं प्रकाश कि उपस्थिति में बहुत तेजी से विघटित होता है किन्तु नीम के तैल में यह विघटित नहीं होता अतः शुद्ध एज़ाडिरैक्टिन के स्थान पर नीम का तेल प्रयोग करने की संस्तुति की जाती है।

एज़ाडिरैक्टिन एक असाधारण कवक नाशी, कीटनाशी एवं जीवाणुनाशी होता है और इसके अंदर कीटों में हार्मोन के स्तर को असंतुलित करने का गुण भी पाया जाता है। एज़ाडिरैक्टिन स्तनधारियों एवं मछलियों को हानि नहीं पहुँचाता। चूहों पर इसके एल.डी. फिफ्टी का मान >5000 मिग्रा/किग्रा होता है।

सैबाडिला

सैबाडिला दक्षिणी अमेरिका में पाये जाने वाले पौधे सेवाडिला नामक पौधे के पके हुए बीजों से निकाला जाता है। सैबाडिला एक प्रकार का वेराट्रीन एल्कलॉयड होता है और यह एक कीटनाशी की तरह कार्य करता है। सैबाडिला धूप एवं हवा के संपर्क में आने पर बहुत तेजी से विघटित होता है अतः इसका उपयोग सीमित है। आमतौर पर इसका प्रयोग लीफ हापर, एक्वास बग, हर्लेक्वीन बग, स्टिंक बग और इल्लियों की रोकथाम के लिए किया जाता है। सैबाडिला मधुमक्खियों के लिए जहरीला होता है अतः इसका प्रयोग हमेशा सायंकाल, मधुमक्खियों के अपने छत्तों में लौटने के पश्चात् ही करना चाहिए।

कार्वोन

कार्वोन, कैरम कार्वी नामक पौधे से निकाला जाता है। नीदरलैण्ड में कार्वोन को टैलेंट के नाम से बेचा जाता है। कार्वोन भंडारण के दौरान आलू के कंदो के अंकुरण एवं सड़न से बचाता है तथा इसका अन्य खाद्यान्नों के भण्डारण के दौरान भी किया जा सकता है। यह स्तनधारियों के लिए जहरीला नहीं होता है। कार्बोन खाद्य पदार्थों के स्वाद एवं गंध में किसी तरह का परिवर्तन नहीं करता।[5]

सुगन्धित तैल

सुगन्धित तैल ऐसे पादप उत्पाद होते है जिनका प्रयोग खाद्यान्नों की सुरक्षा में आसानी से किया जा सकता है। असल में ये तैल पौधों द्वारा स्वयं की सुरक्षा के लिए ही बनाये जाते है। इन सुगन्धित तैलों में मोनो एवं सेस्कवीटरपेनॉइड, ईस्टर, एसिड, कीटोन, एल्कोहल और काउमरीन जैसे घटक मुख्य रूप से पाये जाते है। इन यौगिकों में कवकनाशी, जीवाणुनाशी एवं कीटों को दूर रखने जैसे गुण पाये जाते है। खाद्यान्नों के भण्डारण में इनका उपयोग अत्यंत सरल होता है क्योंकि जैसे ही हम इन्हें धूप अथवा हवा के सम्पर्क में लाते हैं, ये तत्काल खाद्यान्नों से वाष्पीकृत हो जाते हैं और खाद्यान पूरी तरह से तैल रहित हो जाता है, जिसकी वजह से खाद्यान्नों के स्वाद एवं गंध में कोई अंतर नहीं आता।

इन तेलों के कुछ घटक एंटीऑक्सीडेंट का कार्य भी करते हैं जिससे खाद्यान्नों की भण्डारण अवधि बढ़ जाती है। इसके अलावा ये सुगन्धित तैल फंफूदों द्वारा उत्पादित माइकोटॉक्सिन के निर्माण को भी रोकते हैं। आजकल दुनियाभर में इन सुगन्धित तेलों पर शोध हो रहा है। कुछ अमेरिकी कंपनियों ने तो सुगन्धित तैलों पर आधारित कीटनाशियों का निर्माण भी किया है जिसमें सिनामाइट टी.एम. और वैलेरो टी.एम. प्रमुख नाम हैं।

वातावरण को बिना कोई हानि पहुँचायें फसलों को कीटों से बचाना, संपोष्य कृषि का मुख्य लक्ष्य होता है। इसके अलावा संपोष्य कृषि ऐसे तौर तरीकों का भी प्रश्रय करतीं हैं जिसमें पारिस्थितिकी तंत्र को नुकसान न्यूनतम हो और लागत भी कम से कम आये। पादप रसायन ऐसे यौगिकों के समूह होते हैं जिनमें अनेकों गुण होते हैं। कृत्रिम रसायनों की अपेक्षा ये पौधरसायन अत्यधिक सक्रिय होते है और पौधों को रोगाणुओं, कीटों तथा प्रतियोगियों से बचाने की एक तरीके से गारंटी भी देते है। पारिस्थितिकी तंत्र की विभिन्न सेवाओं में प्राकृतिक रूप में कीटों का नियंत्रण, एक प्रमुख स्थान रखता है अतः विभिन्न पादप-रसायनों के कीटनाशी गुणों को खोज निकालना बहुत जरूरी है। पौध-रसायनों द्वारा कीट नियंत्रण प्रयोगकर्ता के लिये भी सुरक्षित होता है क्योंकि ये पौध-रसायन धूप के सम्पर्क में आने के कुछ घंटों/दिनों के बाद ही हानिरहित यौगिकों में टूट जाते है। चूंकि ये रसायन पौधों से प्राप्त होते हैं अतः मिट्टी में पाये जाने वाले सूक्ष्मजीव इनका विघटन बड़ी ही आसानी से कर लेते हैं। कृत्रिम कीटनाशियों के दुष्प्रभाव एवं लोगों में बढ़ी हुई जागरूकता की वजह से प्राकृतिक कीटनाशी दिनोंदिन लोकप्रिय होते जा रहे हैं।

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मिर्गी रोग उन्मूलन में बाधक समस्यायें*

*प्रो. विजयनाथ मिश्र***

मिर्गी अब किसी भी व्यक्ति के लिए अभिशाप नहीं होगा। मिर्गी रोगी से भेदभाव बरतने की जरूरत नहीं है। मिर्गी अन्य रोग की तरह ही है, जिसका इलाज संभव है। मिर्गी रोगियों के साथ होने वाले अमानवीय व्यवहार के खिलाफ जागरूकता कार्यक्रम एक नया दिन लेकर आया है। देश में बड़ी संख्या में मिर्गी रोगियों के साथ अज्ञानता वश भेदभाव और प्रताड़ना का शिकार होना पड़ता था, लेकिन अब इस रोग को छुपाने की जगह इलाज कराकर सामान्य जीवनयापन सम्भव है। मिर्गी के बारे में फैली भ्रांतियों को खत्म करने के लिए फिल्म एक नया दिन लोगों को इस रोग से लड़ने की प्रेरणा प्रदान कर रहा है। रोग से पीड़ित व्यक्ति को राहत पहुँचाना और रोगों से बचाव व भ्रांतियों के बारे में जागरूक करना प्रत्येक चिकित्सक का कर्तव्य होता है। चिकित्सा सेवा बहुत आसान नहीं होता। चिकित्सकों को कई बार विपरीत परिस्थितियों में काम करना होता है। कभी-कभी अपनी उदासी को ढंककर रोगी के सामने मुस्कुराकर उसे जीवन के प्रति आशावान बनाए रखना होता है। हर क्षण चिकित्सक की कोशिश अपने गम को दबाकर रोगी को मुस्कान देने की होती है, या यूं कहें कि रोगी की मुस्कान ही हमारी मुस्कान होती है अतिश्योक्ति न होगा। हाँ तो मैं बात कर रहा था मिर्गी के बारे में अंधविश्वास को खत्म करने के लिए किए जा रहे प्रयासों की। भारत ने तकनीक के साथ-साथ चिकित्सा विज्ञान के क्षेत्र में काफी तरक्की कर लिया है। लेकिन अभी लोगों में जानकारी के अभाव में लोगों को अपने से बिछड़ना पड़ता है। मिर्गी रोग सामान्य रोग है लेकिन भ्रमवश या जानकारी के अभाव में लोगों ने इसे भूत प्रेत, जादू टोना से जोड़ कई नाम दे दिया है। विज्ञान जिसे नसों के चलते उपजी समस्या कहता है उसको पिछड़े क्षेत्रों में अंधविश्वास वश उपरी हवा, भूत प्रेत, जादू टोना बताकर रोगी को प्रताड़ित किया जाता है।

महामना अज्ञानता और अंधविश्वास के विरोधी थे और महामना मानव सेवा को ही सबसे बड़ा धर्म मानते थे। महामना के विश्वास और सेवा भावना से प्रेरित होकर हमने मिर्गी रोग का समूल नाश का बीड़ा उठाया है। शुरू में लोगों को एक-एक कर समझाना मुश्किल लग रहा था, लेकिन कहते हैं कि कोशिश करने वालों की हार नहीं होती। वैसे जिसके आदर्श महामना हो उसकी राह में बाधा तो आ ही नहीं सकती। महामना के आशीर्वाद से आधुनिक तकनीक के माध्यम से मिर्गी रोग के खिलाफ आंदोलन चला रहा हूँ। कितना सफल हुआ, इसका बानगी है मिर्गी रोग के बारे में फैल रही जागरूकता से लगाया जा सकता है। जिस तरह से लोगों को इस मुहिम से लाभ पहुँच रहा है उससे कहा जा सकता है कि मिर्गी रोग के बारे में फैली भ्रांतियाँ अब ज्यादा दिनों तक नहीं टिक सकेगा। इस रोग के बारे में फैली भ्रांतियों को एक नया दिन और चिकित्सा विज्ञान की मदद से दूर किया जा सकेगा। मिर्गी रोग के चलते जब किसी प्रताड़ना की खबर पढ़ता हूँ या देखता हूँ तो मन व्यथित हो जाता है। कई बार खबरों में आता है कि मिर्गी रोगी भूत प्रेत के चक्कर में ढोंगी लोगों के चंगुल में फंस जाते हैं जिससे न सिर्फ रोगी के परिवार वालों को आर्थिक नुकसान होता है बल्कि रोगी को शारीरिक शोषण के साथ-साथ मानसिक प्रताड़ना भी झेलनी पड़ती है। कई बार व्यक्ति की झांड़-फूंक के दौरान मौत तो कभी चुड़ैल बताकर सरेआम नंगा कर घुमाने की घटनाएं-खबरें सभ्य समाज को कलंकित करने वाली खबरें परेशान करती हैं। चिकित्सा के दौरान कई ऐसे लोग मिले जिन्होंने अस्पताल पहुँचने से पहले झाड़-फूंक का सहारा लिए होते हैं। जिस्म पर पड़े निशान झाड़-फूंक की वीभत्स रूप का वर्णन कर रहे होते हैं। कई महिलाओं और पुरूषों की आपबीती रोंगटे खड़े कर देने वाले होते हैं। हाल ही की बात है चन्दौली के एक सज्जन जिनकी उम्र 21 वर्ष थी मिर्गी का दौरे को भूत प्रेत के चक्कर में झाड़ फूंक कराने पहुँचे तो ढोंगी बाबा ने गर्म हसिया से उनके केहुनी (हाथ और कंधे के बीच) के जोड़ पर करीब आधा दर्जन बार दागा। केहुनी पर जले के निशान दिखाते हुए उक्त व्यक्ति रोग से मुक्ति की बात कर रहा था। मिर्गी रोगियों की जांच में पाया गया है कि बेहद सामान्य रोग को भूत प्रेत के चक्कर बताकर किस तरह प्रताड़ित किया जाता है। चिकित्सा का फैसला कैसे किया पूछने पर बताया कि उसके गाँव के मास्टरजी ने न्यूज पेपर में एक नया दिन के द्वारा चलाए जा रहे अभियान के बारे में बताया जो मिर्गी रोग के बारे में है। मेरा मानना है कि विज्ञान ने तरक्की किया है, लेकिन विज्ञान ने इस जानकारी से लोगों को जोड़ना होगा, तभी सही अर्थों में मिर्गी रोग और अंधविश्वास से समाज को निजात मिल सकेगा। अंधविश्वास के खिलाफ मुहिम चलानी होगी तभी हमारा देश भारत महामना के सपनों के भारत का नाम विश्व के मानचित्र पर अपने सुनहरे अक्षरों में दर्ज करा सकेगा। हमारे देश में अंधविश्वास बहुत बड़ी समस्या है। अंधविश्वास के चलते आज भी समाज में ढेर सारे अपराध सरेआम अंजाम दिए जाते हैं जिसका विरोध करने का साहस अज्ञानतावश लोग नहीं कर पाते हैं। आँकड़ों पर गौर करें तो ज्ञात होता है कि आज भी डायन के नाम सैकड़ों औरतों को जान से मार दिया जाता है, उनकी इज्जत सरेआम नीलाम कर दी जाती है। सभ्य समाज में अंधविश्वास का कोई स्थान नहीं है।

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बी.एच.यू. की स्थापना के पीछे महामना का सपना समाज का वैज्ञानिक विकास से था। महामना देश के लोगों को स्वस्थ व विज्ञानपरक जागरूकता लाने के लिए विश्वविद्यालय परिसर में चिकित्सालय की स्थापना किया। जब समाज के सभी लोग जागरूक होंगे तो समाज से अंधविश्वास का सफाया होगा और देश की जनता को रूढ़िगत समस्याओं से निजात मिलेगी। महामना के सपने को साकार करने के लिए बी.एच.यू. चिकित्सा विज्ञान संस्थान के न्यूरो साइंस विभाग में कार्य करते हुए अंधविश्वास के खिलाफ आंदोलन चलाना महामना की सेवा भावना से प्रेरित है।

अंधविश्वास की बेड़ियों में जकड़े मुल्क में अंधविश्वास के खिलाफ फिल्म बना कर आंदोलन चलाने का निर्णय आसान नहीं था। तमाम रूकावटों के बावजूद फिल्म बनाई लोगों के बीच उसके करीब स्वयं लोगों को एक नया दिन जनमानस में मिर्गी रोग के बारे जागरूकता कायम करने में सफलता मिल रही है। अब तक देश में करीब 1.5 लाख शो आयोजित किए जा चुके हैं। **'एक नया दिन'** फिल्म एक मिर्गी रोगी बच्ची और उसके परिवार की कहानी है कि किस प्रकार मिर्गी का दौरा पड़ने के बाद बच्ची अपने दोस्तों और अपने परिवार में अकेली हो जाती है। उसकी माँ बच्ची के इलाज की बात करती है तो उसे भी प्रताड़ना मिलती है लेकिन माँ ने हार नहीं मानी और डॉक्टर से उसका इलाज कराती है। जिसके बाद बच्ची पूर्ण रूप से सामान्य हो जाती है। फिल्म का प्रसारण सिर्फ भारत ही नहीं मध्य एशियाई देशों पाकिस्तान, बांग्लादेश, नेपाल समेत विभिन्न देशों में किया जाएगा।

फिल्म ''**एक नया दिन**'' सी.डी. का लोकार्पण करते हुए भारत के राष्ट्रपति डॉ. प्रणव मुखर्जी के साथ फिल्म के निर्देशक डॉ. विजय नाथ मिश्र एवं साउथ एशिया फाउण्डेशन के राष्ट्रीय महासचिव श्री राहुल वरूआ
स्थान : राष्ट्रपति भवन, 22 जुलाई, 2013

मिर्गी जिसका नाम आते ही लोग नाक-भौं सिकोड़ने लगते हैं। लेकिन क्या मिर्गी रोग से पीड़ित व्यक्ति के साथ दुराव रखना सही है? इस रोग के बारे में जागरूकता अभियान चलाना आसान नहीं था। लेकिन मैंने देश की जनता की सेवा और महामना के जन सेवा की भावना से प्रभावित होकर इस अभियान को चलाने का निश्चय किया। किसी व्यक्ति के साथ सिर्फ इसलिए दुराव रखना की उसे मिर्गी का दौरा पड़ता है, बेहद हास्यापद लगता है। मिर्गी का दौरा पड़ने पर न सिर्फ गाँवों में बल्कि शहरों में भी जूता और बदबूदार जुराबें सूंघाई जाती है, जिसका रोग से दूर-दूर तक कोई लेना-देना नहीं होता। रोग के खिलाफ छेड़ी जागरूकता आंदोलन प्रतिदिन नई ऊँचाई को प्राप्त कर रहा है। रोगियों के तीमारदार में झाड़-फूंक के चक्कर में अपनों की जान तक को दॉव पर लगा बैठते हैं। मिर्गी रोग भूत-प्रेत की छाया नहीं, बल्कि यह नसों में आई विकृतियों के चलते पैदा होने वाला रोग है। इसका इलाज ओझा-सोखा या तंत्र मंत्र या जादू-मंतर वाले नीम-हकीमों के पास नहीं जाना चाहिए। सूदुर गाँवों में मोबाईल और अन्य आधुनिक संचार माध्यमों से लोग परिचित हुए हैं। लेकिन अभी भी अंधविश्वासों के बारे में जागरूकता का अभाव दिखता है। आज भारत आर्थिक महाशक्ति बनने की ओर अग्रसर है, लेकिन विकास के दौड़ में अंधविश्वास बड़ा बाधक है। देश को सशक्त बनाने के लिए अंधविश्वास की बेड़ियों को तोड़ना होगा। जिस प्रकार स्वस्थ शरीर में स्वस्थ आत्मा का वास होता है उसी तरह स्वस्थ्य नागरिक स्वस्थ समाज और स्वस्थ देश के निर्माण में सहायक होते हैं। अंधविश्वास के चलते जगह-जगह साँप काँटे, भूत का साया पड़ने का भय के इलाज के नाम पर तंत्र-मंत्र की दुकानदारी धड़ल्ले से चल रहे हैं। कोई पीलिया का इलाज के नाम पर जेब साफ कर रहा है तो कोई सिरदर्द का ताबीज बनाकर लोगों को लूट रहा है। आलम यह है कि पेट दर्द में भी इन ओझाओं को भूत दिखाई देते हैं, तो मिर्गी और लकवे को ऊपरी हवा का असर बताते हैं। अंधविश्वास अनुवांशिक बीमारियों की तरह लाइलाज हो गई है। आँकड़ों के मुताबिक 1987 से 2003 तक 2556 महिलाओं को डायन घोषित कर मौत के घाट उतार दिया गया।

अब जरूरत आ गया है, देश से मिर्गी रोग के बारे में फैली भ्रांतियों को दूर करने का जिसमें फिल्म ''**एक नया दिन**'' ने लोगों में अंधविश्वास के खिलाफ मुहिम चलाने की नई राह दिखाई है।

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षोडश संस्कारों की वैज्ञानिकता

बिमलेशकुमारमौर्य एवं प्रो. सदाशिवकुमारद्विवेदी***

भारतीय जनमानस की आधारभूमि के रूप में जो एक अजस्र प्राणदायिनी अमृतमयी धारा अनादिकाल से अद्यतन भारतीय जीवन में प्रवाहित होती आ रही है वही भारतीय संस्कृति है। एक सुखद आश्चर्य है कि जहाँ विश्व की अन्य प्राचीन संस्कृतियाँ नाममात्र शेष रह गयी हैं, वहीं भारतीय संस्कृति विविध घात-प्रतिघातों को सहती हुई भी अक्षुण्ण है। उसके चिरस्थायित्व का कारण है- उसमें अनुस्यूत श्रद्धातत्त्व की प्रधानता, सहयोग की भावना, सहिष्णुता, समन्वयात्मकता और विश्वबन्धुत्व का अमरसंदेश। इसमें एक ओर मनुष्य को व्यक्तिगत स्तर पर समुन्नत बनाने के लिए षोडश संस्कारों, जीवन के शाश्वत मूल्य चतुःपुरुषार्थों एवं जीवनपद्धति के नियामक चतुराश्रमों की व्यवस्था की गई है, तो वहीं दूसरी ओर समाज के बहुमुखी उत्कर्ष हेतु वर्णव्यवस्था निधारित की गई है।

षोडश संस्कार, पुरुषार्थचतुष्टय, वर्णाश्रमव्यवस्था-विषयक मान्यतायें ही प्राचीन भारतीय संस्कृति एवं समाज की आधारशिला हैं। इनका जन्म विशुद्ध शास्त्रीय चिन्तन के आधार पर हुआ है। तद्गत कृत्य चिकित्साशास्त्र, मनोविज्ञान तथा वैज्ञानिक सिद्धान्तों के सर्वथा अनुकूल हैं। इस शोधपत्र में षोडश संस्कारों के अनुष्ठान को संस्कृत धर्मशास्त्रों के आधार पर स्पष्ट करते हुए उनमें अन्तर्निहित तत्त्वों को वर्तमान काल में स्वीकृत वैज्ञानिक मान्यताओं के परिप्रेक्ष्य में विवेचित किया गया है, इसके अतिरिक्त यहाँ प्राचीन सिद्धान्तों को आधुनिक शब्दावली में भी अभिव्यक्त करते हुए उसकी अच्छाईयों को गिनाया गया है।

'संस्कार' शब्द की व्युत्पत्ति संस्कृत के 'सम्' उपसर्ग पूर्वक 'कृ' धातु से 'घञ्' प्रत्यय करके की गई है और इसका प्रयोग अनेक अर्थों में किया जाता है-

आचार्य चरक के शब्दों में- ''पहले से विद्यमान दुर्गुणों को हटाकर उनके स्थान पर सद्गुणों का आधान करना ही संस्कार है''-

संस्कारो हि गुणान्तराधानमुच्यते।

इस प्रकार यह स्पष्ट है कि संस्कार शब्द के साथ विलक्षण अर्थों का योग हुआ है, जो उसके दीर्घ इतिहास क्रम में इसके साथ संयुक्त हो गये हैं। इसका अभिप्राय शुद्धि की धार्मिक क्रियाओं तथा व्यक्ति के दैहिक, मानसिक और बौद्धिक परिष्कार के लिए किये जाने वाले अनुष्ठानों से है, जिससे वह समाज का पूर्ण विकसित सदस्य हो सके।

संस्कारों का सविस्तार प्रतिपादन गृह्यसूत्रों तथा स्मृतिग्रन्थों में हुआ है। उपलब्ध साहित्य में संस्कारों की संख्या दस से चालीस तक देखी जा सकती है। संख्या सम्बन्धी मतैक्य न दिखाई देने पर भी प्रायः सभी धर्मशास्त्र संस्कारों की संख्या सोलह मानते हैं- गर्भाधान, पुंसवन, सीमन्तोन्नयन, जातकर्म, नामकरण, निष्क्रमण, अन्नप्राशन, चूडाकर्म, कर्णवेध, विद्यारम्भ, उपनयन, वेदारम्भ, केशान्त, समावर्तन, विवाह तथा अन्त्येष्टि।

1. गर्भाधान संस्कार

गर्भाधान का अर्थ है- गर्भ का आधान या गर्भ स्थापित करना। माता के गर्भ में शिशु का बीजरूप में प्रतिष्ठित होना ही गर्भाधान संस्कार है। विवाहोपरान्त सन्तान की कामना से जिस कर्म द्वारा गर्भधारण किया जाए उसे गर्भाधान कहा जाता है-

गर्भः सन्धार्यते येन कर्मणा
तद् गर्भाधानमित्यनुगतार्थकर्मनामधेयम्॥[1]

इस प्रकार स्त्री-पुरुष का साहचर्य ही गर्भाधान संस्कार नहीं है, अपितु शास्त्रनिर्दिष्ट दिनों में योग्य सन्तति की आकांक्षा से मन्त्रोच्चारणपूर्वक स्वस्थ स्त्री-पुरुष का साहचर्य ही गर्भधान संस्कार कहलाता है।

विवाह के साथ कामाचरण का अभिन्न सम्बन्ध है, परन्तु कामाचरण के लिए संयम की बहुत आवश्यकता बतायी गयी है। आधुनिक चिकित्साविज्ञान का यह सर्वमान्य मत है कि परिपक्व अवस्था प्राप्त होने पर भी समागम में कम से कम प्रवृत्ति होनी चाहिए। सुश्रुत के मत में **'ऊनषोडशवर्षायामप्राप्तः पञ्चविंशतितम्'** कह कर स्पष्ट कर दिया है कि 16 वर्ष से कम आयु की स्त्री और 25 वर्ष से कम आयु के पुरुष को गर्भाधान नहीं करना चाहिए।

स्त्री-पुरुष का पारस्परिक आकर्षण तथा उनका शारीरिक सम्बन्ध स्थापन एक जैविकीय आवश्यकता है। सहवास सर्वथा एकान्तसेव्य और वैयक्तिक प्रक्रिया है। आचार्य सुश्रुत का कहना है कि जैसे ऋतु, क्षेत्र, अम्बु और बीज इन चारों के विधिपूर्वक मिलने से अंकुर पैदा होता है, उसी प्रकार स्त्री-पुरुष के विधिपूर्वक संयोग से सन्तान का जन्म होता है-

ध्रुवं चतुर्णां सान्निध्यात् गर्भः स्याद् विधिपूर्वकः।
ऋतुक्षेत्राम्बुबीजानां संयोगादंकुरो यथा॥[2]

गर्भाधान के समय की शारीरिक तथा मानसिक अवस्था का

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1. शोधच्छात्र, संस्कृतविभाग, कला संकाय, काशीहिन्दूविश्वविद्यालय, वाराणसी
2. प्रोफेसर, संस्कृतविभाग, कला संकाय, काशीहिन्दूविश्वविद्यालय, वाराणसी

सन्तान पर गहरा प्रभाव पड़ता है। यह एक मनोवैज्ञानिक और चिकित्साशास्त्रीय तथ्य है-

निषेकसमये यादृङ्रचित्तविकल्पना।
तादृक्स्वभावस्तम्भूतिर्जन्तुर्विशति कुक्षिगः।।[3]

जीवविज्ञान की दृष्टि से पुरुष में समागमेच्छा का कोई नियम नहीं है, परन्तु स्त्री में ऋतुस्राव के कारण उसमें समागम काल का एक निश्चित नियम है जिसके आधार पर सहवास का विधान है। याज्ञवल्क्यस्मृति में ऋतुस्नान के बाद चौथी रात्रि से सोलहवीं रात्रि तक गर्भाधान के लिए उपयुक्त अवधि मानी गयी है-

षोडशर्त्तुनिशाः स्त्रीणां तासु युग्मासु संविशेत्।
ब्रह्मचार्येय पर्वाण्याद्यश्चतस्रस्तु वर्जयेत्।।[4]

गर्भाधान संस्कार से संस्कारित पति-पत्नी का कर्तव्य है कि वह गर्भाधान के समय सभी चिन्ताओं को छोड़कर क्रोध, द्वेष, ईष्यादि विकारों का त्याग करके सब प्रकार से प्रसन्नचित्त रहें, क्योंकि पति-पत्नी दोनों का ही मानसिक रूप से स्वस्थ और प्रसन्न रहना बालक के लिए बहुत ही श्रेयस्कर और अनुकूल होता है, ऐसा चिकित्साविज्ञान भी प्रमाणित करता है। मनुस्मृति में कहा भी गया है-

सन्तुष्टो भार्यया भर्ता भर्त्रा भार्या तथैव च।
यस्मिन्नेव कुले नित्यं कल्याणं तत्र वै ध्रुवम्।।
यदि हि स्त्री न रोचते पुमांसं न प्रमोदयेत्।
अप्रमोदात्पुनः पुंसः प्रजनं न प्रवर्तते।।[5]

2. पुंसवन संस्कार

पुंसवन शब्द का अर्थ है- पौरुष युक्त या सामर्थ्य सम्पन्न। शिशु के शारीरिक व मानसिक विकास के अनुष्ठान के लिए पुंसवन संस्कार किया जाता है। यह संस्कार गर्भ धारण का निश्चय हो जाने के पश्चात् तथा गर्भ के अभिव्यक्ति होने के पूर्व किया जाता है। गर्भधारण का लक्षण करते हुए कहा गया है-

तत्र सद्योगृहीतगर्भाया लिङ्गानि-श्रमो ग्लानिः पिपासा
सक्थिसदनं शुक्रशोणितयोरवबन्धः स्फुरणं च योनेः।[6]

आचार्य चरक का कथन है कि तीसरे महीने में गर्भ के अवयव अभिव्यक्त होने लगते हैं। आधुनिक गर्भविज्ञान के अनुसार गर्भ की अव्यक्तावस्था छठवें सप्ताह तक रहती है। गर्भ की अव्यक्तावस्था में पुंसवन का विधान होता है, फलतः इसका समय गर्भ धारण से दूसरा-तीसरा महीना माना जाता है। सुश्रुताचार्य का कहना है कि गर्भ स्थापन काल में पुरुष के शुक्र बाहुल्य से पुत्र पैदा होता है और स्त्री के रज की अधिकता से पुत्री पैदा होती है-

तत्र शुक्रबाहुल्यात् पुमान्, आर्तवबाहुल्यात् स्त्री,
साम्यादुभयोर्नपुंसकमिति।[7]

अर्थात् गर्भाधान काल में ही पुत्री अथवा पुत्र के जन्म का निश्चय हो जाता है। आधुनिक विज्ञान 'वाई क्रोमोसोम' की प्रबलता से पुत्र तथा 'एक्स क्रोमोसोम' की प्रधानता से पुत्री की उत्पत्ति मानते हैं।

3. सीमन्तोन्नयन संस्कार

सीमन्तोन्नयन का अभिप्राय है सौभाग्य सम्पन्न होना। यदि इसके शब्दार्थ पर ध्यान दें तो 'शिर की माँग' अर्थ होता है। वीरमित्रोदय में कहा गया है कि जिस संस्कार में गर्भिणी के सीमन्त या केश ऊपर उठाये जाय वह सीमन्तोन्नयन कहलाता है-

सीमन्तः उन्नीयते यस्मिन् कर्मणि तत्

सीमन्तोन्नयनमिति कर्मनामधेयम्।[8]

यद्यपि सौभाग्यवती विवाहिता महिलायें सिर में सदा माँगा भरती हैं तथा माँग भरना सौभाग्य का एक चिह्न भी है, तथा गर्भाधान के तृतीय संस्कार के रूप में इसका विशेष महत्त्व स्वीकार किया जाता है। इस संस्कार के विषय में पारस्करगृह्यसूत्र में कहा गया है- 'प्रथम गर्भे मासे षष्ठेऽष्टमेवा' अर्थात् यह संस्कार प्रथम गर्भ के छठवें या आठवें मास में होता है।

पञ्चसन्धियों वाले सिर को सीमन्त माना गया है। सिरःकपाल में मस्तिष्क में होता है जो हमारे विचार शक्ति का केन्द्र है फलतः सीमन्तोन्नयन का अर्थ हुआ मस्तिष्क का उन्नयन या मानसिक विकास। अभिप्राय यह है कि सीमन्तोन्नयन वह संस्कार है जिसमें माता-पिता का ध्यान गर्भस्थ शिशु के मानसिक विकास पर केन्द्रित हो। आयुर्वेदविज्ञान की दृष्टि से चौथे महीने में शिशु का अङ्ग-प्रत्यङ्ग प्रव्यक्ततर होने लगता है, स्नायुतन्त्र का निर्माण प्रारम्भ हो जाता है, गर्भिणी दौहृदिनी बन जाती है। यही कारण है कि सीमन्तोन्नयन का उक्त समय बताया गया है। वैसे चिकित्साशास्त्रीय मान्यताओं को देखते हुए इस संस्कार का सम्पादन पाँचवें, छठवें या आठवें महीने में भी किया जा सकता है, क्योंकि पाँचवें मास में मन प्रतिबुद्धतर होता है, छठवें में बुद्धि और आठवें में ओज होता है-

पञ्चमे मनः प्रतिबुद्धतरं भवति। षष्ठे बुद्धि।

अष्टमेऽस्थिरीभवत्योजः। तत्र जातश्चेन्न जीवेन्निरोजस्त्वात्।[9]

निष्कर्षतः सीमन्तोन्नयन संस्कार माता-पिता को प्रसन्नचित रखने के लिए किया जाता है। क्योंकि उनकी संतुष्टि-असंतुष्टि, तृप्ति-अतृप्ति आदि स्थितियों का गर्भस्थ सन्तान पर पूरा प्रभाव पड़ता है।

4. जातकर्म संस्कार

सन्तानोत्पत्ति के बाद जो कर्म किये जाते हैं उन्हें जातकर्म संस्कार कहा जाता है। इसके साथ-साथ बच्चे पर मनोवैज्ञानिक प्रभाव डालने का प्रयास भी किया जाता है। शिशु का जन्मकाल ही इस संस्कार का समय है। मनुस्मृति में कहा गया है-

प्राङ्नाभिवर्धनात्पुंसो जातकर्मविधीयते।
मन्त्रवत् प्राशनं चास्य हिरण्यमधुसर्पिषाम्।।[10]

सन्तान के जन्म के समय किये जाने वाले प्रमुख कर्म हैं- गर्भावरण जरायु को हटाकर बच्चे के मुख, नासिका आदि की सफाई, सिर पर घी फाया या पिचु रखना तथा नाभिच्छेदन। इसके बाद सुवर्णशलाका से घी तथा मधु चटाया जाता है। ये सारे कर्म साभिप्राय हैं तथा बच्चे के स्वास्थ्य को ध्यान में रखकर विहित हैं। इस समय नान्दीमुख करने का भी विधान है।

जन्म से पूर्व बच्चा माँ के पेट में एक पानी से भरी थैली में रहता है। थैली का पानी उसके मुँह, नाक तथा कान में न चला जाए, इसलिए प्रकृति इन सब द्वारों को श्लेष्मा कफ जैसे चिकने पदार्थ से बन्द कर दिए रहती है। त्वचा पर भी उसकी एक परत सी चढ़ी रहती है। उस समय बच्चा अपना पूरा पोषण नाभि द्वारा माता से सीधा प्राप्त करता है। जन्म के बाद उसका माता से शारीरिक सम्बन्ध टूट जाता है, वह माँ से पोषण तत्त्व अनायास प्राप्त नहीं कर सकता। इसके लिए स्तनपान हेतु मुख श्वास-प्रश्वास के लिए नासिका रन्ध्रों आदि इन्द्रियों के सक्रिय योगदान की अनिवार्यता हो जाती है। फलतः मुख प्रभृति अङ्गों से श्लेष्मा हटाकर सफाई करना प्रथम कर्म है। आचार्य चरक का कहना है कि तालु, ओष्ठ, कण्ठ तथा जिह्वा आदि का परिमार्जन अङ्गुलि तथा स्वच्छ कोमल कपड़े के सहारे करना चाहिए।

हस्तस्पर्श, वस्त्रस्पर्श तथा वायुस्पर्श को न सह सकने के कारण बालक प्रायः जोर-जोर से चिल्लाने लगता है जिससे उसके जन्म तथा स्वस्थ होने का सबको पता चल जाता है। आधुनिक चिकित्सक भी रोने को बच्चे के स्वास्थ्य का प्रतीक मानते हैं। त्वचा पर लगे अवलेप को छुड़ाने के लिए बच्चो को रगड़कर स्नान कराया जाता है। बच्चे के तालु से ही उसके स्वास्थ्य की परीक्षा होती है। इसलिए नवजात को सर्दी जुकाम आदि से बचाने के लिए तालु पर भी घी का पिचु रखने का परामर्श दिया जाता है।

गर्भकाल में बच्चों की आँतों में एक प्रकार का मल एकत्रित रहता है जिसे 'मेकोनियम' कहते हैं, इस मल को निकालने के लिए घी तथा शहद चटाये जाने का विधान है साथ ही स्वास्थ्य की दृष्टि से आयुर्वेद, होम्योपैथिक आदि सभी चिकित्साविधियों में सुवर्णशलाका द्वारा घी तथा मधु चटाने की शिक्षा विहित है, जिससे अवलेह में भी सोने का प्रभाव आ जाए। वर्तमान चिकित्सा विधियों में एरण्ड तैल पिलाकर मेकोनियम बाहर निकालने का प्रचलन है। ध्यातव्य है कि मेकोनियम एक तो पीने में कष्टकर होता है, दूसरे आँतो को छीलकर घाव बना सकता है जबकि मधु का चटाना बच्चे के लिए सरल है और कार्य भी वैसा ही करता है जैसा आधुनिक तैल प्रयोग। इस प्रकार प्राचीन परम्परा अधिक युक्तिसंगत है।

5. नामकरण संस्कार

नामकरण संस्कार शिशु जन्म के बाद दूसरा संस्कार माना जाता है। किसी वस्तु का ज्ञान नाम के विना नहीं हो सकता है, संसार का सारा व्यवहार नाम के आधार पर ही चलता है-

यावदर्थं वै नामधेयशब्दास्तैरर्थैसम्प्रत्ययः
अर्थसम्प्रत्ययाच्च व्यवहारः।[11]

आधुनिक मनोविज्ञान तथा आङ्किक ज्योतिष की मान्यता है कि बार-बार उच्चरित शब्दों से मनुष्य के मन पर गहरा प्रभाव पड़ता है। यदि किसी स्वस्थ व्यक्ति को भी उसके सम्पर्क में आने वाले व्यक्ति यह कहते रहें कि 'वह तो बीमार लग रहा है' तो इसका उसके स्वास्थ्य पर बुरा प्रभाव पड़ने लगता है। वह मनोवैज्ञानिक रूप से स्वयं को अस्वस्थ समझकर चिन्तित हो उठता है। इसके विपरीत अपने कार्यों के लिए गुरुजनों से प्रशंसित व्यक्ति अदम्य उत्साह और आत्मविश्वास के मार्ग पर आगे ही बढ़ता जाता है। प्राच्य मनीषियों का अटूट विश्वास था कि बच्चे का नाम उसके व्यक्तित्व का निर्माण करता है।

ब्राह्मणग्रन्थों, गृह्यसूत्रों, स्मृतियों आदि में नाम का सविस्तार विवेचन है। बालक का नाम युग्म और बालिका का नाम अयुग्म अक्षरों में होना चाहिए। ब्राह्मण का नाम मङ्गलयुक्त, क्षत्रिय का नाम बलयुक्त, वैश्य का नाम धनयुक्त और शूद्र का नाम निन्दायुक्त होना चाहिए-

मङ्गल्यं ब्राह्मणस्य स्यात्क्षत्रियस्य बलान्वितम्।
वैश्यस्य धनसंयुक्तं शूद्रस्य तु जुगुप्सितम्।।[12]

परन्तु उक्त विधि-निषेधों के अनेक अपवाद मिलते रहते हैं। अतएव नाम चयन में केवल यही तथ्य ध्यान में रखना चाहिए कि वह किसी उच्चभावना को जाग्रत करने वाला हो तथा उच्चारण सुगम हो।

6. निष्क्रमण संस्कार

निष्क्रमण शब्द का अर्थ है- बाहर निकलना। सूतिकागृह के बाहर निकल आने पर भी बच्चा घर की सीमा में ही रखा जाता है, उसे प्रकृति के उन्मुक्त वातावरण में तत्काल ही नहीं ला दिया जाता, क्योंकि नवजात में शीतातापादि सहन करने की क्षमता नहीं रहती, परन्तु बच्चे के समुचित विकास के लिए स्वच्छ प्राकृतिक वायु तथा सूर्य का प्रकाश परमावश्यक है। इसी आवश्यकता की पूर्ति के लिए बच्चे का निष्क्रमण संस्कार किया जाता है। जिसे चिकित्सा विज्ञान भी प्रमाणित करता है। पारस्कर गृह्यसूत्र में इस संस्कार का समय चौथा महीना माना जाता है-

चतुर्थे मासे निष्क्रमणिका सूर्यमुदीक्षयति तच्चक्षुरिति।[13]

शरीररचनाविदों का मन्तव्य है कि समुचित शारीरिक विकास के लिए कैल्शियम तथा फॉस्फोरस को शरीर में विप्रयुक्त होना आवश्यक है। रुधिर में कैल्शियम की कमी से व्यक्ति चिड़चिड़ा हो जाता है, बेचैनी अनुभव करता है। फॉस्फोरस अस्थियों को मजबूत बनाता है। कैल्शियम और फॉस्फोरस को शरीर में उचित मात्रा में

समाहित करने के लिए विटामिन-डी की आवश्यकता होती है। सूर्य की धूप विटामिन-डी का अक्षय स्रोत है। नवीनतम फोटोचिकित्सा में व्यक्ति के मानसिक विषाद से लेकर पथरी, ट्यूमर तथा शरीर की रोग प्रतिरोधक क्षमता में अनियमितता आदि की दशा में सूर्य रश्मियों द्वारा उपचार जाने की विधि विकसित कर ली गई है, फलतः सूर्य दर्शन पूर्णतः वैज्ञानिक है।

7. अन्नप्राशन संस्कार

अन्नप्राशन संस्कार का अर्थ है जीवन में सर्वप्रथम अन्न का अशन अर्थात् भोजन-

बालस्य यत्प्रथमभोजनं तदुच्यते प्राशित्रम्।[14]

पारस्कर गृह्यसूत्र में इसका समय छठवाँ महीना माना जाता है-

षष्ठे मासे अन्नप्राशनम्।[15]

जन्म के समय न तो बालक के पास अन्न चबाने के लिए दाँत होते हैं न ही अन्न पचाने में समर्थ पाचनशक्ति। फलतः प्रकृति उसके जीवन धारण का प्रबन्ध माता के दूध के रूप में अनायास सुलभ करा देती है, परन्तु ध्यान देने योग्य यह है कि बच्चा सम्पूर्ण जीवन माँ के दूध पर निर्वाह नहीं कर सकता। इसके दो कारण हैं- एक तो यह कि केवल दूध के सेवन से शरीर में दृढ़ता नहीं आ सकती बल्कि शरीर थुलथुला रह जाता है। दूध में सब प्रकार के तत्त्वों का समावेश होने पर भी अन्न का ग्रहण परमावश्यक है, यही शारीरिक दृढ़ता का साधन है। दूसरा कारण यह है कि माँ के दूध पिलाने का अर्थ अपने शरीर के भीतर का कैल्शियम बच्चे को दे रही है, इससे उसका शरीर क्षीण होता रहता है। प्रकृति माँ तथा सन्तति दोनों के स्वास्थ्य की दृष्टि से एक निश्चित अवधि के बाद बच्चे में दाँतो की व्यवस्था कर देती है। दाँतो का निकलना इस तथ्य का प्रतीक है कि बच्चें की आँते अब अन्न पचाने में समर्थ हो रही हैं। इससे सिद्ध हो जाता है कि अन्नप्राशन तथा दाँत निकलने का घनिष्ठ सम्बन्ध है। इस संस्कार में बच्चें को दही, शहद तथा घी मिश्रित अन्न खिलाया जाता है-

दधिमधुघृतमिश्रितमन्नं प्राशयेत्।[16]

आधुनिक अनुसंधाता दूध, दही, तथा लस्सी के सेवन को दीर्घ जीवन का रहस्य मानते हैं, कार्बोहाईड्रेट्स में मधु को सर्वोत्तम माना जाता है तथा आयुर्वेद में घी का सेवन आयुवर्धक कहा गया है। इस प्रकार दधिमधुघृतमिश्रित अन्न का खिलाना चिकित्साशास्त्र के अनुरूप है।

8. चूडाकर्म या मुण्डन संस्कार

संस्कृत में चूडा शब्द का अर्थ है- शिखर या चोटी। इस दृष्टि से चूडाकर्म का अभिप्राय हुआ 'चूडाविषयक संस्कार'। चूडाकरण, मुण्डन, केशवपन, क्षौरकर्म आदि इसके पर्याय हैं। इसमें शिखा को छोड़कर गर्भकाल से प्राप्त सारे केश मुड़वा दिए जाते हैं। आचार्य सुश्रुत का कहना है कि मस्तक के भीतर ऊपर की ओर शिरा तथा सन्धि का सन्निपात है। इस अङ्ग पर किसी भी प्रकार का आघात करने पर तत्काल मृत्यु हो जाती है-

मस्तकाभ्यन्तरोपरिष्टात् शिरःसन्धिसन्निपातो।
रोमावर्तोऽधिपतिस्तत्रापि सद्यो मरणम्।।[17]

अतएव इसकी सुरक्षा के लिये शिखा रखने का विधान किया गया है। चूडाकरण संस्कार का समय मनुस्मृति में शिशु जन्म का पहला या तीसरा वर्ष बताया गया है-

चूडाकर्म द्विजातीनां सर्वेषामेव धर्मतः।
प्रथमेऽब्दे तृतीये वा कर्तव्यं श्रुतिचोदनात्।।[18]

फलतः तीसरे वर्ष चूडाकर्म सम्पन्न करना अधिक वैज्ञानिक है। जन्म के प्रथम वर्ष भी मुण्डन कराये जाने का प्रचलन है। इसका कारण है यह कि बच्चे के जब दाँत निकलने लगते हैं तो वह बुखार, दस्त, खाँसी आदि से परेशान हो उठता है, चिड़चिड़ा हो जाता है, इसका भारी प्रभाव सिर पर पड़ता है। इसलिए सिर को हल्का, ठण्डा रखने के लिए वहाँ से बालों का बोझ उतार दिया जाता है। गर्भावस्था के बाल गर्भावरण जरायु के मलिन जल में रहते हैं इसलिए अस्थि-सन्धियों के जुड़ जाने के बाद उन्हें हटा देना आवश्यक होता है। बालों के साफ हो जाने से सिर की खुजली, दाद आदि से रक्षा हो जाती है। और नये पुष्ट बाल उगने में सहायता मिलती है। चरक संहिता में मुण्डन को पुष्टि, वृष्यता, आयु, स्वच्छता एवं सौन्दर्य का वर्धक माना गया है-

पौष्टिकं वृष्यमायुष्यं शुचिरूपं विराजनम्।
केशश्मश्रुनखादीनां कर्तनं सम्प्रसाधनम्।।[19]

9. कर्णवेध संस्कार

कर्णवेध का अर्थ है- कान में छेद कर देना। सुश्रुत ने इसके दो उद्देश्य बताये हैं- बालक की रक्षा तथा आभूषण धारण। **'रक्षाभूषण-निमित्तं बालस्य कर्णौ विध्येते।'** कर्णवेध से अन्त्रवृद्धि या हार्नियाँ रोग से रक्षा होने का उल्लेख मिलता है-

शंखोपरि च कर्णान्ते त्यक्त्वा यत्नेन सेवनीम्।
व्यत्यासात् वा शिरो विध्येत अन्त्रवृद्धिनिवृत्तये।।[20]

कर्णवेध तब किया जाना चाहिये जब शिशु कर्णछेदन से होने वाले कष्ट को सहन कर सके, साथ ही उसके कान कोमल बने रहें अन्यथा छेदना कठिन होगा। निष्कर्ष यह है कि आचार्य सुश्रुत का मत वैज्ञानिक होने से अधिक व्यवहारिक है।

आधुनिक युग में चीन में रोग निवारण की **'एक्यूपंक्चर'** विधि का बहुत प्रचलन है। इसमें शरीर के कतिपय बिन्दुओं पर सुई चुभाकर शल्य क्रिया के अनेक कार्य किये जाते हैं। इसे देखते हुए यह कहना कथमपि असंगत नहीं लगता कि कर्णवेध को संस्कार का

रूप देने वाले प्राचीन आचार्यों को कोई व्यावहारिक अनुभव अवश्य रहा होगा जिसे सुश्रुत ने संकेतित किया है।

10. विद्यारम्भ संस्कार

जब बालक का मस्तिष्क शिक्षा ग्रहण करने योग्य हो जाता था तब शिक्षा का आरम्भ विद्यारम्भ संस्कार के साथ किया जाता था। यद्यपि क्रम की दृष्टि से विद्यारम्भ संस्कार उपनयन से पूर्व आता है किन्तु उद्भव की दृष्टि से विद्यारम्भ उपनयन संस्कार की अपेक्षा अत्यन्त परवर्ती है।

संस्कृत के अध्ययन के लिए लिखने और पढ़ने की प्राथमिक योग्यता अलग से आवश्यक नहीं होती है। बालक की शिक्षा वैदिक ऋचाओं के कण्ठस्थ करने से लेखन कला की सहायता के विना ही आरम्भ होती है। इस प्रकार साहित्य का भण्डार निरन्तर विस्तृत होता जा रहा है और फलस्वरूप स्मरण द्वारा उनकी रक्षा करना प्रायः असम्भव हो गया है। अतः विद्या के भण्डार की सुरक्षा के लिए वर्णमाला और लेखन की कला का आविष्कार किया गया। अक्षरारम्भ के संस्कार के रूप में विलम्ब से मान्य होने के कारण सम्भवतः यह था कि इस संस्कार का अनुष्ठान क्षौर या मुण्डन संस्कार के ही साथ किया जाता है। कौटिल्य अर्थशास्त्र से भी इस धारणा की पुष्टि होती है-

वृत्तचौलकर्मा लिपिं संख्यानञ्चोपयुंजीत।[21]

जिसके अनुसार बालक की लिपि और संस्था की शिक्षा का आरम्भ चौल संस्कार के साथ होता है। भवभूति का नाटक उत्तररामचरितम् भी इसका साक्षी है। वाल्मीकि ने लव और कुश की शिक्षा चौल संस्कार के पश्चात् आरम्भ की और उन्होंने त्रयी के अतिरिक्त अन्य अनेक विद्याओं का आरम्भ उपनयन के पूर्व ही कर लिया था-

निवृत्तचौलकर्मणोश्च तयोस्त्रयीवर्जमितरास्तिस्त्रो विद्याः सावधानेन मनसा परिनिष्ठापिताः।[22]

11. उपनयन संस्कार

उपनयन का अर्थ है- गुरु के समीप ले जाना। गौतम तथा मनु प्रभृति शास्त्रकारों की मान्यता के अनुसार ब्राह्मण बालक का उपनयन आठवें वर्ष में, क्षत्रिय का ग्यारहवें वर्ष में और वैश्य का बारहवें वर्ष में होना चाहिए-

गर्भाष्टमेऽब्दे कुर्वीत ब्राह्मणस्योपनयनम्।
गर्भादेकादशे राज्ञो गर्भात्तु द्वादशे विशः।।[23]

दुग्ध सेवन सात्त्विक वृत्ति का सूचक है जो शक्ति को तथा मृष्टान्न ऐश्वर्य का उक्त भोज्य पदार्थ ब्राह्मण आदि के द्वारा प्राप्त होने वाले सामर्थ्य के प्रतीक हैं।

पौराणिक उल्लेखों से प्राप्त होता है कि उपनयन संस्कार के बाद ही अध्ययन कराया जाए। इसका अभिप्राय यह हुआ कि यह संस्कार शिक्षा के मन्दिर में प्रवेश द्वार है। शिक्षा प्राप्ति के बाद ज्ञान-विज्ञान से प्रकाशित बुद्धि वाले व्यक्ति के सोचने-विचारने की दृष्टि परिमार्जित हो जाती है। इस प्रकार उपनयन एक अत्यन्त महत्त्वपूर्ण संस्कार है। इसलिए यह आज भी प्रायः सर्वत्र प्रचलित है।

12. वेदारम्भ संस्कार

वेदारम्भ का अर्थ है- वेद के अध्ययन का प्रारम्भ। उपनयन के बाद व्यक्ति वेदारम्भ के अर्ह हो जाता है। चूँकि प्राचीन काल में अन्य विषयों की शिक्षा विहित होने पर भी मुख्य रूप से वेद का अध्ययन किया जाता था। इसलिए शिक्षा सम्बन्धी इस संस्कार को वेदारम्भ संस्कार कहा गया है। उपनयन संस्कार सम्पन्न हो जाने पर बालक को गुरुकुल में प्रवेश कराया जाता था, यहाँ उसे अन्तेवासी की संज्ञा मिलती थी।

ब्रह्मचर्यव्रत, वीर्य को नष्ट न होने देना, सदाचार का जीवन व्यतीत करना, शिष्य अथवा अन्तेवासी के लिए प्रमुख एवं प्रथम कर्तव्य निर्धारित है। इसके लिए उसे किसी भी प्रकार के प्रसाधन से पराङ्मुख होने का उपदेश दिया जाता था। प्रतीक रूप में मेखला, कौपीन एवं मृगचर्म धारण कराया जाता था-

अध्येष्यमाणस्त्वाचान्तो यथाशास्त्रमुदङ्मुखः।
ब्रह्माञ्जलिकृतोऽध्याप्यो लघुवासा जितेन्द्रियः।।[24]

गुरुकुल वनों में होते थे अतएव वन्य पशुओं से सुरक्षा के निमित्त दण्ड धारण का विधान था, सहपाठियों में ऊँच-नीच के भाव को दूर करने के और सदैव विनम्र व्यवहार का प्रशिक्षण प्राप्त करने के लिए शिष्य से भिक्षाटन कराया जाता था। इस प्रकार ब्रह्मचारी को आश्रम के नियमों, उपनियमों का पालन करते हुए अनालस्यपूर्वक वेदारम्भ करना होता था। मनुस्मृति में कहा गया है कि वेदाध्ययन के आरम्भ तथा अन्त में अन्तेवासी को ॐ शब्द का उच्चारण करना चाहिए। ऐसा न करने से अध्ययन नष्ट हो जाता है और बुद्धि में स्थिर भी नहीं होता-

ब्राह्मणः प्रणवं कुर्यादादावन्ते च सर्वदा।
स्रवत्यनोङ्कृतं पूर्वम्, पुरस्ताच्च विशीर्यति।।[25]

13. केशान्त अथवा गोदान संस्कार

केशान्त अथवा प्रथम क्षौरकर्म चार वैदिक व्रतों में से एक था। वैदिक स्वाध्याय से घनिष्ठतया सम्बन्धित तीन व्रतों के लुप्त हो जाने पर, केशान्त उससे अलग हो गया तथा उसे स्वतन्त्र स्थान प्राप्त हुआ। यह संस्कार संस्कार्य व्यक्ति के लिए शारीरिक दृष्टि से भी उपादेय है ऐसा आधुनिक चिकित्साविज्ञान प्रमाणित करता है। केशान्त अनिवार्य रूप से विद्यार्थी के शरीर तथा उसके व्यवहार से सम्बद्ध है। यह संस्कार सोलह वर्ष की आयु में सम्पन्न होता है तथा यह यौवन के पदार्पण का सूचक है। केशान्त कर्म ब्राह्मण को सोलहवें, क्षत्रिय को बाइसवें और वैश्य को चौबीसवें वर्ष में करना चाहिए-

केशान्तः षोडशे वर्षे ब्राह्मणस्य विधीयते।
राजन्यबन्धोर्द्वाविंशे वैश्यस्य द्व्यधिके ततः।।[26]

युवक के हृदय में पौरुष की चेतना का उदय हो जाता है। उसकी यौवनपूर्ण प्रवृत्तियों के नियमन के लिए अपेक्षाकृत अधिक सतर्कता अपेक्षित होती है, यह मनोवैज्ञानिक कारण है। केशान्त या गोदान की विधि बहुत कुछ चूडाकरण के समान ही है। इस संस्कार में गुरु को गौ का दान दिया जाता है। इसलिए गोदान शब्द भी प्रयोग में आने लगा। कालान्तर में यह संस्कार समाप्त हो गया कुछ गृह्यसूत्रों में बताया गया है कि इस संस्कार में भी शिखा सहित सम्पूर्ण सिर का मुण्डन होता है।

14. समावर्तन संस्कार

समावर्तन का अर्थ है- शिक्षा गहण करने के बाद घर वापस लौटना। एक वेद के अध्ययन में प्रायः बारह वर्ष लगते हैं। विद्यार्थी अपनी योग्यता के अनुसार एक, दो या सभी वेदों का अध्ययन करता था।

कुछ लोग आजीवन ब्रह्मचर्यव्रत का पालन करते थे। फलतः समावर्तन का समय निर्धारित नहीं किया जा सकता। सामान्य रूप से समावर्तन का समय 24वाँ वर्ष माना जा सकता है। इस अवसर पर आचार्य अन्तेवासी को भावी जीवन में सफल और तेजस्वी होने के मूलभूत मूल्यों का उपदेश देते थे-

सत्यं वद। धर्मं चर। स्वाध्यायान्मा प्रमदः।[27]

समावर्तन के पश्चात् अधिकारी को स्नातक कहा जाता था। आजकल विश्वविद्यालय में प्रचलित दीक्षांत समारोह को समावर्तन संस्कार का एक रूप माना जा सकता है।

15. विवाह संस्कार

विवाह संस्कार का अर्थ है- वधू को उसके पितृगृह से विशेषरूप से अथवा प्रयोजन विशेष के लिए ले जाना। उद्वाह, परिणय, उपनय, पाणिग्रहण प्रभृति इसके अपर पर्याय हैं। मनु के विचार से विवाह का उद्देश्य है- सन्तानप्राप्ति, शास्त्रोक्त धर्मों का पालन और यौनतुष्टि-

अपत्यं धर्मकार्याणि शुश्रूषा रतिरुत्तमा।
दाराधीनस्तथा स्वर्गः पितृणामात्मनश्च ह।।[28]

हिन्दू समाज में कोई भी धार्मिक कृत्य स्त्री के विना पूरा नहीं होता, केवल पुरुष अधूरा माना जाता है। अर्धनारीश्वर की कल्पना इसी तथ्य को पुष्ट करती है कि पति-पत्नी एक-दूसरे के पूरक हैं।

विवाह के प्रधान लक्ष्य सन्तान प्राप्ति को ध्यान में रखते हुए आचार्य सुश्रुत ने पुरुष के लिए 25 वर्ष तथा स्त्री के लिए 16 वर्ष की अवस्था को विवाह के योग्य बताया है-

पञ्चविंशे ततो वर्षे पुमान् नारी तु षोडशे।
समत्वागतवीर्यौ तौ जानीयात् कुशलो भिषक्।।[29]

इसका रहस्य यह है कि शरीरविज्ञान की दृष्टि से बाल्यावस्था के गर्भाधान से सन्तानोत्पत्ति नहीं हो सकती क्योंकि इस अवस्था में स्त्री में रजस् और पुरुष में शुक्र का निर्माण नहीं हुआ रहता। किशोरावस्था के युगल प्रजनन समर्थ तो होते हैं, परन्तु उससे उत्पन्न सन्तान या तो जीवित नहीं रहती है या दुर्बल होती है। क्योंकि उनका विकास अभी भी परिपक्व नहीं हुआ रहता। युवावस्था में उनका पूरा-पूरा शारीरिक एवं मानसिक विकास हो चुका होता है। इसलिए इसमें किए गए गर्भाधान से स्वस्थ एवं गुणसम्पन्न सन्तान की प्राप्ति होती है। चूँकि स्त्रियाँ शरीर रचना के कारण स्वाभाविक रूप से पुरुषों की अपेक्षा पहले प्रजनन में समर्थ हो जाती हैं। इसलिए उनकी अवस्था कम निर्धारित की गई है। कामसूत्र में भी कन्या का पुरुष से कम से कम तीन वर्ष कम अवस्था वाली होना बताया गया है-

त्रिवर्षात् प्रभृति न्यूनवयसाम्।[30]

वैवाहिक कृत्य आज भी यथावत् प्रचलित हैं। इन सबका प्रयोजन यह मनोवैज्ञानिक प्रभाव डालना है कि विवाह द्वारा एक सूत्र में बँधे पति-पत्नी जन्म-जन्मान्तर के साथी हो गये हैं। वे एक दूसरे के पूरक हैं और कठिन से कठिन परिस्थितियों में भी एक-दूसरे का साथ नहीं छोड़ेंगे।

16. अन्त्येष्टि संस्कार

अन्त्येष्टि का अर्थ है- अन्तिम इष्टि या कर्म। अतएव अन्त्येष्टि संस्कार का तात्पर्य उस संस्कार से है जिसके आगे उस शरीर के लिए कोई भी अन्य संस्कार शेष नहीं रह जाता।

मत्स्यपुराण में अन्त्येष्टि संस्कार की तीन विधियों का उल्लेख किया गया है-

यः संस्थितः पुरुषो दह्यते वा निखन्यते
वाऽपि निकृष्यते वा।[31]

इसमें से शवदाह की प्रक्रिया अधिक वैज्ञानिक है। क्योंकि अग्नि में भस्म हो जाने पर प्रदूषण की सम्भावनाएँ कम रहती हैं। जबकि भूमि के नीचे गाड़ने पर शरीर का सड़ना अवश्यम्भावी है। खुला फेंक देने पर मांसभक्षी पशु-पक्षियों के द्वारा अस्थि और मांस खण्डों को इधर-उधर बिखराया जाना स्वाभाविक है। इन सबसे वातावरण दूषित होता है। यहीं नहीं शवदाह में कम स्थान की आवश्यकता होती है। सरकार ने शव गाड़ने में बेकार होने वाली भूमि जनता के उपयोग हेतु बचाने के उद्देश्य से यह नियम बनाया है। हिन्दू परिवारों में अन्त्येष्टि संस्कार प्राचीन मान्यताओं के अनुरूप आज भी प्रचलित है।

अन्त्येष्टि संस्कारगत पिण्डदान आदि कृत्यों का धार्मिक महत्त्व तो है ही मृत्यूपरान्त विविध कार्यों में संलग्न रहने से मृतक के पुत्र प्रभृति स्वजनों की व्यस्तता के कारण दुःखानुभूति से उबरने का मार्ग भी मिल जाता है। जब तक अशौच समाप्त होता है, ब्राह्मण भोज

होता है, तब तक मृत्यु हुए कई दिन व्यतीत हो जाते हैं। इस प्रकार अतिशय दुःख की बेला में विविध कर्मकाण्डों में व्यस्त रहने से तथा सारे कृत्यों के समाप्त हो जाने के पश्चात् शोकाग्नि शनैः-शनैः शान्त हो जाती है। अन्त्येष्टि संस्कार में शोकापनयन की यह मनोवैज्ञानिक प्रक्रिया व्यावहारिक रूप से अति लाभप्रद है।

उपसंहार

उपर्युक्त विवरण से यह ज्ञात होता है कि वैदिक संस्कारों की प्रक्रिया जन्म के पूर्व से लेकर मृत्यु के बाद तक फैली हुई है। आरम्भ में बहुत जल्दी-जल्दी तथा बाद में देर से संस्कारों का जो विधान हुआ है वह इस तथ्य का पोषक है कि बच्चा जब तक अल्पायु है तब तक उस पर मन चाहे प्रभाव डाले जा सकते हैं। परन्तु ज्यों-ज्यों वह प्रौढ़ होता जाता है उस पर परिस्थितिजन्य अनुभवों का भी प्रभाव पड़ता है केवल विचारों का नहीं। इस प्रकार संस्कार व्यवस्था में सुनिश्चित किया गया समयान्तराल प्राच्य मनीषियों की वैज्ञानिक सूझ-बूझ का परिचायक है। इसके गहन चिन्तन के फलस्वरूप वैयक्तिक एवं सामाजिक उत्कर्ष की दृष्टि से किया गया यह निर्विवाद तथ्य है।

उक्त संस्कार पद्धति के कतिपय संस्कार आज भी प्रचलित है। कुछ संस्कार गत कृत्य किये तो जाते हैं, परन्तु संस्कार के रूप में समझकर नहीं। कोई भी तथाकथित आधुनिक व्यक्ति प्राचीन व्यवस्था को वैज्ञानिक युग में अनुपयोगी कह सकता है। इसे हिन्दू समाज मात्र के लिए निर्मित कहकर धर्मगत भेदभाव का सूचक बता सकता है। परन्तु उपर्युक्त गर्भाधान, जातकर्म, नामकरण, विवाह तथा अन्त्येष्टिगत कृत्यों का अपलाप नहीं कर सकता। उसे न चाहते हुए भी इन्हें स्वीकार करना पड़ेगा। भले ही वह शब्दावली बदल ले, विधा कोई भी क्यों न अपना ले।

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ज्योतिषशास्त्र : एक वैज्ञानिक अध्ययन

*डॉ. शत्रुघ्न त्रिपाठी**

सूर्यादिग्रह एवं नक्षत्रादि पिण्डों के विविध प्रकार के स्थितियों का निदर्शन करने वाला भारत का अतीव प्राचीन शास्त्र ज्योतिषशास्त्र पूर्णतया विज्ञान है। हिन्दू धर्म में व्याप्त सनातनी-परम्परा को अक्षुण्ण रखने में महत्त्वपूर्ण दायित्व का निर्वहन करने वाला ज्योतिश्शास्त्र, आज भी अपने वैशिष्ट्य से नित्य नूतन चिन्तनों को जन्म दे रहा है। प्राचीन भारतीय परम्परा के कुम्भ जैसे महान् पर्वों का आयोजन एवं उसमें स्नानादि के विधान की उद्घोषणा कर भारतीय एकता, अखण्डता एवं संस्कृतियों के परस्पर मिलन को गौरवान्वित एवं अत्यधिक मजबूती प्रदान करता है।[1] एक बार महामना पं. मदन मोहन मालवीय जी से इलाहाबाद के कुम्भ महापर्व के अवसर पर एक विदेशी विद्वान् ने पूछा कि महामना जी! भारत में ऐसी कौन सी विज्ञापन प्रणाली है जिसके आधार पर इतने सारे लोग एक ही समय पर, एक हीं स्थान पर तथा एक हीं उद्देश्य के लिए एकत्रित हो गये हैं? ऐसे प्रश्न को सुनकर महामना मुस्कुराये और बोले महाशय, इसका श्रेय ज्योतिषशास्त्र को जाता है, जिसके पञ्चाङ्ग के आधार पर भारत के कोने-कोने से धार्मिक जनता पहुँचती है तथा स्नानादि पुण्य लाभ प्राप्त करती है। कुम्भ महापर्व में सामयिक विषयों पर चिन्तन किया जाता था तथा उसमें प्रश्नों का उचित समाधान किया जाता था, जिसमें राष्ट्रीय मुद्दों को प्रमुखता दी जाती थी। इस प्रकार ज्योतिश्शास्त्र सामाजिक एकता तथा अखण्डता के संरक्षण में मुख्य भूमिका का निर्वहन करता रहा है।

ज्योतिषशास्त्र के वैज्ञानिक पक्षों के अध्ययन हेतु सबसे पहले यह विचार करना आवश्यक है कि विज्ञान किसे कहते हैं तथा विज्ञान की परिभाषा क्या है? वैसी कौन सी परिधि विज्ञान की है जिसमें ज्योतिषशास्त्र आता है या नहीं? प्रस्तुत प्रसङ्ग में विचार करते हैं-

विज्ञान की परिभाषा के प्रसंग में भगवान् श्रीकृष्ण गीता में कहते हैं कि-

'ज्ञानं तेऽहं सविज्ञानमिदं वक्ष्याम्यशेषतः'[2]

यदि अमरकोश में विज्ञान पद की परिभाषा या अर्थ देखा जाय तो पाते हैं कि-

'मोक्षे धीर्ज्ञानमन्यत्र विज्ञानं शिल्पशास्त्रयोः'

–अमरकोशे (प्रथमकाण्ड, धीवर्ग)

आद्य शङ्कराचार्य जी ने गीता के पद्यों की व्याख्या करते हुए लिखा है कि **'स्वानुभवसंयुक्तं ज्ञानं विज्ञानम्**।' आचार्य मधुसूदन ओझा जी ने बताया है कि, दृष्टि के सामने आने वाले विभिन्न पदार्थों में समान रूप से मूलतः वर्तमान रहने वाले किसी एक तत्त्व का अनुभव ज्ञान कहलाता है और मूल में एक स्थायी नित्य तत्त्व मानकर उसकी ही अनन्त पदार्थों के रूप में परिणति का वर्णन **विज्ञान** कहलाता है।[3] यदि **'आक्सफोर्ड डिक्शनरी'** में उल्लिखित विज्ञान की परिभाषा देखें तो पाते हैं कि- The intellectual and practical activity encompassing the systemic study of the structure and behavior of the physical and natural world through observation and experiment. लैटिन शब्दकोश में लिखा है कि- Knowledge attained through study or practice or knowledge covering general truths of the operation of general laws, esp. as obtained and tested through scientific method and concerned with the physical world.[4] आगे विज्ञान की इस परिभाषा का विस्तृत विश्लेषण किया जाएगा।

प्राचीन विज्ञान के रूप में

भारतवर्ष की परम्परा में प्राचीनता की दृष्टि से ज्योतिष एवं आयुर्वेद की वैज्ञानिक महत्ता ऐतिहासिक एवं विविध प्रकार के शिलालेखों द्वारा प्रमाणित एवं प्रकाशित हो चूकी है। प्राचीन काल में ज्योतिष आयुर्वेद एवं धनुर्वेद हीं विज्ञान के रूप में प्रतिष्ठित थे, जिसमें आयुर्वेद स्वास्थ्य की रक्षा हेतु विविध प्रकार से समाज हित में कार्य करता था तो दूसरा विज्ञान ज्योतिष था, जिससे खगोल, भूगोल एवं वृष्टि-भूकम्पादि विषयों का ज्ञान किया जाता था।

(क) वैदिक कालीन ज्योतिष

वेदों में ज्योतिष शास्त्रीय बहुत सारे विषयों की प्राप्ति होती है। ब्राह्मण ग्रन्थों में नक्षत्रों की चर्चा ऋग्वेद में ग्रह-नक्षत्रों की कहानियाँ तथा अथर्ववेद में विविध प्रकार के ग्रहों के सूक्त तथा ग्रहणादि विषयों की उपस्थिति प्राचीनता को स्वयं द्योतित करते हैं।[5]

इस प्रकार यदि वेद विश्व के सर्वाधिक प्राचीन साहित्य के उदाहरण हैं तो हमारा वेदाङ ज्योतिष शास्त्र भी उतना हीं प्राचीन एवं ज्ञान-विज्ञान से परिपूर्ण है।

(ख) पौराणिक ज्योतिष

भारतीय पुराण धर्म के प्राण माने जाते हैं। वैदिक कथाओं एवं आख्यानों तथा विविध प्रकार के मानकों पर पुराणों का समुद्भव हुआ है। वेद व्यास जी की अद्भुत रचना शैली ने अपने गर्भ में बहुत सारे विज्ञानों को पल्लवित पुष्पित रखा है। पुराण हमारी जीवन

*असिस्टेन्ट प्रोफेसर, ज्योतिष विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी

शैली तथा मानव मूल्य एवं जीवन जीने की कला के प्रतिष्ठापक शास्त्र रहें हैं। व्यक्ति के जीवन जीने की परम्परा तथा शारीरिक एवं मानसिक विकास के साधक रूप में आज भी पुराण सर्वाधिक प्रासङ्गिक हैं। पुराणों में निम्नलिखित विज्ञानों की प्राप्ति होती है जिसका सम्बन्ध साक्षात् ज्योतिष से है-[6]

(1) भूगोल विज्ञान
(2) सामाजिक विज्ञान
(3) नक्षत्र विज्ञान
(4) वृष्टि विज्ञान
(5) रत्न विज्ञान
(6) चिकित्सा विज्ञान
(7) भैषज्य विज्ञान
(8) वास्तु विज्ञान
(9) गणित विज्ञान
(10) खगोल विज्ञान
(11) मनोविज्ञान

अश्वशास्त्र एवं हस्तिशास्त्र तथा गायों की चिकित्सा – महाभारत (सभापर्व 5/109), अग्निपुराण (अध्याय 282, 288), गरुड पुराण (अध्याय 201)।

आयुर्वेद – गरुड पुराण (56 अध्याय 146 से 202), अग्निपुराण (अध्याय 279-281)।

रत्नविज्ञान – गरुड पुराण (अध्याय 68-80), अग्निपुराण (अध्याय 234)।

वास्तुविद्या – मत्स्यपुराण (अध्याय 252-270), विष्णुधर्मोत्तरपुराण (2/29-31)।

खगोलविज्ञान – भागवतमहापुराण (16 एवं 25 अध्याय), देवीभागवत (5 अध्याय, 20 अध्याय), गरुड पुराण (59 से 64 अध्याय)।

धनुर्विद्या – महाभारत (शान्तिपर्व 210/21), अग्निपुराण।

इस तरह अनेक ऐसे विषयों का संग्रह पुराणों में प्राप्त होता है जिसका सीधा सम्बन्ध ज्योतिश्शास्त्र से है। इस सन्दर्भ में उपर्युक्त विषय एवं विज्ञानों का बीज रूप में संकलन ज्योतिष शास्त्र के संहिता स्कन्ध में भी प्राप्त होता है।

भारत के प्राचीन परम्परा एवं ऐतिहासिक साक्ष्यों के आधार पर यदि विचार-विमर्श करें तो पाते हैं कि, प्राचीन भारतवर्ष में दो प्रकार के विज्ञान की परम्परा रही है।

(क) आयुर्वेद विज्ञान

इसके द्वारा हमें चरक, सुश्रूत, वाग्भट्ट, लोमश, हारीत, आदि के ग्रन्थों से मनुष्य के शरीर में व्याप्त रोगों की चिकित्सा के समस्त विधाओं का ज्ञान होता है तथा वनस्पतियों का प्रयोग औषधि के रूप में दीर्घ परम्परा से आज भी सुरक्षित एवं संरक्षित है।

(ख) ज्योतिष विज्ञान

खगोलीय पिण्डों से प्रारम्भ कर पार्थिव जीवों पर पड़ने वाले ग्रह प्रभाव तथा प्राकृतिकोत्पात एवं भौगोलिक गणना जिसके अन्तर्गत पूर्णतया सुरक्षित रहे, वह हमारा ज्योतिष विज्ञान है। आयुर्वेद के अतिरिक्त सभी शेष आज के प्रसिद्ध विज्ञान इसके गर्भ में मूल रूप में विद्यमान थे।

विषय एवं प्रयोग की दृष्टि से ज्योतिष शास्त्र की वैज्ञानिकता

(1) गणितीय प्रयोग

ज्योतिष शास्त्र में गणित की प्रधानता को सभी आचार्यों ने स्वीकार किया है तथा बताया है कि **''तस्माद्यो गणितं न वेत्ति स कथं गोलादिकं ज्ञास्यति''** – सि.शि. 1

अर्थात् गणित शास्त्र के ज्ञान के बिना इस ब्रह्माण्ड गोल का ज्ञान कथमपि संभव नहीं है। ऐसी स्थिति में अङ्कज्ञान की परम्परा से प्रारम्भ कर धनर्ण, गुणन-भाजन, वर्ग-वर्गमूल, घन-घनमूल, संक्रमण गणित, कुट्टक, बीजगणित, क्षेत्रमिति, रेखागणित, चलन-कलन, अनुपात, त्रैराशिकगणित आदि विविध प्रकार के गणितों का अध्ययन एवं अध्यापन आज भी समस्त विश्वविद्यालय एवं महाविद्यालयों में अनुदिन होता है।[7] इस प्रकार के गणितीय ग्रन्थ संस्कृत भाषा में आचार्य परम्परा द्वारा निर्मित हैं जिनका, मूलाधार वैदिक गणित है। आज भी इनके उपर शोधकार्य एवं विविध परियोजनाओं का संचालन होता है। यदि इस प्रकार के गणितीय प्रयोग विज्ञान नहीं होता तो ज्योतिष भी शायद विज्ञान नहीं होता, स्वयं विद्वद्गण विचार करें। आचार्य आर्यभट्ट, भास्कर, कमलाकर, गणेश दैवज्ञ, बापुदेव शास्त्री, सुधाकर द्विवेदी, आदि आचार्य परम्परा ने गणितीय विद्या को पुष्ट एवं संरक्षित करने में अथक प्रयास किया है। गणित शास्त्र के विद्वान् इन आचार्यों के ग्रन्थों का अध्ययन कर स्वयं वैज्ञानिकता का परीक्षण कर सकते हैं।

(2) खगोलीय प्रयोग

खगोलीय ज्ञान का प्रमुख केन्द्र रहा है ज्योतिष। ज्योतिष शास्त्र के द्वारा हमारे प्राचीन आचार्यों ने धरती पर बैठकर जिस प्रकार की अङ्क-भगण-राश्यादिमान की परिकल्पना से करोड़ों मील दूर स्थित ग्रहों का साधन करते थे तथा उनके गति-स्थिति आदि के सम्यक् निरीक्षण द्वारा लोक में चमत्कार करने वाले ग्रहण-ग्रहोदयास्त की भविष्यवाणी वर्षों पूर्व किया करते थे, वह आज भी अनुकरणीय एवं श्लाघनीय है। आचार्य चाणक्य ने अर्थशास्त्र में लिखा है कि, आकाश में बिना दूत भेजे भूमि पर बैठकर इस प्रकार ग्रहों की स्थिति का निदर्शन करने वाला कैसे विद्वान् नहीं है?[8] हमारे प्राचीन साहित्य एवं ऐतिहासिक ग्रन्थ इसके साक्ष्य हैं कि, हम सबसे पहले से खगोलीय पिण्डों का अध्ययन करते रहे हैं तथा आर्यभट्ट, लल्ल, ब्रह्मगुप्त, भास्कर, मुनीश्वर, गणेश दैवज्ञ, कमलाकर, केतकर, सामन्त चन्द्रशेखर आदि आचार्यों ने उत्तरोत्तर खगोलीय ज्ञान को

नवीनता एवं पुष्टता प्रदान की है। आज वैश्विक स्तर पर वर्तमान खगोलीय विज्ञान का प्रारम्भ काल 16वीं से 17वीं शताब्दी के बीच स्वीकार किया जाता है जबकि, बी.सी. 1400 शताब्दी से प्रारम्भ कर आज भी सतत् गतिशील इस परम्परा में कुछ ऐसे भी ग्रन्थ हैं जिनका काल निश्चित नहीं हैं, जिनमें आर्ष परम्परा के ग्रन्थ भी हैं। विषय की दृष्टि से विचार करें तो, कालगणना, कालमान (9 प्रकार), ग्रह बनाने की विधि, ग्रहण, उदयास्त, दिनरात का वैचित्र्य, अक्षांश-देशान्तर, भूस्वरूप, दिग्साधन, देश ज्ञान, ब्रह्माण्ड ज्ञान, सूर्योदयादि साधन, ग्रहकक्षागत वैशिष्ट्य, यन्त्र निर्माण एवं उनके द्वारा वेधज्ञान, ग्रहगति, ग्रहबिम्बादिमान सदृश अनेक ऐसे विषय है जो ज्योतिष शास्त्रीय स्कन्ध में सिद्धान्त ज्योतिष के अन्तर्गत परिगणित होते हैं। अरबों रूपयों के द्वारा विविध प्रकार के जिन यन्त्रों के प्रयोग के द्वारा आज हम इन ग्रहों के विविध स्थिति का ज्ञान करते हैं। उनके सहस्रांश व्यय में ज्योतिषीय विद्या को विकसित कर आसानी से कार्य कर सकते हैं। आवश्यकता है कि हमें शोध की सुविधा प्रदान की जाय तथा प्रायोगिक गणित एवं गोलीय हेतु उचित मार्ग-निर्देशन प्राप्त हो। ज्योतिष शास्त्र में निहित खगोलीय विशेषताओं का अध्ययन एवं उसके ऊपर गहन शोध की आवश्यकता है, जिससे प्राचीन इस विज्ञान का समुचित लाभ प्राप्त हो और वैश्विक स्तर पर इसकी गणना संभव हो सके। सूर्यसिद्धान्त, आर्यभट्टीयम्, पञ्चसिद्धान्तिका, शिष्यधीवृद्धिद्, ब्रह्मसिद्धान्त, सिद्धान्तशिरोमणि, ग्रहलाघव, सिद्धान्ततत्त्वविवेक, केतकरीय, सिद्धान्तदर्पण, सिद्धान्तशेखर, उपपत्तिन्दुशेखर, आदि ग्रन्थों की सुदीर्घ ग्रन्थ परम्परा भी रही है।

(3) भौगोलिक प्रयोग

ज्योतिष शास्त्रोक्त भौगोलिक वर्णन के आधार ग्रन्थ पुराण हैं। विष्णुधर्मोत्तर एवं अग्निपुराण तथा वामन एवं नारदीय पुराणों में भुवनकोश के रूप में भौगोलिक स्थितियों को विस्तृत रूप से बताया गया है। ज्योतिष शास्त्रोक्त भौगोलिक गणना कुछ परिवर्तित एवं विशिष्ट रूप में परिलक्षित होती है। कारण यह है कि भूगोल स्वरूप निर्धारण से प्रारम्भ कर भूमि पर ऋतुओं के क्रम एवं अक्षांशादि भेद नितान्त सूक्ष्म एवं महत्त्वपूर्ण हैं। कहाँ कितने दिनमान होगें, कब रात्रि होगी। भूव्यास एवं परिधि का सम्बन्ध क्या है। हम कैसे परिधि का ज्ञान करते हैं तथा भिन्न-भिन्न स्थानों पर क्या अन्तर पड़ता है। भूमि के किस दिशा में क्या है तथा भारतवर्ष की भौगोलिक स्थिति एवं उसका आधार क्या है। भूमि के ऊपर कैसे स्थान एवं लोग रहते हैं तथा समुद्र एवं पक्षी कैसे निवास करते हैं।[9] पृथ्वी की गति कैसी है तथा भूगोल पर वन-पर्वत आदि की स्थिति कैसी है। भूमि के दो कपाल तथा दो प्रकार के गोल चार भागों में कैसी विभाजित कर भौगोलिक गणना को सुलभ बनाते हैं, आदि विषयों की चर्चा बृहत्रूप में प्राप्त होती है। इस प्रकार के भौगोलिक अध्ययन की वैज्ञानिकता को स्वयं विद्वान् परिभाषित करें। ज्योतिष शास्त्र में भौगोलिक स्थितियों का ज्ञान सिद्धान्त ग्रन्थों में तथा संहिता एवं फलित ग्रन्थों में भी प्राप्त होता है।

(4) मौहूर्तिक प्रयोग

ज्योतिष शास्त्र में मुहूर्त वस्तुतः काल (समय) का वाचक है। ग्रहों पर आधारित पञ्चाङ्ग (Almnac) मुहूर्त के मूलाधार हैं। क्योंकि इसके प्रतिदिन एवं प्रतिक्षण के काल का विभाजन विभिन्न आधार पर प्राप्त होता है तथा मुहूर्त्तों की शुभता एवं अशुभता का परीक्षण किया जाता है। किस काल में कौन सा कार्य करें तथा भावी जीवन पर इस कार्य का क्या प्रभाव होगा। किस कार्य हेतु किस प्रकार के ऋतु की आवश्यकता है तथा किस काल में यह कार्य किया जाए, जिससे लाभ की प्राप्ति हो।

दिन एवं रात्रि के भेद से 15-15 मुहूर्त्तों की परिकल्पना तथा बहुत सारे विकल्पों की समुपलब्धता मुहूर्त शास्त्र की सबसे बड़ी विशेषता रही है।[10] किसानों के प्रयोगार्थ बीजवपन एवं वृष्टि की आसन्नता के ज्ञान के द्वारा रोपण तथा मानव को सुसंस्कृत एवं सुसभ्य करने में सहायक 16 संस्कारों के काल का निर्धारण एवं उनके उपयुक्त मुहूर्त का निर्धारण ज्योतिष का प्रमुख प्रातिपाद्य है। मुहूर्त ग्रन्थों में मुहूर्तगणपति, मुहूर्तचिन्तामणि, मुहूर्तमार्तण्ड, मुहूर्तमञ्जरी आदि हैं, जिनमें मानव हिताय सभी प्रकार के शुभाशुभ मुहूर्त्तों की प्राप्ति होती है। इस विद्या की एक और विशेषता है कि मुहूर्त ग्रन्थों के ग्रन्थकार कुछ ऐसे हैं जिन्होंने फलित तथा खगोलीय ग्रन्थों की रचना भी की है।

(5) वास्तुशास्त्रीय प्रयोग- वास्तुशास्त्र ज्योतिष शास्त्र का अभिन्न अङ्ग है। मानव की अनिवार्य आवश्यकताओं में आवास का स्थान प्रमुख होता है। गृह के बिना गृही तथा गृहस्थ आश्रम की पूर्णता नहीं प्राप्त होती है।[11] प्राचीन काल से ही मानव ने अपने रहने के लिए गृह के निर्माण में वास्तुशास्त्र का प्रयोग प्रारम्भ कर दिया था, जिसके उदाहरण पुराणों एवं ऐतिहासिक ग्रन्थों में प्राप्त होता है। चारों दिशाओं के लिए चार प्रकार के विशेषज्ञों की आधारशिला पर निर्मित तथा सूत्रधार, विश्वकर्मा, बर्द्धकि आदि द्वारा सुशोभित यह वास्तु का इतिहास अतीव प्राचीन एवं सरणिबद्ध परम्परा पर पूर्णतया आधारित है। भवननिर्माण, नगर एवं दुर्गनिर्माण, मूर्तिनिर्माण, महलनिर्माण, कूपनिर्माण, मन्दिरनिर्माण सेतु आदि विविध प्रकार के निर्माणों से सम्बन्धित यह वास्तुशास्त्र बहुत हीं समृद्ध एवं पुरातन है। गृह निर्माण प्रसङ्ग के ऊपर हीं यदि हम केन्द्रित होकर विचार करें तो पाते हैं कि भू-चयन से प्रारम्भ कर गृहप्रवेश तक समस्त स्थितियों का सूक्ष्म प्रकार से वर्णन प्राप्त होता है। जिसमें भूविचार, मानचित्र निर्माण, दिवाल, द्वार, उचाई, 16 प्रकार के विशिष्ट गृह का नियोजन, जल, नाली, वृक्ष, बगीचा आदि का गंभीर रूप से विचार किया गया है।

क्या विश्व में ऐसी कोई विद्या गृहनिर्माण की है, जो इतनी प्राचीन थी? क्या आज अभियान्त्रिकी का एक भाग वास्तुशास्त्र नहीं है? क्या किसी सैद्धान्तिक तरीके से गृहनिर्माण, विज्ञान की परिधि

में नहीं आता? लगभग 20 से ज्यादा पुस्तक वर्तमान में वास्तुशास्त्र पर केवल लिखित हैं, जिनका सदुपयोग हम वर्षों से करते आ रहें हैं तथा विश्वकर्मा, मय, ब्रह्मा आदि आचार्यों का प्रयोग आज भी पूर्णतया विज्ञान के रूप में प्रतिष्ठित है।

(6) चिकित्सकीय प्रयोग

ज्योतिष के फलित स्कन्ध के अन्तर्गत मनुष्यों में उत्पन्न होने वाले विविध रोगों की चर्चा प्राप्त होती है। कालपुरुष की अवधारणा एवं जन्माङ्गचक्र के द्वारा मनुष्य के प्रमुख अङ्गों को 12 भागों में बाँटकर पृथक्-पृथक् ग्रहाधारित प्रकृति, अवयक, धातु, आदि के द्वारा मनुष्यों के रोगों का ज्ञान होता है।[12] यहाँ ग्रहयोगों के आधार पर रोगों एवं उनकी साध्यता-असाध्यता का निर्णय कर कुछ उपचारों द्वारा चिकित्सा की भी व्यवस्था बताई गई है। नख से शिर तक शरीराङ्ग के विभिन्न भागों में उत्पन्न होने वाले विविध प्रकार के रोगों की चर्चा प्रायः सभी फलित शास्त्र के ग्रन्थों में है। आज कई विशेष ऐसे ग्रन्थ भी प्रकाशित हो गए हैं जो केवल रोगकारक ग्रहयोग का हीं प्रतिनिधित्व करते हैं।

आयुर्वेद की परम्परा पर पूर्णतया आधारित ज्योतिष की रोगज्ञान परम्परा आज भी उतना हीं प्रासङ्गिक है जितना ईसा पूर्व थी। हाँ, आज रोगों की संख्या परिवर्तित होकर बढ़ गई है, परन्तु मनुष्य के मूल अङ्गों एवं उपाङ्गों में कोई भी परिवर्तन नहीं आया है। कालपुरुष की अवधारणा, मनुष्य के अङ्गों एवं धातु, अवयव आदि का समन्वय आज भी वही है, जो ईसा पूर्व के मानव में था। फलित शास्त्र की सहायता से वैद्य लोग भी रोगियों पर परीक्षण तथा औषधियों पर परीक्षण का काल निर्धारित करते थे, तथा काल विशेष के उपचार एवं वमन, शल्यक्रिया, पञ्चकर्म आदि के द्वारा मानव की चिकित्सा करते थे। ज्योतिष शास्त्र के गदावली, वीरसिंहावलोक, प्रश्नमार्ग, पारिजात, जातकतत्त्व आदि ग्रन्थों में बृहत् रूप से उदर, मस्तिष्क, हृदय, रक्त, अस्थि, लिङ्ग, गुप्तरोग, बुखार, कफजन्यरोग, विषजन्य, नेत्र, मुख आदि विविध रोगों के ग्रहयोग वर्णित हैं।

(7) वृष्टिशास्त्रीय प्रयोग

ज्योतिष शास्त्र का संहिता स्कन्ध विषय की दृष्टि से सबसे महत्त्वपूर्ण एवं बड़ा स्कन्ध है। इसमें व्यक्तिगत फलादेश एवं ग्रहगणितीय विद्या के अतिरिक्त सभी विषयों का संकलन किया गया है। इस संकलन में वृष्टिविद्या का विचार अतीव महत्त्वपूर्ण है। वृष्टि के निर्माण के सहायक तत्त्व धूम, वायु, प्रकाश, जल आदि की गणना से प्रारम्भ कर मेघ गर्भधारण स्थिति, केवल वायु की स्थिति, बाढ़, अनावृष्टि, अतिवृष्टि, ओला वृष्टि आदि प्रकार के विषयों की मीमांसा की गई है।[13] इसमें दो प्रकार की स्थिति प्राप्त होती है-

1. ग्रहयोगाधारित स्थिति

प्रस्तुत स्थिति के द्वारा ग्रहयोगों के आधार पर निश्चित होता है कि कब अच्छी वृष्टि होगी तथा कब वृष्टि नहीं होगी तथा सूर्य एवं चन्द्र के राशिसञ्चार तथा ग्रहों के राशि सञ्चार के द्वारा वृष्टि का ज्ञान प्राप्त होता है।

2. आकाशीय स्थिति

प्रस्तुत स्थिति के द्वारा आकाश के वर्ण, आकृति, चिह्न एवं वायु के द्वारा मेघ के सभी प्रकार की स्थितियों को बताया गया है। जिसमें, नक्षत्रों का आधार लेकर भी बहुत योगों का वर्णन प्राप्त होता है।[14] इन नक्षत्रों के आधार पर कवि 'घाघ' एवं 'भड्डरी' की लोक कहावतें आज भी सटीक वृष्टि की भविष्यवाणी करती हैं। पंचाङ्ग में उल्लिखित वृष्टि का विचार भी महत्वपूर्ण होता है। वृष्टि हेतु मेघमाला, वृष्टिप्रबोध, कादम्बिनी, आर्षवायुवृष्टिविज्ञानम्, बृहत्संहिता, अद्भूतसागर आदि ग्रन्थ पर्याप्त एवं तथ्ययुक्त विवरण आज भी प्रदान कर रहे हैं।

(8) वृक्षायुर्वेदीय प्रयोग

वनस्पति एवं ओषधियों को दृष्टि में रखते हुए प्राचीन दैवज्ञों ने बहुत ही मौलिक कार्य किया है। वृक्षारोपण, सिंचन, कर्तन, वृक्ष के रोगों की चिकित्सा, आयुर्वेदीय ओषधियों का प्ररोपण आदि कार्यों का ज्योतिष शास्त्र में प्राचीन काल से ही वर्णन प्राप्त होता है।[15] किस नक्षत्र में कौन-सी ओषधि का रोपण करें तथा उसके पत्ते या जड़ का किस समय उपयोग करें आदि, विद्याओं का वर्णन ज्योतिष शास्त्र में प्राप्त होता है। 27 नक्षत्रों से सन्दर्भित वृक्ष एवं नवग्रहों हेतु नव समिधा तथा उनके रख-रखाव का चिन्तन आज भी सम्प्रयोग की दृष्टि से महत्त्वपूर्ण है। कृषकों के लिए विविध प्रकार के अन्नों का उत्पादन एवं खरीफ तथा रबी फसलों के लिए उत्तम काल एवं बीजों के दीर्घकाल संरक्षण में काल की उपयोगिता का सर्वतोभावेन महत्त्वपूर्ण स्थान है जिसका, ज्ञान हमें ज्योतिष के माध्यम से प्राप्त होता है। वनस्पति वृक्ष एवं ओषधियों हेतु मुख्यरूप से बृहत्संहिता, गर्गसंहिता, बृहद्दैवज्ञरञ्जन, अद्भुतसागर, वशिष्ठसंहिता आदि ज्योतिषीय ग्रन्थों में बृहद् रूप से वर्णन प्राप्त होता है।

(9) ब्रह्माण्डीय प्रयोग- आज समस्त विश्व ब्रह्माण्ड के रहस्य को एवं सृष्टि के सिद्धान्त को जानने के लिए विविध प्रकार के नित्य नूतन प्रयोग कर रहा है। प्रकृति के इस अनसुलझे रहस्य को सुलझाने में मानव मस्तिष्क छोटा पड़ रहा है तथा परिणामस्वरूप अनुदिन नये-नये शोध उत्पन्न हो रहे हैं। इस ब्रह्माण्ड का स्वरूप, विस्तार, इसमें निहित स्थिति, भूमि एवं ग्रहों के मार्ग आदि का ज्ञान ज्योतिष में बताया गया है। कहाँ तक इस ब्रह्माण्ड का विस्तार है तथा इसमें जीवों की स्थिति एवं स्थानों की स्थिति कैसी है आदि का विवरण प्राप्त होता है।[16] ब्रह्माण्ड के अन्तर्गत ग्रह-नक्षत्रों एवं मनुष्य की स्थिति का वर्णन पुराणों में भी प्राप्त होता है, जैसा कि आचार्यों ने कहा है। इसके अन्तर्गत आर्यभट्टीयम्, ब्राह्मस्फुटसिद्धान्त, शिष्यधीवृद्धिदम्, सूर्यसिद्धान्त, सिद्धान्तशिरोमणि आदि ग्रन्थों में विस्तार से ब्रह्माण्ड के विविध प्रयोग बताये गये हैं। इस प्रकार के विविध प्रयोग ज्योतिष में प्राप्त होते हैं जिनका वैज्ञानिक प्रयोग हम

आज भी कर रहें हैं तथा उनके सिद्धान्तों का लाभ भी प्राप्त हो रहा है।

निष्कर्ष

विज्ञान को हम यदि पद से अभिहित करें तो वह पद पारिभाषिक रूप में शब्दकोश एवं विदेशी व्युत्पत्ति से ही सिद्ध हो जाता है। जिसमें एक निश्चित सिद्धान्त, ''जिसका परीक्षण प्रयोग द्वारा बार-बार करने पर प्रयोगशाला में एक हीं निष्कर्ष मिले तथा प्राकृतिक एवं भौतिक चिन्तन से युक्त हो'', को विज्ञान कहते हैं। यदि इस प्रकार की परिभाषा की व्याख्या करें तो पाते हैं कि, भौतिक पदार्थों का जब हम प्रयोगशाला द्वारा विविध प्रयोग से निष्कर्ष एक ही प्राप्त करते हैं तब उसे विज्ञान कहते हैं। प्रस्तुत परिभाषा के सापेक्ष यदि विचार करें तो पाते हैं कि, ज्योतिष शास्त्र भी पूर्णतया विज्ञान है। आचार्य भास्कर की सिद्धान्त की परिभाषा **त्र्युट्यादिप्रलयान्तकालकलनेति** श्लोक पूर्णतया विज्ञान की परिभाषा जैसा ही है। हम भौतिक पिण्डों का वा ग्रहनक्षत्रों का गणित करते हैं तथा वेधशाला में प्रयोग द्वारा गणितीय मान की पुष्टि करते हैं तथा उनका परिणाम सतत् एक हीं आता रहता है। गणितीय प्रयोगात्मक भूल (Experimental error) या गलतियों को संस्कृत करते हेतु कुछ वर्षों बाद उसमें कुछ संस्कार की प्राचीनाचार्यों की उक्ति ज्योतिष की वैज्ञानिकता को अधिक पुष्ट करती है।[17] ग्रहों के मान, कक्षामान, गति, वृत्तात्मक गणित, क्षेत्रव्यवहार, दीर्घवृत्त की परिकल्पना, ग्रह एवं सूर्योदयास्त तथा ग्रहोदयास्त जैसे विषयों की गणना नितान्त वैज्ञानिक है। गणित की दृष्टि से समग्र विश्व भारत का ऋणी है। आचार्य आर्यभट्ट, भास्कर, वराह एवं कमलाकर जैसे आचार्य इस चमत्कारिक विज्ञान के प्रमुख साधक आचार्य हैं।

हाँ, आज के ग्रहमानों के परिणाम के अन्तर को देखकर तथा उनके गणितीय मान को निकालकर कुछ अल्पज्ञ वैज्ञानिक इसे विज्ञान की कोटि में सम्मिलित नहीं करते हैं। उनका कहना है कि, इसके गणितीय मान अन्तरित हैं तथा ग्रहण आदि का सही-सही मान नहीं आता है। ऐसी परिस्थिति में इसे विज्ञान स्वीकार करना चूनौति है।

प्रस्तुत प्रसङ्ग में कुछ बातें विचारणीय हैं। एक तो यह कि क्या 17वीं शताब्दी के पहले हम ग्रहण का ज्ञान नहीं करते थे? क्या हम ग्रहगोलीय विशेषताओं को गणित द्वारा आनयन नहीं करते थे? यदि नहीं तो यह विज्ञान नहीं है। यदि हाँ, तो क्या अन्तर उत्पन्न होने पर परिणाम में सफलता संभव है? ऐसी परिस्थिति में उत्तरोत्तर शोध का ह्रास क्रम हीं इसको विकसित करने में बाधक रहा तथा सभी पश्चात् दैवज्ञों ने फलादेश को हीं महत्त्वपूर्ण माना और खगोलीय विज्ञान से दूरी हो गई। फलस्वरूप आज सभी परिणाम अन्तरित हो गये हैं,[18] तथा ज्योतिष के उपर विविध प्रकार के आक्षेप लगने लगे हैं।

विचारणीय बिन्दु यह भी है कि, क्या विदेशी परम्परा में ऐसा नहीं हुआ, अपितु वहाँ भी हुआ। वहाँ भी गैलेलियो, कैप्लर, पाइथागोरस, टाइबोक्रोही, न्यूटन आदि विद्वानों की परम्परा के नये-नये शोध ने पुराने सिद्धान्तों एवं मतों को तिरस्कृत किया और नित्य नूतन अन्वेषण का जन्म होता रहा। अन्तर केवल यह है कि, वहाँ यह परम्परा आज भी सतत् गतिशील है तथा हमारे देश में इस परम्परा को कथा, इतिहास एवं कपोलकल्पित कहानी, ढोंग आदि की संज्ञा देकर मूलभूत अन्वेषण की सुविधाओं से वंचित कर, हमेशा के लिए नष्ट करने का प्रयास किया जा रहा है। इन सब स्थितियों को देखकर मैथिलीशरण गुप्त जी ने भारत-भारती में लिखा है कि-[19]

''वृतान्त पहले व्योम का प्रकटित हमीं ने था किया।
वह क्रान्तिमण्डल था हमी से अन्य देशों ने लिया॥
जिस अंकविद्या के विषय में वाद का मुँह बन्द है।
वह भी यहीं के ज्ञान-रवि की रश्मि का अमन्द है॥
उन शुल्वसूत्रों के जगत् में जन्मदाता हैं हमीं।
रेखागणित के आदि ज्ञाता या विधाता हैं हमीं॥
हमको हमारी वेदियाँ पहले इसे दिखला चूँकीं।
जिन रम्य-रचना हेतु वे रेखागणित सिखला चूकीं॥''

-भारत भारती, अतीत खण्ड, 2/3

आज वे लोग ज्योतिष को विज्ञान नहीं मानते जो स्वयं ज्योतिष के ज्ञान से पूर्णतया वंचित हैं। जिनके पास कुछ भी ज्ञान ज्योतिष शास्त्र का है वे लोग शास्त्र की गहराइयों में उतरकर बड़े-बड़े पुरस्कार तथा सम्मान प्राप्त कर लिये। आज पश्चिम का विज्ञान जिस स्थिति में है, उसे वहाँ तक पहुँचाने में पूर्व का सफलतम् हाथ है तथा रहेगा।

हाँ, इस शास्त्र को और उन्नत शिखर पर पहुँचाया जा सकता था परन्तु उसमें भी हमारे समाज का हीं हाथ है। हमने सभी विद्याओं में उत्तम विद्या को केवल भाग्य बताने वाला समझ लिया तथा इसके गणितीय एवं सैद्धान्तिक पक्ष को छोड़ दिया। सारिणी ग्रन्थ बनाकर सिद्धान्त गणित की परम्पराओं को नष्ट कर दिया गया तथा वर्तमान को हीं सब कुछ मान लिया गया। यदि आज भी तीव्र बुद्धि छात्रों का अध्ययन-अध्यापन में प्रयोग हो और सभी नूतन संसाधनों का प्रयोग किया जाए तो शोध के द्वारा पुनः इस शास्त्र के अन्तर को समाप्त कर सभी खगोलीय मानकों का आनयन किया जा सकता है। आज इकीसवीं सदी के भारतीय वैज्ञानिक एवं खगोल चिन्तक प्रो. जयन्त विष्णु नार्लीकर ने भास्कराचार्य के गोलाध्याय की टीका[20] (पं. केदारदत्त जोशी कृत्) के प्राक्कथन में लिखा है कि- **''भास्कराचार्य को मैं पूर्व परम्परा के वैज्ञानिकों की मालिका का अन्तिम मणि मानता हूँ। आचार्य भास्कर के ग्रन्थ के चार खण्ड लीलावती, बीजगणित, ग्रहगणित और गोलाध्याय भारत में गणित की पाठ्यपुस्तकों के रूप में पाँच सौ वर्ष अध्ययन के विषय बने रहे, फारसी में अनूदित हुए एवं उनकी कीर्ति यूरोप तक पहुँची।'' आगे भास्कराचार्य के**

विविध वैशिष्ट्य को उल्लिखित करते हुए बताते हैं कि 'गुरुत्वाकर्षण शक्ति की कल्पना में वे अपने समय से आगे थे।' (गोलाध्याय, प्राक्कथन – प्रो. जयन्त विष्णु नार्लीकर, टाटा इन्स्ट्यूट ऑफ फंडामेंटल रिसर्च, अक्टूबर 1987)।

इस प्रकार भास्कराचार्य को वैज्ञानिक स्वीकार करना तथा कुछ विषयों में उन्हें आगे स्वीकार करना ज्योतिष की वैज्ञानिकता को स्वतः प्रमाणित कर रहा है। फलित ज्योतिष की वैज्ञानिकता की दृष्टि से लिखते हैं कि 'ज्योतिष शास्त्र के प्रयोजन को फलित ज्योतिष हेतु परंपरागत विचारधारा को दुहराया है।' फलित ज्योतिष के विषय में आचार्य नार्लीकर कहते हैं कि **'आधुनिक विज्ञान की दृष्टि से आज ये विचार गलत हैं पर हमें आज उनको तत्कालीन विचार परम्परा के कुशाग्रबुद्धि वैज्ञानिक पर पड़े दबाव के रूप में देखना है।' - प्रो. जयन्त विष्णु नार्लीकर**, अक्टूबर 1987।

कुछ ऐसे विद्वान् भी हैं जो गणित ज्योतिष को तो विज्ञान की श्रेणी में रखते हैं परन्तु फलित ज्योतिष को अवैज्ञानिक कहते हैं। जबकि गणित ज्योतिष का ही एक भाग है फलित ज्योतिष तथा दोनों स्कन्धों के आचार्य भी एक हीं हैं। कुछ स्थितियों में, पर क्या गणित ज्योतिष का आचार्य है तो वैज्ञानिक है और जातक ग्रन्थ का है तो अवैज्ञानिक। ग्रहों के प्रभाव के परिणामाङ्कन की यह विद्या सर्वथा मानव हिताय ऋषियों नें बनाया है। फलित ज्योतिष की वैज्ञानिकता को प्रकाशित करने का कोई यन्त्र-विशेष नहीं है। हाँ, यदि है तो स्वयं ग्रहयोगों का मनुष्य के ऊपर प्रयोग जिसके आधार पर स्वयं हम परीक्षण कर सकेगें। स्वयं मैंने (लेखक) 2 परियोजना[21] (Major Project) के उपर कार्य किया है तथा भविष्य में ऐसी परियोजना पर कार्य करने की भी योजना है, जिससे कोई भी व्यक्ति केवल अपना विवरण (जन्मतिथि, समय, स्थान) कम्प्यूटर में डालकर कौन-कौन सा रोग होगा का ज्ञान स्वयं कर लेगा। ऐसे कार्य के द्वारा स्वयं वैज्ञानिकता प्रमाणित होगी तथा हजारों वर्ष पूर्व के ऋषियों के अनुभव का लाभ समस्त समाज को प्राप्त होगा। आज भी फलित ज्योतिष के अन्तर्गत सैकड़ों ऐसे विज्ञान के शाखासूत्र उपलब्ध हैं, जिनके द्वारा फलित की वैज्ञानिकता प्रमाणित होती है। आज भी विज्ञान की परम्परा में Data Stores का अधिक महत्त्व है। इसके द्वारा नूतन तथ्यों एवं अन्वेषणीय विषयों का ज्ञान आसानी से हो जाता है। ठीक इस प्रकार हम ज्योतिष शास्त्रीय फलित के ग्रन्थों को Data Store मानकर हीं उसके आधार पर प्रयोग करें, तो इसकी वैज्ञानिकता नितान्त प्रशंसनीय होगी। आज भी यह शास्त्र जाति, धर्म एवं लिङ्ग, वय, क्षेत्र आदि की परम्परा से बहिर्भूत है तथा आधुनिक विज्ञान की तरह सभी जनों को समान रूप से लाभ प्रदान कर रहा है। आधुनिक दृष्टि में अपोलोनिकस की ग्रहगति की परिकल्पना क्षेत्रभङ्गी की दृष्टि से नीचोच्चवृत्त भङ्गी रूप में भास्कराचार्य को पुष्ट करती है। हिपार्कस की ग्रह वेध शैली तथा राशियों के उदयमान तारों के भोगांश एवं सूर्य की परमाक्रान्ति 23^0।।51' सूर्यसिद्धान्तोक्त 24^0 क्रान्ति की याद दिलाती है।

प्रस्तुत प्रसङ्ग में चाहें क्लाडियस टालमी हों, निकोलस कोपरनिकस हों, केपलर हों, या न्यूटन हों इनके अध्ययन के बाद यह कहना आसान है कि ग्रहगति एवं ग्रहों के भ्रमण सम्बन्धित तथ्यों को प्रदर्शित करने में हमारे प्राचीन ऋषियों की युक्तियाँ आज भी श्लाघनीय हैं।[22] - **ग्रहगति का क्रमिक विकास –(पं. श्रीशचन्द्र मिश्र, पृष्ठ 36-38),** श्रीकृष्णदास अकादमी, 1982।

अन्त में आचार्य मैथिलीशरण गुप्त जी की पक्तियों से समापन करते हैं कि-[23]

आये नहीं थे स्वप्न में भी जो किसी के ध्यान में।
वो प्रश्न केवल हल हुए थे एक हिन्दूस्तान में।।
आकार देख प्राकार देख वो जान जाते आप हीं।
वो शास्त्र सामुद्रिक सरीखे थे बनाते आप हीं।।
विज्ञान से भी फलित ज्योतिष हो रहा अब सिद्ध है।
यद्यपि अविज्ञों से हुआ यह निन्द्य और निषिद्ध है।।

भारत-भारती, अतीतखण्ड, पृ.201

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तन्त्रागमीय मूर्त्ति-निर्माण में मान

*डॉ. शीतलाप्रसाद पाण्डेय**

तन्त्रागमशास्त्र एक प्रायोगिक विज्ञान है। तान्त्रिक पद्धति अध्यात्मिक अभ्युत्थान के साथ ही सांसारिक सुखों को भी अपना उद्देश्य बनाती है। डॉ. जेम्स एच. कजिन्स का निष्कर्ष है कि तन्त्र एक प्रायोगिक तथा प्रदर्शनशील मनोविज्ञान पर आधारित है, इसे वैयक्तिक भक्ति ने विशदीकृत किया तथा दैनिक जीवन में इसका प्रयोग कर इसे प्रयोगशील बनाया। तन्त्रशास्त्र मानवता की आवश्यकताओं के विकास पर एक महत्त्वपूर्ण प्रकाश डालता है, जिसकी पूर्त्ति विभिन्न प्रकार के तान्त्रिक अनुष्ठानों के द्वारा होती है।

तन्त्रागम ग्रन्थों में आनुष्ठानिक क्रियाओं के सम्पादनार्थ देवालय-निर्माण, मूर्त्तिकल्पना तथा भगवदाराधन विषयों का विस्तार से विवेचन उपलब्ध होता है। इस वर्णन प्रसङ्ग में वास्तुशास्त्र तथा शिल्पशास्त्रीय अपेक्षित तकनीकी विषयों का भी अत्यन्त सूक्ष्मता से निर्देश प्राप्त होता है। देवालय - कल्पना के लिए अपेक्षित भूमिचुनाव, उसका शोधन प्रथमेष्टिका (नींव की ईंट) के वर्णन से शुरू कर विमानसूरक (गुम्बद के ऊपर स्थित सूक्ष्म कलश) तक, प्रासाद में संलग्न एक-एक ईंट आदि के कल्पन तथा व्यवस्थापनक्रम से मन्दिर निर्माण की सम्पूर्ण प्रक्रिया का वर्णन, जो सर्वोत्तम वास्तुशास्त्रीय विषय है, वर्णित है।[2]

यद्यपि मूर्त्ति-निर्माण प्रक्रिया विशुद्धरूप से शिल्पशास्त्रीय विषय है, तथापि समूर्त्ताराधनपरक वैष्णवागम में मूर्त्तिकला से सम्बद्ध सारे विषयों का यथा— प्रतिमा का स्वरूप, विग्रह-भेद, लक्षण, कल्पन-विधि तथा प्रतिमोपादान द्रव्यों की सूची अति विस्तारपूर्वक निरूपित है।[3]

तन्त्रागम ग्रन्थों में मूर्त्ति-निर्माणार्थ बिम्ब-मान-प्रमाण (Iconometry) विषय का विस्तार से विवेचन प्राप्त होता है। प्रतिमा-निर्माण के क्रम में इन मानों का उपयोग अत्यन्त आवश्यक होता है। इसी के आधार पर विग्रह (मूर्त्ति) के एक-एक अङ्ग का मान निर्धारित कर मनोहारी मूर्त्ति का निर्माण सम्भव हो पाता है। विभिन्न आगम संहिताओं ने सामान्यतः अङ्गुलादि मानों का निर्देश कर वासुदेवादि मूर्त्ति के प्रत्येक अङ्ग का विस्तृत विवरण दिया है। प्रकृत शोध-पत्र में वैष्णवागमीय मूर्त्तिकल्पनमापों के तकनीकी शब्दों तथा उनके प्रमाण विषयक विवेचन का एक विनम्र प्रयास है।

आगमशास्त्र में मूर्त्ति के लिए 'बेर' शब्द बहुप्रयुक्त है। महर्षि मरीचि ने विमान में प्रतिष्ठापित होने वाली प्रतिमा (बेर) मानविभाग के लिए अङ्गुलादिसंज्ञा प्रदान की है—

अथ विमानबेरादिमानविभागार्थमङ्गुलानां संज्ञां वक्ष्ये।
मानाङ्गुलं, मात्राङ्गुलं, देहलब्धाङ्गुलमिति त्रिविधं भवति।[4]

वैखानस तथा पाञ्चरात्रागम में मान की तीन विधियाँ दी गयी हैं—

1. अङ्गुलादिमान, 2. मानादिविभाग तथा 3. तालमानविभाग।

इन तीनों शब्दों की परिभाषा और उसकी मौलिक इकाई (Unit), उन-उन प्रमाणों के उपयोग स्थल और अवसर, तत्तत् प्रतिमानों का विषय, देवालयादि में उन-उन वस्तुओं के आधार पर उनके अनुरूप सापेक्ष रूप से मूर्त्ति का निर्धारण तथा प्रतिपादन प्राप्त होता है।

बेर-बाप की सबसे छोटी इकाई 'अङ्गुल' कही गयी है। अङ्गुल का मान प्रायः एक इञ्च के समान होता है। अङ्गुल के तीन भेद— 1. मानाङ्गुल, 2. मात्राङ्गुल तथा 3. देहलब्धाङ्गुल- निर्दिष्ट हैं।[5] मानाङ्गुल-माप में परमाणु या अणु सबसे छोटी अन्विति कही गयी है। परमाणु को परिभाषित करते हुए कहा गया है कि गवाक्ष से भीतर कक्ष में आती हुई सूर्य की रश्मियों में दिखने वाले कणों को परमाणु या लवाणु कहते हैं।[6]

मानाङ्गुल प्रमाण (The Measures Angula)

महर्षि मरीचि ने मानाङ्गुलादि अधोलिखित रूप में कहा है—

दिने आदित्यरश्मौ जालकान्तः प्रविष्टे तद्गोचरा अत्यन्तक्षुण्णा लवा अणवः प्रोक्ताः। त एव परमाणवः। परमाणुभिरष्टाभिरथ रेणुः। रथेरण्वष्टगुणितं रोमाग्रम्। रोमाग्राष्टगुणिता लिख्या। लिख्याष्टगुणितं यूकम्। यूकाष्टगुणितं यवम्। यवाष्टगुणितं मानाङ्गुलम्। अर्थात् –

8 परमाणु या अणु = 1 अधरेणु
8 अधरेणु = 1 रोमाग्र
8 रोमाग्र = 1 लिक्ष
8 लिक्ष = 1 यूक
8 यूक = 1 यव
8 यव = 1 अङ्गुलि[7]

खिलाधिकार में मानाङ्गुल की स्थिति अधोलिखित है—

अप्रत्यक्षघना नित्या अणवः परिकीर्तिताः।
अणुभ्यश्च तथाष्टभ्यो रथरेणुर्विनिश्चितः॥
अष्टभ्यो रथरेणुभ्यः केशाग्रमभिधीयते।

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*असिस्टेन्ट प्रोफेसर, धर्मागम विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी

केशाग्रेभ्यस्तथाष्टाभ्यो लिक्षा चेति विनिश्चितः।।
लिक्षाभ्यश्च तथाष्टभ्यो यूका चेति विनिश्चितः।
यूकाभ्यश्च तथाष्टभ्यो यवमध्यमुदाहृतम्।।
अष्टभ्यो यवमध्येभ्यो मानाङ्गुलभुदाहृतम्।।

अर्थात्—

8 अणु = 1 रथरेणु
8 रथरेणु = 1 केश
8 केश = 1 लिक्ष
8 लिक्ष = 1 यूक
8 यूक = 1 यव
8 यव = 1 अङ्गुल

यहाँ अणु को अप्रत्यक्ष नित्यघन अणु कहा गया है।[8]

यज्ञाधिकार के अनुसार मानाङ्गुल प्रमाण का क्रम निम्नवत् है—

8 परमाणु = 1 रथरेणु
8 लिक्षा = 1 यूका
8 रथरेणु = 1 रोमाग्र
8 यूका = 1 यव
8 रोमाग्र = 1 लिक्षा
8 यव = 1 अङ्गुल[9]

2. मात्राङ्गुल

मध्यमपुरुषस्य दक्षिणहस्तस्य मध्यमाङ्गुलेर्मध्यमपर्वणो विस्तारायामं मात्राङ्गुलम् –

अर्थात् दक्षिण हस्त के मध्यमाङ्गुल के मध्य पर्व के दीर्घ का परिमाण 'मात्राङ्गुल' कहा जाता है।[10] मात्राङ्गुल मान को उत्तम बताया गया है।[11]

3. देहलब्धाङ्गुल-लक्षण

बेरोत्सेधं तत्तालवशेन विभज्यैकांशं देहलब्धाङ्गुलम् ।

तालगणन से विभक्त प्रतिमा के आधार पर जो अङ्गुल-मान होता है, उसे देहलब्धाङ्गुल प्रमाण कहते हैं।[12]

अङ्गुलमान का प्रयोग ब्रह्मा आदि देवताओं के प्रतिमान-कल्पन के लिए होता है।[13] मात्राङ्गुल-प्रमाण से गृह-निर्माण, शय्यासन, इध्म, स्रुक् आदि के पात्रों की माप होती है—

गृहं शय्यासनं यानं पात्रमायुधमेव च।
इध्मस्रुक्स्रुवजुह्वादीन् कुर्यान्मात्राङ्गुलेन वै।।[14]

ध्रुवादि प्रतिमा-कल्पन में देहलब्धाङ्गुल मान का प्रयोग होता है—

ध्रुवाद्याः प्रतिमाः सर्वा देहलब्धाङ्गुलेन वै।[15]

शाखाङ्गुल मान का उपयोग अग्निकुण्डादि के निर्माणार्थ होता है[16]—

अग्निकुण्डादिषु स्मृतः।

मात्राङ्गुल का ही प्रभेद शाखाङ्गुल है। यवादि मान का उपयोग गृहार्चन के लिए निर्दिष्ट है।[17]

यवेन च तिलेनैव मितमेतद् गृहार्चने

—यज्ञाधिकार- 19/29.

अङ्गुष्ठ तथा तर्जनी के मध्य की दूरी को प्रदेशमान कहते हैं।[18] अङ्गुष्ठ तथा मध्यमा के बीच की दूरी को तालमान की संज्ञा दी गयी है।[19] अङ्गुष्ठ तथा अनामिका के मध्य के अन्तराल को वितस्तिमान कहा गया है।[20] अङ्गुष्ठ तथा कनिष्ठिका के बीच की दूरी को गोकर्णमान से अभिहित किया है।[21] चौबीस अङ्गुल का एक हाथ होता है, उसी को किष्कुहस्तान कहते हैं।[22] संवृतमुष्टि को रत्निमान कहते हैं।[23] दो यमों से अरत्निमान होता है। प्रसृत-अङ्गुल को अरत्नि कहते हैं।[24]

अरत्निः प्रसृताङ्गुलिः — समूर्त्तार्चनाधिकरण- 22/22.

चार हाथ का दण्ड होता है।[25] 25 अङ्गुल का प्राजापत्य हस्तमान निर्दिष्ट है।[26] 26 अङ्गुल का धनुर्ग्रह, 27 अङ्गुल की धनुर्मुष्टि, यही क्रम दोनों अर्थात् 26 अङ्गुल का धनुर्मुष्टि तथा 27 अङ्गुल का धनुर्ग्रह भी होता है।[27] कपिञ्जलसंहिता में मान का सामान्य निर्देश प्रायः इसी तरह है।[28] शयनादि प्रतिमाओं का कल्पन वितस्तिमान से, देवालय का कल्पन प्राजापत्य हस्तमान से, प्रतिमानिर्माण धनुर्ग्रह या धनुर्मुष्टिमान से, मनुष्य अथवा ब्रह्मा का विग्रह किष्कुहस्तमान से, मनुष्य गृह, देवालय कल्पन हस्तमान से तथा ग्रामादि का कल्पन दण्डमान प्रमाण से करना चाहिए—[29]

शयनादि वितस्त्या च। हस्तेन देवतावासं मनुष्यसदनादिकम्।। दण्डेन ग्रामादीनां विन्यासं कारयेत्।

एक अङ्गुल से आरम्भ कर सत्ताईस अङ्गुल प्रमाण-मान-मात्रादि नक्षत्रपर्यन्त विशेष मान तथा उनके पर्याय का विशद विवेचन वैखानस ग्रन्थों में प्रतिपादित है।[30]

प्रतिमा की ऊँचाई को सुनिश्चित कर दशतालादिसंख्या को द्वादश भाग में विभक्त कर उसके एक भाग को देहलब्ध अङ्गुलमान कहा जाता है—[31]

दशतालादिसंख्यया बेरोत्सेधं विनिश्चित्य तद्द्वाशांशोत्थं मानं देहलब्धाङ्गुलमुच्यते।

मान (Measurement) छः प्रकार का कहा गया है। 1. मान, 2. प्रमाण, 3. उन्मान, 4. परिमाण, 5. उपमान तथा 6.

लम्बमान।[32] यहाँ मान से तात्पर्य 'ऊर्ध्वमान' से है।[33] शरीर के पैर से लेकर सिर तक की ऊँचाई 'ऊर्ध्वमान' के नाम से अभिहित है। प्रमाण का लक्षण तिर्यङ्मान कहा गया है।[34] प्रत्येक अङ्ग के विस्तार (लम्बाई, चौड़ाई, ऊँचाई) को प्रमाण कहा गया है।[35] उन्मान (Thickness) का अभिप्राय प्रत्येक अङ्ग की मोटाई (Diameter) से है।[36] परिधि अथवा विस्तार को परिमाण की संज्ञा दी गयी है।[37] उपमानमान को उपाङ्ग कहा गया है। पीठ, प्रभा, छत्र तथा शङ्ख-चक्रादि आयुध इसके उदाहरण हैं।[38] लम्बमान का लक्षण सूत्रमान साहूलमान बताया गया है।[39]

पाञ्चरात्रागम में मानोन्मानादि शब्द का निरूपण निम्नलिखित रूप में निर्दिष्ट है— 1. मान-उत्तुङ्गमान, 2. उन्मान-विस्तृतमान, 3. प्रमाण-नाभिमान, 4. उपमान-अन्तर्मान, 5. लम्बमान-सूत्रमान।[40]

मान का पर्यायवाची शब्द आयाम, आयत तथा दीर्घ कहा गया है। प्रमाण का समानार्थक शब्द विस्तार, विस्तृति, व्यास, विपुल तथा विशाल वर्णित है। तुङ्ग, उन्नत, उत्सेध तथा उच्छ्राय उन्मान का द्योतक है। परिमाण का पर्यायवाचक शब्द निष्क्रम, निष्कृति, निर्गम तथा परिमाण है। विवर, तीव्र और अन्तर उपमान के परिचायक हैं।[41]

ध्रुवबेर-कल्पन (मूल-विग्रह) के समय षण्मानादि पर विशेष बल दिया गया है। न्यूनातिरेक मूर्त्ति बनने पर उसके परिणाम प्रतिपादित हैं, जो अधोलिखित हैं—

1.	मानहीन	— धनधान्यनाश
2.	मानाधिक	— रोगवर्धक
3.	प्रमाणाधिक या न्यून	— दृष्टादृष्टफलनाश
4.	उन्मानविहीन या अधिक	— पुत्रमृत्यु
5.	परिमाणविहीन या अधिक	— स्त्रीमृत्यु
6.	लम्बमानविहीन या अधिक	— ग्राम-विनाश
7.	उपमानविहीन या अधिक	— राजा की मृत्यु।[42]

अङ्गुलमान के निरूपण के पश्चात् अब तालमान के स्वरूप पर विचार करने का यत्न होगा। तालमान एकताल से शुरू होकर दश ताल तक वर्णित है।[43] ये उत्तम, मध्यमादि भेद से पृथक्-पृथक् प्रतिपादित हैं।[44] किसी भी विग्रह-विशेष के मान को दश भागों में बाँटकर, उसके एक भाग को पुनः द्वादश भागों में विभक्त करने से जो एक भाग होता है, उसके एक भाग को पुनः द्वादश भागों में विभक्त करने से जो एक भाग होता है, उसे अङ्गुल की संज्ञा दी गयी है। अङ्गुल का अष्टमांश यव कहा गया है। द्वादशाङ्गुलक मान ताल के नाम से जाना जाता है। यही ताल मुख्य ताल मान कहा गया है। प्रस्तुत क्रम में दश ताल से विष्णु, ब्रह्मा तथा रुद्र की मूर्ति के मान का विधान है।[45] मध्यमदशतालमान से श्रीदेवी, भूमिदेवी, उमा तथा सरस्वती की प्रतिमा बनाने का निर्देश है।[46] द्वादश आदित्य, चन्द्रमा, एकादश रुद्र तथा अष्ट वसुओं आदि की मूर्तियों का कल्पन अष्टदशतालमान में करने को कहा गया है।[47] सार्द्धनवतालमान से यक्षेश, नवग्रह की प्रतिमा का मान निर्धारित होता है।[48] खिलाधिकार का कहना है कि नवार्द्धताल का उपयोग रवि, स्कन्द तथा इन्द्र की प्रतिमा के लिए है।[49] नवताल से निशाचरों तथा असुरों की प्रतिमा निर्मित होनी चाहिए।[50] प्रकीर्णाधिकार में प्रतिपादित है कि नवतालमान से मुनियों, गणदेवताओं तथा चारणों की प्रतिमा बनानी चाहिए।[51] मनुष्यमूर्त्ति अष्टमान प्रमाण की कही गयी है।[52] बेतालों की सप्ततालमान, प्रेतों की षट्तालमान, कुब्जों की पञ्चतालमान से प्रतिमा के कल्पन का विधान है।[53] चतुस्तालमान से विमानों की प्रतिमा, त्रितालमान से भूतों तथा किन्नरों की प्रतिमा, द्वितालमान से कूष्माण्डों की प्रतिमा तथा एकतालमान से कबन्धों की प्रतिमा के कल्पन का निर्देश है।[54] जहाँ तक दशतालमान के स्वरूप का प्रश्न है, यह 120 अङ्गुल परिमित कहा गया है।[55] यहाँ उत्तम दशतालमान 124 अङ्गुल बताया गया है।[56] मध्यम दशताल 120 अङ्गुल तथा अधम दशताल 116 अङ्गुल का माना गया है।[57]

ऊपर जो प्रतिमा-प्रमाण का विवेचन किया गया है, वह सामान्यतः प्रायः ध्रुवबेर का विषय है। ध्रुवबेर के अतिरिक्त आलयों में कुछ अन्य बेरों की भी चर्चा है। अधिकतर देवालयों में ध्रुवबेर के अतिरिक्त कुछ अन्यान्य बेर भी स्थापित होते हैं। इन बेरों में आराधनामूलक विविध कर्म सम्पादित होते हैं। ये बेर मूलबेर की अपेक्षा लघु होते हैं। कौतुक, स्नपन, उत्सव तथा बलिबेर का मान अधोलिखित है—

''ध्रुवबेरस्योत्सेधं त्रिधा कृत्वा एकांशमुत्तमम्, द्विभागं त्रिधा कृत्वा एकांशं मध्यमम्, तद्द्विभागं त्रिधा कृत्वा एकांशमधमम्, ध्रुवबेरं दशांशं कृत्वा एकांशं तालम्, तत्तालं द्वादशभागं कृत्वा एकांशमङ्गुलं तदङ्गुलेनैकदशाऽङ्गुल समारभ्य त्र्यङ्गुलअधिक षष्ट्यङ्गुलान्तं द्वि-अङ्गुलवृद्ध्या सप्तविंशत्यिङ्गुलान्तानि कौतुकादीनि कारयेत्।''[58]

उपर्युक्त विवेचन से यह स्पष्ट होता है कि विश्व व्यापार के अवयवी परम पुरुष की आवधारणा को विग्रह रूप देकर उस निराकार को साकार किया जाता है, क्योंकि अवयवी नित्य वस्तु है। वह स्वतः अवयवों में समाहित होते हुए भी अपना पृथक् अस्तित्व रखता है। शास्त्र-सम्मत निर्मित साकार विग्रहार्चना से अभ्युदय तथा निःश्रेयस की प्राप्ति हो जाती है। इस प्रकार मूर्त्ति-माप-प्रणाली ऋषियों द्वारा अनुभूत वैज्ञानिक प्रक्रिया है जो पूर्णतया विज्ञान पर आधारित तथा लोककल्याणकारी है। वर्तमान समय में इसकी प्रासंगिकता लन्दन हाईकोर्ट द्वारा निर्णीत प्रसिद्ध नटराज केस पठनीय है—

"Thus the Āgamic text like Marici Samhita, Kamikagama, etc, were found relevant in deciding the case in favour of India, and I was happy that a knowledge of Āgamic sdtudies helped me in proving in a foreign court the famous London Nataraja case.

I would like to state that this is an excellent example of the relevance of Āgamic studies in modern times. There are many intricate questions that require answers based on textual material. In my opinion this study has been neglected far too long and deserves to be given immediate attention." (Relevance of Āgamic studies in Modern Times - A case study, Dr. R. Nagaswamy, Agama Susama, p. 267-274.

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39. विमानार्चनकल्प, पटल 22; अर्चनाधिकार 13.
40. अनिरुद्धसंहिता, 12/1-9.
41. विमानार्चनकल्प, पटल 22 - आयाममायतं दीर्घं मानमित्येकार्थवाचकाः। विस्तरं विस्तारं तारं विस्तृति - विसृर्तिः विस्तृ त ततिः विसृतं व्यासं विसारं विपुलं ततं विष्कम्भं विशालमिति प्रमाणस्य। उच्छ्रयं तुङ्गम् उन्नतमुदयम् उच्छायमुत्सेधम् ऊर्ध्वमित्युमानस्य। निष्क्रमं निष्कृतिर्निर्गमं निर्गतिरुद्गमिति परिमाणस्य। विवरंनीब्रम् अन्तरमित्युपमानस्य।
42. विमानार्चनकल्प, पटल 22 — षण्मानसहितं मुष्यम्। मानहीनं धनधान्यनादानम्। मानाधिकं रोगवर्धनम्। प्रमाणाध्णिकं हीनं च दृष्ट दृष्टफलविनाशनम्। उन्मानविहीनम् अधिकं वा पुत्रविनाशनम्। परिमाणविहीनम् अधिकं वा भार्याविनाशनम्। लम्बमानविहीनमधिकं

वा ग्रामविनाशनम्। उपमानविहीनमधिकं वा नृपनाशनम् स्यात्।

43. खिलाधिकार, 15/1 2-1 3 — ''दशतालं सार्धनवमष्ट सप्ताथ षट्क्रमात्। पञ्चतालं चतुरस्तालं त्रितालं चाभिधीयते।''
44. ज्ञानकाण्ड, अध्याय 50 — उत्तममध्यमाधमभेदेन दशतालं त्रिविधं भवति।
45. ज्ञानकाण्ड, अध्याय 50 — विष्णुब्रह्मरुद्राणां दशतालम्।
46. विमानार्चनकल्प, पटल 22; ज्ञानकाण्ड, अध्याय 50— श्रीभूम्योरुमासरस्वत्योश्च मध्यमं दशतालम्।
47. विमानार्चनकल्प, पटल 22-23.
48. विमानार्चनकल्प, पटल 22.
49. खिलाधिकार, 15/194 - रविस्कन्देन्द्राणां नवार्धतालम्।
50. विमानार्चनकल्प, पटल 22; ज्ञानकाण्ड, अध्याय 50— निशाचराणामसुराणां च नवतालम्।
51. प्रकीर्णाधिकार, 9/41 — नवतालैर्मुनीश्चैव गणांश्चैव तु मानयेत्। उरगाश्चारणायश्चान्ये नवतालमितोदयाः।।
52. विमानार्चनकल्प, पटल 22; यज्ञाधिकार, 19/21— मर्त्यानामष्टतालम्। अष्टताला नरा ज्ञेयाः।
53. विमानार्चनकल्प, पटल 22; ज्ञानकाण्ड, अध्याय 50; यज्ञाधिकार, 19/21 — वेतालानां सप्ततालम्। प्रेताना षट्तालम्। कुज्ञानां पञ्चतालम्।
54. विमानार्चनकल्प, पटल 22; ज्ञानकाण्ड, अध्याय 50; प्रकीर्णाधिकार, 9/41; यज्ञाधिकार, 19/21.
55. खिलाधिकार, 15/198.
56. विमानार्चनकल्प, पटल 22; यज्ञाधिकार, 19/23.
57. विमानार्चनकल्प, पटल 22; यज्ञाधिकार, 19/24.
58. विमानार्चनकल्प, पटल 22.

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शिखा धारण की वैज्ञानिकता

अरुण कुमार त्यागी एवं प्रो० उषा शर्मा***

भारतीय संस्कृति में संस्कारों की पद्धति और स्वरूप-निरीक्षण, अनुभव तथा विज्ञान पर आधारित है। अति प्राचीनकाल में संस्कारों की पद्धतियाँ विस्तृत तथा विशिष्ट थीं, जिनका निश्चित उदय सुदूर अतीत के अन्तराल में निहित है, किन्तु यह निश्चित है कि सामाजिक आवश्यकताओं में संस्कारों का जन्म हुआ और कालक्रम से उन्हें धार्मिक आवरण प्राप्त हो गया। प्राचीन समय में सामाजिक संस्थाएँ, विश्वास, भावना, कला तथा विज्ञान आदि सभी एक दूसरे से मिश्रित थे, इसी कारण संस्कारों ने जीवन व विज्ञान को अपनाया-

संस्कारो हि नाम संस्कार्यस्य गुणाधानेन
वास्याद् दोषापनयनेन वा॥[1]

इसी जीवन व विज्ञान का द्योतक शिखा स्थापन है जो चूडाकर्म के अन्तर्गत आता है। 'चूडा क्रियन्तेऽस्मिन्' इस विग्रह के अनुसार चूडाकर्म का अभिप्राय है, जिसमें बालक को चूडा अर्थात् शिखा दी जाए, अमरकोष के 'शिखा चूडा शिखण्डस्तु'[2] इत्यादि श्लोकानुसार चूडा का अर्थ शिखा से हैं। वैदिक साहित्य में भी इसके अनेक प्रमाण हैं-

शिवो नामासि स्वाधितिस्ते पिता।[3] यत क्षुरेण मर्चयता सुतेजसा।[4], तृतीयेऽशब्दे चूडाकर्म।[5], चूडाकर्या यथाकुलम्।[6], चूडाकर्म कुलोचितम्।[7]

इस प्रकार शास्त्रों के उद्धरणों से प्रमाणित होता है कि शिखा स्थापन समाज का कितना महत्त्वपूर्ण अङ्ग था, किन्तु जगत् की परिवर्तनशीलता से प्रभावित होकर भारतीय संस्कृति के मानदण्डों में भी परिवर्तन हो गया और यह शिखास्थापन धर्म विशेष, रुढ़िवादिता व आडम्बर के रूप में परिणत हो गया। शिखा शब्द √शिख् गत्यर्थक धातु से बनता है जिसका अर्थ है, शिखा अर्थात् ब्रह्मरन्ध्रस्थ बालों के द्वारा जीवनशक्ति का आना और जाना है।

''तत्सृष्टवा तदेवानुप्राविशत्''[8] इस मन्त्र में बताया गया है कि मनुष्य शरीर में ब्रह्मरन्ध्र के शिखा भाग द्वारा परमात्मा का प्रवेश होता है जिस परमात्मा को जीवात्मा कहते हैं। इसकी प्रमाणिकता में विज्ञान का यही नियम है कि मनुष्य या प्राणिमात्र जब गर्भ स्थिति में रहता है तब प्रथम शिर की रचना होती है, बाद में अन्य अङ्गों की। शिखा धारण का रहस्यमय कारण विज्ञान ही था। जिसमें प्रमाणित किया गया है कि जो मस्तिष्क की मॉस पेशियाँ हैं वे प्रायः कोमल होती हैं उनमें जितनी शीघ्रता से गर्मी और सर्दी प्रवेश करती है, उतनी किसी स्थान में नहीं कर सकती। शिखा धारण वीर्य रक्षा के लिए अत्यन्त उपयोगी है-

तेन ते आयुषे वपामि सुश्लोकाय स्वस्तये।[9]

शिखा स्थापन की विमुखता के कारण ही वर्तमान नर समाज विलासिता की ओर अग्रसर हो रहा है। शिखा की गति ऊर्ध्व हुआ करती है जैसे दीपक की शिखा। जिस प्रकार दीपक अपनी शिखा द्वारा धुएँ के रूप में पापरूपी दोष को निर्गत करता है ऐसे ही शिखा भी ब्रह्मरन्ध्र से पापरूपी धुएँ को निकालकर अन्त में अपने यथेष्ट को पहुँचाती है।[10] इसी शिखा के द्वारा-

चिद्रूपिणि! महामाये दिव्यतेजः समन्विते!
तिष्ठ! देवि! शिखामध्ये तेजो वृद्धिं कुरुष्व मे॥[11]

शिखा बाहर की सर्दी या गर्मी को मस्तिष्क में प्रविष्ट नहीं होने देती है, क्योंकि केशों में ऊन के सभी गुण विद्यमान हैं जैसे ऊन पर पानी कम ठहरता है वैसे ही बालों में भी पानी कम ठहरता है। विज्ञान में प्रमाण दिया है कि पशु-पक्षियों की गर्मी को पंख ऊनी तन्तु की भाँति शारीरिक गर्मी को बाहर नहीं निकलने देते वैसे ही शिखा पर स्थित बालों का व्यापार है, तात्पर्य यह है कि जीवन क्रम के प्रचलित स्वरूप को परिवर्तित करने का वैज्ञानिक व मनोवैज्ञानिक माध्यम चूडाकर्म व शिखा स्थापन है। वैज्ञानिक इस कारण से कि विधान करते समय मंत्रों का उच्चारण यज्ञ, कर्मकाण्ड शिर संस्थान के तन्तुओं को अमुक दिशा व मस्तिष्क के गहन अन्तराल में भी हलचल मचाती है इस कारण भावात्मक परिवर्तन सरल हो जाता है।

यज्ञादि में शिखा स्थापन का प्रमुख वैज्ञानिक रूप है कि यज्ञादि द्वारा अमोघ तेज प्राप्त होता है, जिससे शरीरगत उष्णता प्रबल हो जाती है, जिसे बाहर जाना ही चाहिए। इस उष्णता को निष्क्रमण मार्ग देने के लिए शिखा आवश्यक है। The Harmonialman पुस्तक में अमेरिकन डॉक्टर Andrew Jection Devis बताते हैं कि सिर, दाढ़ी, मूँछ के बालों को ईश्वर ने वीर्य रक्षा के लिए बनाया है। उनके अनुसार जिसके सिर पर बाल और दाढ़ी मूँछ के बाल बड़े होते हैं उनकी शारीरिक वीर्य वृद्धि इतर मनुष्यों से अच्छी पायी जाती है, इसका रक्षण कृत्रिम उपायों से नही हो सकता।[12] मस्तिष्क विद्या के आचार्यों का कथन है कि शिखा स्थान मस्तिष्क की नाभि है। इसे हृदय भी कह सकते है। इस केन्द्र से उन सूक्ष्म तन्तुओं का संचालन होता है जिनका प्रसार समस्त मस्तिष्क में हो रहा है। इस केन्द्र स्थान से सम्बन्धित चार दिशाओं में पॉच शक्तियाँ रहती हैं- 1. विवेक शक्ति, 2. दृढ़ता शक्ति 3. दूरदर्शिता शक्ति, 4. प्रेम शक्ति, 5. संयम शक्ति, इन पांचों की जड़

*शोधच्छात्र, संस्कृत विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी
**प्रोफेसर, संस्कृत विभाग, काशी हिन्दू विश्वविद्यालय, वाराणसी

शिखामूल में है। शिखा मस्तिष्क का हृदय होने व शक्ति केन्द्र के कारण इसका महत्व शरीर के सब स्थानों से अधिक है।''[13]

अन्तरेण तालुके य एषः स्तन इव अवलम्बते स इन्द्रयोनिः। अत्र असौ केशान्तो विवर्तते, व्यपोह्यशीर्षकपाले।[14]

इस प्रकार इस मर्म स्थान की सब प्रकार से रक्षा करनी चाहिए, इस स्थान को सुरक्षित रखने की सर्वोत्तम युक्ति **'केशाच्छादित'** रखना है। इस प्रकार शिखा स्थान पर बाल रखने से बाहरी सर्दी-गर्मी का अनावश्यक प्रभाव मस्तिष्क पर नहीं होता है।

प्रत्येक वस्तु का एक केन्द्र होता है जो उसका मर्म स्थान कहलाता है। इस केन्द्र की बनावट चक्राकार होती है। फल जिस स्थान पर डंठल से जुड़ा होता है, वह उसका केन्द्र है। जड़ व चैतन्य सभी का एक केन्द्र होता है और उसी के ऊपर सत्ता निर्भर रहती है। मस्तिष्क का केन्द्र शिखा स्थल है। सर्वव्यापी आत्मा का मनुष्य शरीर में जो प्रधान स्थान है, वह शिखामूल ही है। इस स्थान पर शिखा रूपी मन्दिर अनिवार्य है।

वट वृक्ष की जटाएँ उसे प्रतिदिन परिपुष्ट बनाती हैं। पत्तियाँ उसके निमित्त प्राणवायु खींचती हैं, इसी प्रकार मनुष्य शरीर पर जो बाल हैं वे छिद्र युक्त हैं और आकाश से प्राणवायु प्राप्त करते हैं। पशु-पक्षी भी अपने बालों को खुला रखते हैं जिससे उनकी रोग प्रतिरोधक क्षमता अधिक होती है। इस कारण से शरीर के अन्य स्थानों की अपेक्षा शिर के बाल, उनमें भी शिखा स्थान का सर्वोपरि महत्त्व माना गया है।[15]

योगशास्त्र के सिद्धान्त के अनुसार शिर पर ब्रह्मरन्ध्र है और ब्रह्मरन्ध्र के बराबर सहस्रदल कमल में आत्मा का केन्द्र स्थान है। यहाँ उच्च सात्विक, आध्यात्मिक शक्तियाँ निवास करती हैं। उनकी रक्षा करने के लिए गौ-खुर के बराबर शिखा रखनी चाहिए।[16]

मस्तिष्क पर हुए वैज्ञानिक शोधों ने शिखा स्थान को वही महत्ता प्रदान की है, जिसे हिन्दुओं ने श्रद्धावश प्रदान किया है। सुप्रसिद्ध वैज्ञानिक नेल्सन ने अपनी विश्व विश्रुत पुस्तक 'ह्यूमन मशीन' में तंत्रिका जाल (रेयेक्युलर फ्रार्मेशन) पर विस्तार से प्रकाश डालते हुए बताया है कि शरीर में सतर्कता के सारे कार्यक्रमों का नियमन शिखा-स्थान से होता है। जैसे ही यह स्थान अपने आस-पास के वातावरण, जल-वायु आदि में तनिक भी परिवर्तन अनुभव करता है, वैसे ही यह उसे समझकर और परिवर्तन के अनुसार शरीर में समायोजित करता है।

शरीर-रचना के सम्बन्ध में विज्ञान वेत्ताओं ने निष्कर्ष निकाला है कि क्रिया का सम्बन्ध तन्तु जाल से ही है। हमारे मस्तिष्क के पार्श्विक भाग में तृतीय स्थान शून्य स्थान की सतह मेहुला आब्लॉ गेरा (सुषुम्ना) से लेकर हाइपोथैलमस तक एक रचना पाई जाती है, जिसका नाम 'रेटीकुलर फार्मेशन' है। रेटीकुलर का अर्थ है- जाल। यह जाल सभी रीढ़धारी जानवरों में पाया जाता है। इस जाल का निर्माण बहुत सी नाड़ी तन्तुओं के समानान्तर रूप से एक ही केन्द्र की ओर जाने से होता है। यह दो भागों में विभक्त है। जब सभी नाड़ी तन्तु अलग-अलग इन्द्रियों जैसे आँख, नाक, कान स्पर्शेन्द्रियों संकुचन व प्रसारण वाली मांस-पेशियों से निकल कर आगे बढ़ते हैं, तो वे सब मध्य मस्तिष्क में नाड़ी गुच्छक की तरह एक स्थान पर मिल जाते हैं, इसे 'सेन्ट्रफ्युगल फार्मेशन' कहते हैं। पुनः उसी भाग से नाड़ी जाल ऊपर की ओर सेन्ट्रपीटल रूप में ऊपर की ओर 'सेरेबलकारटेक्स' जो शरीर की सम्पूर्ण संवेदना का ग्रहण, नियमन और नियंत्रण करने वाला आश्चर्यजनक भाग मस्तिष्क ऊपर की ओर चलता है और उसमें सर्वत्र फैल जाता है। दोनों नाड़ी जाल जिस बिन्दु तक पहुँचते हैं, उससे 90 डिग्री का कोण बनाते हुए एक रेखा ऊपर खींची जाये तो यही भाग चोटी का होगा।

इससे स्पष्ट है कि बाह्य परिवर्तनों का संग्राहक और व्यवस्थापक ही नहीं अनेक विलक्षण अनुभूतियों का मार्ग भी यह शिखा स्थान है, इसे ही सूक्ष्म तरंगे प्रभावित करती हैं। इसीलिए यदि यह कहा जाये कि समाधि अवस्था के अतीन्द्रिय ज्ञान, ध्यान द्वारा आकाश स्थित सूक्ष्म शक्तियों का आकर्षण का यह मूल बिन्दु है तो उससे किसी को आश्चर्य नहीं होना चाहिए।

दीमक भी दिन भर कार्य करती है और वर्षा काल से पहले व्यापार बन्द कर देती है एवं अपने बिल में चली जाती है यह जानकारी उसे तन्त्रिका जाल से ही मिलती है।

इंग्लैण्ड से छपने वाली विज्ञान-पत्रिका 'नेचर' के एक अङ्क में दो अमेरिकी विद्वानों द्वारा प्रकाशित लेख में एक प्रयोग का प्रमाण देकर यह सिद्ध किया गया कि यदि मस्तिष्क के इस केन्द्र को (शिखा-स्थान) अत्यधिक संवेदनशील बना दिया जाये। जो सभी ज्ञानेन्द्रियों की संवेदनाओं को ग्रहण करता है और उनके अनुरूप प्रतिक्रिया व्यक्त करता है, तो जो कार्य आँख, नाक, त्वचा आदि करती हैं वह अपने आप में किया जा सकता है कि

''मस्तकाभ्योन्तरोपरिष्टात् शिरासम्बन्धिसन्निपातो रोमावर्तोऽधिपतिस्तत्रापि सद्यो मरणम्।''[17]

सुश्रुत के अनुसार 'मस्तिष्क' के भीतर ऊपर की ओर शिरा तथा सन्धि का सन्निपात है, वही रोमावर्त में अधिपति है। इस अङ्ग को किसी भी प्रकार का आघात लगने पर तत्काल मृत्यु हो जाती है। अतः इस महत्वपूर्ण अङ्ग की सुरक्षा आवश्यक मानी जाती थी तथा उसी अङ्ग पर शिखा रखने से इस प्रयोजन की पूर्ति हो जाती थी।

एशियाई देशों में आज भी शिखा स्थापना प्रथा प्रचलित है यहाँ के लोग आज भी केशों का गुच्छ सिर पर रखते हैं।[18] राजा रणजीत सिंह और जनरल वेन्टुरा की उपस्थिति में सन्त हरिदास ने एक माह की समाधि लगायी थी। जब वे बाहर निकले थे तब डाक्टरों ने उनकी जाँच करते समय पाया कि उनकी चोटी वाले स्थान का तापमान इतना अधिक था कि उसे स्पर्श भी नही किया जा सकता था।[19]

इससे चिकित्सक वर्ग ने प्रमाणित किया कि समाधि की स्थिति में सांस लेने की क्रिया और उत्सर्जन क्रिया (शरीर का प्रत्येक सेल बदलता रहता है, उसे उत्सर्जन क्रिया कहते हैं) रोक कर उन्हें यथावत स्थिति में रखने का काम तक इस शिखा द्वारा किया जा सकता है। इस अवस्था में शरीर का सारा पोषण सूक्ष्म आकाश से होता है, साथ ही आत्मचेतना का बाह्य जगत् से मुक्त सम्बन्ध तक जुड़ जाता है। यह इस बात के प्रमाण है कि अनन्त शक्तियों से सम्पर्क और दुरानूभूतियों का केन्द्र भी शिखा स्थान है। इस स्थान को भारतीय उपासना पद्धति में संवेदनशील बनाने के लिए इसका अनिवार्य विधान किया गया है।

अमेरिकी वैज्ञानिकों ने एक बिल्ली के 'रेटिक्यूलर फार्मेशन' नामक तंत्रिका जाल वाले बिन्दु पर स्टेनलेस स्टील के महीन तार जोड़ दिये, और उसकी छाती पर गीगर काउन्टर (एक विकिरण मापक यंत्र) बाँध दिया। इसके बाद कमरे में एक कोने में एक छोटा सा विकिरण स्रोत लगा दिया। जब तक बिल्ली दूर रही तब तक वह सामान्य रही जैसे ही स्रोत से पांच फुट पर आयी, तो तीव्र झटका उसे लगा और वह पीछे डर कर रह गयी।

इसके निष्कर्ष से वैज्ञानिकों ने कहा कि मस्तिष्क की आँख सूक्ष्म विकिरण तक देख सकने में समर्थ है। योगशास्त्रों में उसे ही सहस्त्रासार कमल पर बैठे हुए भगवान् शिखा-शक्ति माना गया, वही देखता, सुनता, चलता-फिरता और सभी कार्यों का कर्माध्यक्ष हो इसलिए केन्द्र को जितना अधिक संवेदनशील बना सकते हैं, संसार के रहस्यों आत्मा के रहस्यों, भूत और भविष्य में होने वाली घटनाओं की सत्य संज्ञानता को उतना ही अधिक स्पष्ट और पूर्णतः सत्य देख-सुन एवं अनुभव कर सकते हैं। शुद्ध हुए इस संस्थान की सहायता से योगी एक-एक दिन की भविष्यवाणी कर सकने में समर्थ होते है।[20]

ब्रह्माण्ड के लिए एरियल या ट्रान्समीटर शिखा है इसलिए इसे आध्यात्मिकता का मूल बिन्दू मानकर इतना महत्त्व दिया है। जिसे हम शिखा स्थान कहते हैं, और वैज्ञानिक इसे 'रेटीकुलर फार्मेशन'। फ्रांसीसी वैज्ञानिक प्रो0 डेल्गाडो ने निष्कर्ष दिया कि समस्त सुख-दुःखों का केन्द्र भाग मस्तिष्क के इसी भाग से सम्बन्धित है। हारमोन विज्ञान ने यह सिद्ध कर दिया है, कि मनुष्य की प्रसन्नता ही नहीं शारीरिक स्वास्थ्य तक भावनाओं और विचारों के अच्छे बुरे होने पर निर्भर है। निकृष्ट विचार, कुत्सित भावनाओं से शरीर में दूषित रसायनों का स्राव होता है, जबकि पवित्र और अच्छी भावनाओं से अच्छे हारमोन शरीर को स्वस्थ और संतुलित रखते एवं जीवन को समृद्ध बनाते है।[21] इस प्रकार सबका केन्द्र भी तन्त्रिका जाल है। इसकी विशेषता यह है, कि क्रमबद्ध एक ही विषय के सैकड़ों विचार एकत्रित कर सकते हैं। प्रयोग में देखा गया है कि यदि रक्त में कार्बनडाई आक्साइड या एड्रिनलीन की मात्रा बढ़ा दी जाये तो इस जाल की क्रियाओं पर प्रभाव पड़ता है और इससे उसकी गति तीव्र हो जाती है। जिससे चित्त की चञ्चलता व अस्थिरता बढ़ जाती है, तथा समप्रवाह तीव्र गति से होने लगता है।

नेल्सन ने इस जाल की गतिविधियों को उत्तेजना की गति का समानुपाती माना है अर्थात् यह भाग जितना अधिक सूक्ष्म संवेदनशील होगा बाह्य जगत् की सूक्ष्म संवेदनाओं से भी हम उतने ही प्रभावित होंगे।[22]

शिखा व्यक्ति को ब्रह्म से, व्यष्टि-समष्टि और अपनी सूक्ष्म क्षमताओं को अनन्त क्षमताओं से जोड़कर लाभान्वित होने का माध्यम है। उसकी जितनी महिमा कही जाये कम है। आज लोग इस महत्त्व को भूलते जा रहे हैं। जबकि शिखा स्थापन वैज्ञानिक लाभ का ही पर्याय है।

मस्तिष्क का वह केन्द्र बिन्दु जहाँ मेरुदण्ड एवं मस्तिष्क के स्नायु तन्तु परस्पर सम्बद्ध होते हैं। उस स्थान को हमारी मानसिक शक्तियों का उद्गम स्थान माना जाता है। वह पृथ्वी के उत्तरी ध्रुव की तरह सन्तुलन संस्था एवं शक्ति केन्द्र भी हैं। इस स्थान की सुरक्षा उच्चस्तरीय भावनाओं की सुरक्षा के लिए सूक्ष्मदर्शी ऋषिओं ने अत्यन्त आवश्यक मानी है।

उस संस्थान की ऋतुओं के प्रभाव या मामूली चोट आदि से रक्षा होती रहे इसलिए इस स्थान पर कोमल गद्दी की ढाल स्वरूप चोटी रख दी जाती है। इसके फलस्वरूप हमारा श्रद्धा केन्द्र बना रहता है और हमारी आदर्शवादिता शिथिल नहीं होती है। यह तत्त्व इस आधुनिक सभ्य समाज में भी चोटीधारी सारे संसार के निवासियों की अपेक्षा अब भी कही अधिक है। मेरुदण्ड का शीर्ष बिन्दु जिसे योगी पुरुष सहस्त्र कमल मानते है,आध्यात्म शास्त्र की दृष्टि से अत्यन्त प्रभावशाली संस्थान है- उस संस्थान पर आने वाले बालों को काटने से वहाँ विकृति एवं अनावश्यक हलचल पैदा होती है। कटे हुए बालों की जड़ पुनः सक्रिय होती है, उनकी यह सूक्ष्म हलचल कामुकता, कामवासना, क्रोध आदि दुर्वृत्तियों को प्रोत्साहन देती है यह हलचल हमारी आन्तरिक श्रेष्ठता में बाधा पहुँचाती है। शिखा स्थान के बाल कटवाने से मस्तिष्क की जड़ों में हलचल और मस्तिष्क से सम्बन्धित वासना तन्तुओं से प्रवेश कर जाती है, फलस्वरूप कामवासना भड़क जाती है। इस अनिष्ट से परिचित होने के कारण ऋषिजन पञ्चकेश रखते थे शिर पर जटा, दाढ़ी, मूँछ, बगल में बाल तथा गुप्त स्थानों के बाल और जिससे इन्द्रियों पर नियंत्रण पाने में भी बड़ी सहायता मिलती थी। मस्तिष्क में भी ऐसी उत्तेजना का उदय बाल काटने से होता है। अतः सिर पर बाल रखने और शिखा रखने से कामवासना संयमित रहती है।

शिखा हमारी ज्ञान शक्ति को चैतन्य रखते हुए उसे सर्वदा अभिवृद्धि की ओर अग्रसर करती है। यह विज्ञानानुकूल बात है, कि काली वस्तु सूर्य की किरणों में से अधिक ताप तथा शक्ति का आकर्षण किया करती है। श्वेत व कृष्ण वर्ण के वस्त्र व पात्र इसके उदाहरण है। काली वस्तु में सूर्य किरणों को विशेष रूप से अपने में आत्मसात् करने की शक्ति होती है। शिखा का काला रंग सूर्य से

मेधा प्रकाशिनी शक्ति का विशेष आकर्षण करके ऊर्ध्वाभिमुखी बुद्धि को और भी उन्नत करने में सहायक होता है।[23]

शारीरिक विज्ञान के अनुसार जिस स्थान पर शिखा रखी जाती है उसे पिनल ज्वैंड कहा जाता है इसके नीचे एक विशेष प्रकार की ग्रंथी होती है जो पिचुइट्री कहलाती है। इसी ग्रन्थी में विशेष प्रकार का रस बनता है जो स्नायुओं द्वारा सम्पूर्ण शरीर में व्याप्त होकर शरीर को विकसित और बलशाली बनाता है। शिखा द्वारा इन ग्रन्थियों को अपना कार्य करने में बड़ी सहायता प्राप्त होती है एवं वे चिरकाल तक अपना कार्य करती रहती है। विगत वर्षों में इस सम्बन्ध में पाश्चात्य वैज्ञानिकों ने जो खोज की है और वे जिस परिणाम तक पहुँचे हैं इसका कुछ आभास उनके लेखों के अनूदित उद्धरणों से सम्यक प्रकार से परिलक्षित होता है।

सर चार्ल्स ल्यूक्स के अनुसार- ''शिखा का शरीर के उस आवश्यक अङ्ग से बहुत सम्बन्ध है, जिससे ज्ञान वृद्धि और सम्पूर्ण अङ्गों का संचालन होता है जब से मैंने इस विज्ञान की खोज की है, तभी से मैं स्वयं चोटी रखता हूँ।''[24]

डॉ0 हाव्वमन के अनुसार- ''मैंने कई वर्षों भारत में प्रवास कर भारतीय संस्कृति का अध्ययन किया है। यहाँ के निवासी प्राचीन काल से शिर पर चोटी रखते है, जिसका वर्णन वेदों में भी पाया जाता है। दक्षिण में तो आधे सिर पर 'गोखुर' के समान चोटी रखते हैं। उनकी बुद्धि की विलक्षणता देखकर मैं प्रभावित हूँ। शिर पर चोटी या बाल रखना अत्यन्त लाभदायक है। मेरा तो हिन्दूधर्म में अगाध विश्वास है। मैं स्वयं भी चोटी रखने का आदि हो गया हूँ।''[25]

सुप्रसिद्ध डॉ0 आई0ई0 क्लार्क, एम0ए0डी0 ने लिखा है- 'जब मैं चीन भ्रमण करने गया तो वहां मैंने देखा कि चीनी लोग भी भारतीयों के समान अर्द्ध शिर से ज्यादा पर बाल रखते हैं। मैंने जब से इस विज्ञान की खोज की है उसी क्षण से मैं विश्वस्त हो गया कि हिन्दुओं का हर नियम विज्ञान से परिपूर्ण है। चोटी रखना हिन्दुओं का धर्म नहीं सुषुम्ना के केन्द्रों की रक्षा के लिए ऋषि-मुनियों की विलक्षण खोज का चमत्कार है।'

इसी प्रकार मि0 अर्ल थामन ने अलार्म पत्रिका, 1921 के वार्षिकांक में पृष्ठ सङ्ख्या 1994 पर लिखा है-

''सुषुम्ना की रक्षा हिन्दू लोग शिखा रखकर करते हैं जबकि अन्य देशों में लोग शिर पर लम्बे बाल रखकर या हैट लगाकर इसकी रक्षा का प्रयत्न करते हैं। इन सब में चोटी रखना सर्वाधिक महत्वपूर्ण है।[26] वट वृक्ष की जटायें और वृक्षों की पत्तियाँ अपने सूक्ष्म छिद्रों से हवा और प्रकाश कण खींचती है जिनसे उनमें प्रकाश संश्लेषण की क्रिया होती है और वे अपना विकास करती है इसी प्रकार शिखा के बाल देखने में अत्यन्त सूक्ष्म व छिद्रयुक्त होते है और जो कि सम्पूर्ण शरीर के पोषक हैं।

पाश्चात्य विज्ञान वेत्ताओं व आध्यात्मिक सिद्धान्तों पर दृष्टिपात करने से ज्ञात होता है कि शिखा स्थापन का कोई साधारण प्रयोजन नहीं था। हमारे इस शिखा विज्ञान का ही प्रत्यक्ष फल है कि भारतीय ऋषियों का उत्कृष्ट चिन्तन उनके उन्नत मस्तिष्क होने का साक्षी है। उन्होंने इस शिखा सिद्धान्त को ऊँचे-ऊँचे मन्दिर शिखरों पर भी प्रयोग किया तथा आकाश से गिरने वाली विद्युत् के वेध को रोकने के प्रयोजन वश मन्दिरों के शिखरों पर कलश, चक्र, त्रिशूल आकृतियाँ बनाकर वर्तुल वेध सिद्धान्त को सिद्ध किया। इतिहास इसका प्रमाण है कि हमारा कोई भी प्राचीन मन्दिर बिजली पात से भूमिसात् नहीं हुआ है। पाश्चात्य विज्ञान वेत्ताओं ने भी ऊँची मीनारों की रक्षा के लिए हमारा शिखा सिद्धान्त अपनाया।

शिखा धारण प्रथा का आज ह्रास हो रहा है और हिन्दू जाति के अतिरिक्त अन्य जाति के पुरुष इस शिखा विज्ञान से विमुख हो गये हैं। वैदिककाल से वर्तमान तक ऐसा प्रमाण नहीं मिलता है, जिसमें किसी के लिए शिखा का निषेध किया गया हो लेकिन कालांतर में परिवर्तन के प्रवाह में यह संस्कार धर्म व जाति विशेष का चिह्न हो गया है। भारतीय मनीषियों का ऐसा प्रयोजन कदापि न रहा होगा। उनके लिए 'सर्वजनसुखाय' की भावना इष्ट रही होगी। हमारे ऋषि वैज्ञानिक थे। उन्होंने जीवन को जन्म के पूर्व से लेकर मरणोत्तर जीवन तक संस्कारों को विज्ञान सम्मत प्रक्रिया के साथ इस प्रकार अविच्छिन्न रूप से जोड़ दिया कि जीवन यात्रा में निरन्तर परिशोधन-प्रगति के अतिरिक्त किसी का अनिष्ट न हो पाये।

किसी और सभ्यता या संस्कृति में इतना गूढ़ वैज्ञानिक व दार्शनिक समावेश नहीं देखा जा सकता जिससे कि गुण सूत्र, (जीन्स) तक प्रभावित होते हैं। विज्ञान प्रमुखतया उन नियमों की खोज करता है, जिनसे संपूर्ण जगत् संचालित हो रहा है। इस देव संस्कृति का भी यही प्रयास रहा। इसने अध्यात्म के साथ विज्ञान को भी इस जगत् का सत्य जानने का माध्यम बनाया। वेदों के आरम्भ में सृष्टि की सृजन प्रक्रिया के प्रति जिज्ञासा व्यक्त की गयी। ऋषि जीवन के प्रत्येक सत्य को जानने के लिए सतत् प्रयासरत रहे। उनके द्वारा अनुभूत भौतिक विज्ञान के अनेक सत्य आज भी संपूर्ण विश्व को आश्चर्यचकित करते हैं। शिखा-विज्ञान इस सभी का प्रमाण है।

आज हम शिखा विज्ञान के महत्त्व को विस्मृत कर चुके हैं तो हमारी बौद्धिक क्षमताएँ सुषुप्त पड़ी हैं; हमारी दूरदर्शिता हमें त्याग कर अपने गन्तव्य को चली गयी है। लोग मानवेतर जीवों की भाँति ही स्थूल इन्द्रियों के विषय में मर्मज्ञ हैं। जबकि शिखा स्थापन इस अमूल्य जीवन के भौतिक व आध्यात्मिक पक्ष का अक्षय भण्डार है। जिससे हम अज्ञानतावश विमुख हो रहे हैं।

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मनोविकार से मुक्ति में योगशास्त्र की वैज्ञानिकता

*डॉ. शशिकान्त द्विवेदी**

आयुर्वेदीय चिन्तन में स्वास्थ्य का चरमोत्कर्ष ही मोक्ष है। चिकित्सकीय दृष्टि से स्वास्थ्य शरीर, सत्त्व तथा आत्मा की ''समत्व''पूर्वक सुखावह अवस्था है। वस्तुतः प्राच्य स्वास्थ्य विज्ञान ''समत्व'' के सिद्धान्त पर आधारित है। योगशास्त्र में मानसिक साम्य को महत्त्व देते हुए ''पूर्ण स्वास्थ्य'' की अवधारणा उपस्थित की गयी है। जैसा कि –

समदोषः समाग्निश्च समधातुमलक्रियः।
प्रसन्नतेन्द्रियमनाः स्वस्थ इत्यभिधीयते॥ सुश्रुत सूत्र 15

रोगस्तु दोषवैषम्यं, दोषसाम्यमरोगता।

भावप्रकाश, मिश्रप्रकरण, 6/1

दोषधातुमलानां या साम्यकृत्सैव रोगहृत।

भावप्रकाश, मिश्रप्रकरण, 6/11 इत्यादि

जिस प्रकार स्थूल शरीर में अनेक प्रकार के रोग होते हैं, उसी प्रकार सूक्ष्म शरीर में भी अनेक प्रकार के रोग होते हैं। प्राच्य परम्परा में मानव जीवन के स्वास्थ्य और कल्याण के लिए मन, वाणी तथा काय को प्रमुख घटक स्वीकार किया गया है। जीवन के सारे क्रियाकलाप एवं स्वास्थ्य इन्हीं पर निर्भर हैं। इसलिए इन तीन घटकों की शुद्धि हेतु योगशास्त्र, व्याकरण, एवं आयुर्वेद नामक विद्याओं का विकास किया गया। जैसा कि चरकसंहिता में शारीरिक व्याधि के निवारण के लिए आयुर्वेदशास्त्र एवं मानसिक व्याधि के निवारण के लिए ज्ञान, विज्ञान, धैर्य, स्मृति और समाधि को बताया गया है।

वायुः पित्तं कफश्चोक्तः शारीरो दोषसंग्रहः।
मानसः पुनरुद्दिष्टो रजश्च तम एवं च॥
प्रशाम्यत्यौषधैः पूर्वो दैवयुक्तिव्यपाश्रयैः।
मानसो ज्ञानविज्ञानधैर्यस्मृतिसमाधिभिः॥

चरकसंहिता, सूत्रस्थान, 56-57

इस प्रकार से मन को शुद्ध करने का सर्वोत्तम साधन योगशास्त्र है। इसके द्वारा वैज्ञानिक रूप से मानसिक रोगों से मुक्ति सम्भव हो सकती है। सर्वप्रथम इन मानसिक रोगों के उत्पन्न होने का क्या कारण है इस पर रामचरितमानस में बहुत ही स्पष्ट तरीके से स्पष्ट किया गया है ।

श्रीरामचरितमानस के उत्तरकाण्ड में गरुडजी काकभुशुण्डि से इस प्रकरण में कहते हैं –

मानस रोग कहहु समुझाई। तुम्ह सर्वग्य कृपा अधिकाई॥

रामचरितमानस 7/121/28 पृ. 537

इस पर श्रीभुशुण्डिजी वहीं कहते हैं-

सुनहु तात अब मानस रोगा। जिन्ह ते दुख पावहिं सब लोगा॥

रामचरितमानस 7/121/28 पृ. 537

मानस रोगों का परिचय देते हुए सर्वप्रथम समस्त मानसरोगों का मूल मोह को सिद्ध करते हुए वे कहते हैं -

मोह सकल व्याधिन्ह कर मूला। तिन्ह ते पुनि उपजहिं बहु सूला॥

रामचरितमानस 7/121/29 पृ. 537

अर्थात् समस्त व्याधियों का मूल आदिकारण मोह ही है और इसी से सभी व्याधियाँ उत्पन्न होती हैं। इस संसार में किसी भी वस्तु के प्रति रागातिशय मोह का एक कारण है।

काम बात कफ लोभ अपारा। क्रोध पित्त नित छाती जारा॥
प्रीति करहिं जौ तीनिउ भाई। उपजइ सन्निपात दुखदाई॥
विषम मनोरथ दुर्गम नाना। ते सब सूल नाम को जाना॥

रामचरितमानस 7/121/30-32 पृ. 538

ऐसे तो मानसिक रोगो की संख्या अपार है लेकिन उनमें तीन ही प्रधान हैं। भगवान श्रीकृष्ण ने गीता में इनको रजोगुण से उत्पन्न होने वाला कहा है –

काम एष क्रोध एष रजोगुणसमुद्भवः।

श्रीमद्भगवद्गीता 3/37

गोस्वामी जी ने काम को वातरोग, लोभ को कफजनित रोग तथा क्रोध को पित्तजनित रोग कहा है। मानसिक रोग या विकार की दशा में यदि काम, क्रोध और लोभ मर्यादा में रहें तो जीवात्मा को कोई नुकसान नहीं है, लेकिन जब ये तीनों त्रिदोष की तरह कुपित होकर विषम हो जाते हैं तो सन्निपात का होना तय ही है। एक ही रोग मृत्यु के लिए पर्याप्त है, फिर ये अनन्त व्याधियो से भला जीव को शान्ति से कहाँ रहने देंगी।

एक व्याधि बस नर मरहिं ए असाधि बहु व्याधि।
पीडहिं संतत जीव कहुँ सो किमि लहै समाधि॥

रामचरितमानस 7/121 पृ. 538

* असिस्टेन्ट-प्रोफेसर, वैदिकदर्शन विभाग, संस्कृतविद्या धर्मविज्ञान संकाय, काशी हिन्दू विश्वविद्यालय

समाधि की बात तो बहुत दूर है, मानसिक रोगी कभी सामान्य सुख-शान्ति का अनुभव भी नहीं कर सकता है। वह त्रितापों की ज्वाला में निरन्तर जलता ही रहता है। मानसिक विकारवाले की एक विलक्षण विशेषता यह है कि वह स्वयं को विकारग्रस्त या रोगी न मानकर सामनेवालों को रोगी या विकारग्रस्त मानता है। अतः जबतक रोगी को अपने रोग का ज्ञान नहीं होगा तबतक वह उसका उपचार भी नहीं करायेगा। रोग का ज्ञान होनेपर वह निदान के लिए तत्पर होता है लेकिन ये रोग इतने प्रबल हैं कि क्षीण तो हो जाते हैं लेकिन समूल नष्ट नही होते –

जाने ते छीजहिं कछु पापी। नास न पावहिं जन परितापी।।

रामचरितमानस 7/122/3 पृ. 538

बल्कि कुपथ्य का जल पाकर पुनः अंकुरित हो जाते हैं ये कुपथ्य विषयगत भोग ही हैं। बडे बडे मुनियों में यह देखा जाता है तो सामान्य मनुष्य की क्या बात करें–

विषय कुपथ्य पाइ अंकुरे। मुनिहु हृदयँ का नर बापुरे।।

रामचरितमानस 7/122/4 पृ. 538

इस प्रकार रजोगुण या तमोगुण के कारण ही मनुष्य मानसिक रोग से ग्रस्त है। सृष्टि के त्रिगुणात्मक होने से मानसिक रोगों से सारा संसार ही ग्रस्त है। काम, क्रोध, लोभ, मोह आदि सभी के हृदय में कुण्डली मारकर बैठे हैं, इनका विस्फोट कब हो जायेगा इसका अनुमान लगाना भी मुश्किल है। जब बडे-बडे मुनियों ज्ञानियों के मन को ये व्यथित कर देते हैं तो फिर सामान्य मानव की क्या बात। मन के व्यथित होने पर जीव अविवेकी हो जाता है। वास्तव में अविवेकता का मूल कारण देहाभिमान अज्ञान ही है। शोक अज्ञान से होता है। शरीरादि में अहंबुद्धि मात्र अज्ञान से ही होती है। मन, बुद्धि, एवं अहंकार के समूह को योगशास्त्र में चित्त कहा जाता है। योगवासिष्ठ में चित्त को शान्त करने के लिए प्राणायाम, ध्यान आदि उपाय के रूप में बताये गये हैं जैसा कि –

योगिनश्चित्तशान्त्यर्थं कुर्वन्ति प्राणरोधनम्।

प्राणायामैस्तथा ध्यानैः प्रयोगैर्युक्तिकल्पितैः।।

योगवासिष्ठ, उपशमप्रकरण, 91/26

हठयोग में भी कहा गया है –

चले वाते चलं चित्तं निश्चले निश्चलं भवेत्।

हठयोगप्रदीपिका 2/2

अर्थात् चंचल मन को वश में करने के लिए प्राणायाम आवश्यक है। और चंचल मन में ही विकार होता है नियन्त्रित मन में विकार सम्भव नहीं, इसलिए मानसिक विकार को रोकने के लिए प्राणायाम एक उपाय बताया गया है। यदि मन विकृत हो ही जाय तो उसके उपचार के लिए ज्ञान या विज्ञान आवश्यक है जो श्रीमद्भगवद्गीता आदि में वर्णित है।

वेदान्त के तीन प्रस्थान हैं, श्रौत प्रस्थान, स्मार्त प्रस्थान तथा दर्शन प्रस्थान या सूत्र प्रस्थान के नामों से व्यवहृत होता है। जिसमें उपनिषद् को श्रौत प्रस्थान के रूप में, श्रीमद्भगवद्गीता को स्मार्त प्रस्थान के रूप में, ब्रह्मसूत्र को दर्शन या सूत्र प्रस्थान के रूप में, भारतीय दर्शन के समालोचकों या विद्वानों द्वारा प्रतिष्ठित किया जाता है। श्रीमद्भगवद्गीता के अध्याय समाप्ति या पुष्पिका में ''उपनिषत्सु''शब्द आता है। भगवान् श्रीकृष्ण के श्रीमुख से यह उपदेश हुआ है अतः इसे भी भगवान् के निःश्वासभूत अपौरुषेय वेद या श्रौत उपनिषद् के समान ही माना गया है। किन्तु यह स्मार्त उपनिषद् है। अतः यहाँ उपचरित उपनिषद् शब्द मानना श्रेयस्कर होगा। मुख्य उपनिषद् श्रौत उपनिषद् है।

श्रीमद्भगवद्गीता का आविर्भाव समस्त शास्त्रों को मथकर हुआ है। परमनिःश्रेयस अर्थात् कल्याण या मोक्ष की प्राप्ति के लिए प्रतिपादित सभी सिद्धान्त तथा मतमतान्तर के वाद-विवाद की शान्ति इस श्रीमद्भगवद्गीता से प्राप्त होती है। सम्प्रदाय जाति और देश की भिन्नता का निराकरण करने वाली गीता एक सार्वभौम सिद्धान्त प्रतिपादक ग्रन्थ है। सिद्धान्तों की प्रामाणिकता स्थापन करने हेतु सभी आचार्य गीता को आधार मानते हैं। यही एक ऐसा महनीय ग्रन्थ है जिसमें धर्म, जीवनदर्शन एवं नीति का समन्वय हुआ है। धर्म हमें जीवन जीने की कला सिखाता है। गीता मनुष्यों के उच्च आदर्शों को स्थापित करती है और उसे प्राप्त करने का मार्ग बताती है। पाश्चात्य विद्वानों को विश्वसाहित्य के इस ग्रन्थ ने इतना प्रभावित किया कि वे भी इसकी मुक्तकण्ठ से प्रशंसा किया करते हैं। श्रीमद्भगवद्गीता पर बहुत से भाष्य हैं– जिसने जिस दृष्टि से देखा उसी के अनुसार निरुपण कर दिया। हमारे राजनीतिज्ञों ने उससे प्रेरणा ली और स्वतन्त्रता प्राप्ति में अग्रणी बने। तिलक जी ने कर्मयोग, गांधी जी ने अनासक्त योग, महर्षि अरविन्द व विनोबा ने भक्तियोग के ग्रन्थ के रूप में गीता को माना है। मेरी अल्पबुद्धि व ज्ञान में वह जीवन को सही ढंग से जीने की विधा बताती है कि कैसे हम, समस्याओं से अभिमुख हों और उनसे पलायन करने के लिए मन में विचित्र तर्क न जुटायें। आधुनिक समय में समाज के समक्ष ऐसे बुद्धिविमोहित करनेवाले प्रश्न उपस्थित होते हैं जिनका समाधान गीता से ही सुगम है।

गीता एक धर्मग्रन्थ है। धर्म कोई अध्यात्म या लोकोत्तर वस्तु ही नहीं है बल्कि यह कुलाचार से प्राप्त वेदानुमोदित कर्तव्य या कर्म ही धर्म है। गीता का प्रारम्भ ''**धर्मक्षेत्रे**... ... ...'' श्रीमद्भगवद्गीता 1/1 तथा समापन ''... ... ...**नीतिर्मतिर्मम**'' श्रीमद्भगवद्गीता 18/78 से होने से कुछ विद्वानों का मानना है कि प्रारम्भ से ''धर्'' तथा अन्तिम श्लोक से ''म'' लेकर धर्म बनता है अतः सम्पूर्ण श्रीमद्भगवद्गीता में धर्म वर्णित है।

कुछ विद्वान् गीता को ''**श्रीकृष्णाऽर्जुन संवाद**'' भी कहते हैं। उपनिषदों में भी संवाद शैली का प्रचुर प्रयोग हुआ है। गीता का यह संवाद उपनिषद् साहित्य में प्राप्त होने वाले ब्रह्मज्ञान विषयक

संवादों से सर्वथा भिन्न है। धृतराष्ट्र को गीता सुनाने वाले सञ्जय ने तो इसे ''**अद्‌भुत संवाद**'' कहा है—

राजन् संस्मृत्य संस्मृत्य संवादमिममद्भुतम्।

केशवार्जुनयोः पुण्यं हृष्यामि च मुहुर्मुहुः॥

श्रीमद्‌भगवद्‌गीता 1/76

गीता में सर्ववाद समन्वय देखने को प्राप्त होता है। इसमें वेद, उपनिषद् के साथ ही साथ सभी षड् भारतीय दर्शनों के सिद्धान्तों का भी समन्वय प्राप्त है। गीता के व्याख्याताओं में किसी ने द्वैतवाद को लेकर तो किसी ने अद्वैतवाद को लक्ष्य करके, तो किसी ने द्वैताद्वैत भाव के आधार पर व्याख्या की है। कोई इसमें ज्ञान की प्रधानता, तो कोई भक्ति की प्रधानता, तो कोई कर्म की प्रधानता को लक्ष्य मानता है। भगवान् की एक ही उक्ति में कई प्रकार के पृथक्-पृथक् भावों का सन्धान पाया जाता है । कोई इसके भीतर केवल 'योग' का ही सन्धान पाता है, तो इस आधार पर उसको दोष नहीं दिया जा सकता है, क्योंकि भगवत् प्राप्ति के लिए जिस प्रकार ज्ञानमार्ग, भक्तिमार्ग और कर्ममार्ग प्रसिद्ध हैं उसी प्रकार योग-मार्ग भी एक सुप्रसिद्ध पथ है। अतः गीता में भी भगवान् ने योग की एक अविरल धारा ही प्रवाहित की है। यहाँ पर पतञ्जलिकृत योग और गीता के योग में व्यापक भिन्नता पायी जाती है। योगसूत्र में योग चित्तवृत्तियों के निरोधपूर्वक समाधि के लिए होने से, लक्ष्य या साध्य है वहीं गीता में वर्णित योग अप्राप्त अर्थात् मोक्ष की प्राप्ति का निमित्त होने से, साधन या लक्षण या मार्ग है। सांख्यवादी गीता में सत्कार्यवाद के साथ-साथ प्रकृति-पुरुष आदि का अनुसन्धान पाते हैं। कोई इसको न्याय की दृष्टि से भी देखता है। इस प्रकार गीता सभी के मतों, सिद्धान्तों का समर्थन करती है।

गीता संशययुक्त मनुष्य, जो तरह तरह के तर्कों के द्वारा अपना संशय व्यक्त करता है, उस संशय को निराकृत करने का मार्ग बताती है। अर्जुन युद्धभूमि में संशयग्रस्त या ये कहें कि द्विविधा में है। युद्ध की विभीषिका और उससे उत्पन्न होनेवाली समस्यायें उसे युद्ध से रोकती हैं। उसका मन कायरता एवं पलायन की राह चलने को कहता है। उनको छिपाने के लिए वह कृष्ण से तर्क करता है – मैं स्वजन, सम्बन्धियों को मारकर राज्यसुख नहीं चाहता। कुल के नाश होने पर कुलधर्म नष्ट होंगे, वर्णसंकर उत्पन्न होगें, पितरों को जल देने वाला कोई नहीं रहेगा, पाप बढेगा और सद्‌धर्म का नाश हो जायेगा। केवल राज्य लोभ के कारण हम यह जघन्य पाप करने को तत्पर हैं। हमारे जीवन में भी ऐसी ही मोह, अज्ञान जनित द्विविधा उत्पन्न होती रहती है और हम बहादुर दिखने के लिए उन्हें तर्क जाल में छिपा कर उनसे पलायन करते हैं।

तस्मान्नार्हा वयं हन्तुं धार्तराष्ट्रान्स्वबान्धवान् ।

स्वजनं हि कथं हत्वा सुखिनः स्याम माधव ॥

श्रीमद्‌भगवद्‌गीता 1/37

कुलक्षये प्रणश्यन्ति कुलधर्माः सनातनाः।
धर्मे नष्टे कुलं कृत्स्नमधर्मोऽभिभवत्युत॥

श्रीमद्‌भगवद्‌गीता 1/40

अधर्माभिभवात्कृष्ण प्रदुष्यन्ति कुलस्त्रियः।
स्त्रीषु दुष्टासु वार्ष्णेय जायते वर्णसङ्करः॥

श्रीमद्‌भगवद्‌गीता 1/41

पतन्ति पितरो ह्येषां लुप्तपिण्डोदकक्रियाः॥

श्रीमद्‌भगवद्‌गीता 1/42

उत्तम मानस स्वास्थ्य के लिए नानाविध मनोविकारों से मुक्ति आवश्यक है। व्यावहारिक दृष्टि से ''उद्वेग'' एवं अवसाद / विषाद ये दो प्रमुख मानसिक विकार हैं। श्रीमद्भगवद्गीता में इन दोनों विकारावस्थाओं का अत्यन्त सुन्दर चित्रण किया गया है। महाभारत के दो प्रमुख पात्र अर्जुन व दुर्योधन इन्हीं विकारों से ग्रस्त हैं। दुर्योधन चित्तोद्वेग का जन्मजात रोगी है जबकि अर्जुन को युद्धस्थल में अवस्था से उत्पन्न चित्तावसाद या विषाद होता है। अर्जुन युद्धस्थल पर प्रतिद्वन्द्वी स्वजनों को देखकर पहले उद्वेग से पीडित होते हैं, फिर उन्हें विषाद होता है और फिर घोर चित्तावसाद को प्राप्त हो जाते हैं तथा भगवान् श्रीकृष्ण को वे अपनी व्यथा सुनाते हैं। यह चित्तावसाद के लक्षणों का अत्यन्त सुन्दर निरूपण है-

सीदन्ति मम गात्राणि मुखं च परिशुष्यति।
वेपथुश्च शरीरे मे रोमहर्षश्च जायते॥
गाण्डीवं स्रंसते हस्तात्त्वक्चैव परिदह्यते।
न च शक्नोम्यवस्थातुं भ्रमतीव च मे मनः॥

श्रीमद्‌भगवद्‌गीता 1/29-30

अर्जुन के अवसादग्रस्त होने के लक्षण का कारण क्या है, इसके उत्तर में स्वयं चिन्ता को कारण मानते हैं। उनने स्वयं कहा है-

कुलक्षये प्रणश्यन्ति कुलधर्माः सनातनाः।
धर्मे नष्टे कुलं कृत्स्नमधर्मोऽभिभवत्युत॥

श्रीमद्‌भगवद्‌गीता 1/40

पतन्ति पितरो ह्येषां लुप्तपिण्डोदकक्रियाः॥

श्रीमद्‌भगवद्‌गीता 1/42

ऐसे घोर मनोरोगी अर्जुन को योगेश्वर स्वरूप मनोचिकित्सक प्राप्त होते हैं जो इन्हें रोगमुक्त करने में सफल होते हैं। दूसरी ओर दुर्योधन उपयुक्त चिकित्सा के अभाव में अन्त तक चित्तोद्वेग से निजात नहीं पाता क्योंकि उसे योगेश्वर कृष्ण जैसे मनोचिकित्सक प्राप्त नहीं हो पाते और दुर्भाग्य से दुर्योधन जीवनपर्यन्त उद्विग्न ही रह जाता । उसकी उद्विग्नता का ही परिणाम है महाभारत जिसमें व्यक्ति अपना तो विनाश करता ही है संबद्ध समाज का भी नाश करता है। गीता के प्रथम अध्याय में इसी प्रक्रिया का निरूपण है। इस अध्याय में भगवान् स्वयं बिल्कुल नहीं बोलते हैं, वे केवल देखते व सुनते हैं। अर्जुन के उद्वेग व अवसाद के अनन्तर वे

क्रमबद्ध तरीके से मनोरोगी अर्जुन की चिकित्सा करते हैं। इस प्रकार गीता मानस भावों की उत्कृष्टता को प्रतिपादित करती है।

स्वरूप की विस्मृति होने के कारण वासना के वशीभूत हुआ जीव भीषण असाध्य रोगो का क्रीडास्थल बना हुआ है। सद्वैद्य के अभाव में वह दैहिक, दैविक, भौतिक रोगों से मुक्ति नहीं पाता। स्वयं के अविचार से वह दुःखी है। आचार्य शंकर के शब्दों में विना विचार किये जिस किसी साधन को पकड़ लेने का फल मुक्ति से वंचित रहना और अनर्थ की प्राप्ति है –

अविचार्य यत्किंचित् प्रतिपद्यमानो निःश्रेयसात् प्रतिहन्येतानर्थं चेयात्।

शारीरकभाष्य1/2/2

अतएव वास्तविक सुख की प्राप्ति के लिए उस उत्तम साधन की खोज करनी चाहिए और वह साधन है तत्त्वज्ञान। तत्त्वज्ञान की प्राप्ति हो जाने से जाग्रत् काल में जो राग और वासना से रहित सुषुप्ति अवस्था प्राप्त होती है, उसे तत्त्वज्ञ पुरुष स्वभाव कहते हैं तथा उसमें परिनिष्ठित हो जाना मुक्ति कहलाती है। ऐसी निष्ठा प्राप्त हो जाने पर तत्त्वज्ञानी को कर्ता, कर्म और करण से हीन द्रष्टा, दृश्य और दर्शन से शून्य तथा बाह्य और आभ्यन्तर विषयों से रहित ब्रह्म जगत् रूप से स्थित जान पड़ता है, अर्थात् जगत् ब्रह्मस्वरूप ही प्रतीत होता है। इस कारण उसके समस्त रोग नष्ट हो जाते हैं। योगवाशिष्ठ में वसिष्ठ जी पथभ्रष्ट जीव का मार्गदर्शन करते हुए तत्त्वज्ञान को ही उत्तम साधन बताते हुए कहते हैं – तत्त्वज्ञान के प्राप्ति की इच्छा सबके लिए आवश्यक है जिससे फिर कभी जन्म-मरण का भय उपस्थापित न हो, क्योंकि वासना का क्षय परमात्मा का यथार्थ ज्ञान और मनोनाश इन तीनों का एक साथ दीर्घकाल तक प्रयत्नपूर्वक अभ्यास किया जाय तो ये परमपदरूप फल देते है। जैसा कि –

वासनाक्षयविज्ञानमनोनाशा महामते।
समकालं चिराभ्यस्ता भवन्ति फलदा मुने।।

योगवाशिष्ठ, उपशमप्रकरण, 92/17

श्रीवशिष्ठजी दृढतापूर्वक कहते हैं कि – अध्यात्मविद्या की प्राप्ति साधुसंगति वासना का सर्वथा परित्याग और प्राणस्पन्दन का निरोध ये युक्तियाँ चित्तरूपी संसार पर विजय पाने एवं सुखी होने के लिए निश्चित दृढ उपाय हैं।

अध्यात्मविद्याधिगमः साधुसङ्गम एव च ।।
वासनासंपरित्यागः प्राणस्पन्दनिरोधनम् ।
एतास्ता युक्तयः पुष्टाः सन्ति चित्तजये किल।।

योगवाशिष्ठ, उपशमप्रकरण, 92/35-36

आधुनिक समय में समाज के समक्ष ऐसे बुद्धिविमोहित करनेवाले प्रश्न उपस्थित होते हैं जिनका समाधान इसी गीतादर्शन की वैज्ञानिक दृष्टि से ही सुगम है।

योगसूत्र में प्रतिपादित सिद्धान्त का विवेचन गीता में भी देखने को प्राप्त होता है। जैसा की गीता में योगाङ्गों का नामतः वर्णन प्राप्त होता है —

अहिंसा सत्यमक्रोधस्त्यागः शान्तिरपैशुनम्।

दयाभूतेष्वलोलुप्त्वं मार्दवं ह्रीरचापलम्।।

श्रीमद्भगवद्गीता 10/26

गीता के प्रत्येक अध्याय में किसी-न-किसी योग का वर्णन अवश्य किया गया है। योगसूत्र में योग का लक्षण— **''योगश्चित्तवृत्तिनिरोधः''** (योगसूत्र 1/2) बताया गया है, जबकि गीता में **''समत्वं योग उच्यते''** (गीता 2/48) एवं **''योगः कर्मसु कौशलम्''** (गीता 2/50) योग का लक्षण माना गया है। इसके अतिरिक्त -

तं विद्याद्दुःखसंयोगवियोगं योगसञ्ज्ञितम्।

स निश्चयेन योक्तव्यो योगोऽनिर्विण्णचेतसा।।

श्रीमद्भगवद्गीता 6/23

इस प्रकार योग का लक्षण प्रस्तुत किया गया है। योगसूत्र में योग जहाँ उपेय या साध्य है, वहीं पर गीता में योग, उपाय, साधन के रूप में वर्णित है। इस प्रकार गीता योग के निकट भी पायी जाती है।

योगशास्त्र के प्रारम्भ में ही चित्तवृत्ति के निरोध को योग कहा गया है और यह चित्त है मन, बुद्धि, अहंकार की त्रिपुटी। इसलिए मन को शुद्ध रखना है तो योग की जो वैज्ञानिक विधि अलग-अलग साधकों के भेद से बतायी गयी है। जैसा कि – उत्तम साधक या व्यक्ति के लिए अभ्यास और वैराग्य का माध्यम, मध्यम के लिए क्रियायोग, अधम के लिए अष्ट योगाङ्गों का माध्यम बताया गया है। तत्पश्चात् – **''तदा द्रष्टुः स्वरूपेऽवस्थानम्''** (योगसूत्र 1/3 की) स्थिति होती है।

ये कह सकते हैं कि प्रकृति एवं पुरुष के धर्मों में जब तक भेदज्ञान नही होगा तब तक भ्रम का निवारण सम्भव नहीं हो सकता। आत्मस्वरूप के ज्ञान के बिना इस शोक, मोह से निवृत्त नहीं हुआ जा सकता । इस प्रकार विषाद में पड़ा अर्जुन जो स्वयं ही पहले क्षात्र धर्मरूप युद्ध में प्रवृत्त हुआ था, शोक, मोह के कारण विवेक विज्ञान के दब जाने पर भी उस युद्ध से रुक गया और भिक्षावृत्ति द्वारा जीवन निर्वाह करना आदि दूसरों के धर्म का आचरण करने के लिए प्रवृत्त हुआ, क्योंकि शोक, मोह आदि दोषों से जिनका चित्त घिरा होता है, ऐसे सभी प्राणियों से स्वधर्म का त्याग एवं निषिद्ध धर्म का सेवन स्वाभाविक होता है। यदि वे स्वधर्म के पालन में लगे भी होते है तो भी उनके शरीर, मन, वाणी की प्रवृत्ति फलाकांक्षापूर्वक और अहङ्कार सहित ही होती है। अतः इन शोक, मोह, जो दोनों संसार के बीजरूप हैं, इनकी निवृत्ति सर्वकर्मसंन्यासपूर्वक आत्मज्ञान के अतिरिक्त अन्य उपाय से नहीं हो सकती। अतः आत्मज्ञान का उपदेश कराने की इच्छा वाले भगवान्

वासुदेव अर्जुन को सांख्ययोग का उपदेश कराते है, जो अर्जुन की मोहाच्छन्न चित्तवृत्ति के लिए एक प्रकाश बिन्दु रूप में परिलक्षित होता है और वह इस उपदेश के माध्यम से स्वधर्म का निर्णय कर पाता है।

कर्म में ही मनुष्य का अधिकार है, अतः किसी भी अवस्था में फल की चिन्ता न करते हुए अनासक्त भाव से कर्म करना चाहिए। कर्मफल की इच्छा से कर्म में प्रवृत्त नहीं होना चाहिए और न ही कर्मत्याग का विचार ही मन में लाना चाहिए अर्थात् कामना छोड़कर सदैव कर्मरत रहना चाहिए -

कर्मण्येवाधिकारस्ते मा फलेषु कदाचन्।
मा कर्मफलहेतुर्भूर्मा ते सङ्गोऽस्त्वकर्मणि॥

श्रीमद्भगवद्गीता 2/47

हे धनञ्जय! तुम योग में स्थिर होकर शास्त्रोक्त सब कर्म करते जाओ। कर्म में सिद्ध या असिद्ध होने पर दोनों अवस्थाओं में हर्ष या विषाद से अपनी चित्तवृत्ति को कलुषित मत करो -

योगस्थः कुरु कर्माणि संङ्गं त्यक्त्वा धनञ्जय।

सिद्ध्यसिद्ध्योः समो भूत्वा समत्वं योग उच्यते॥

श्रीमद्भगवद्गीता 2/48

यह सुनकर अर्जुन स्थितप्रज्ञ के बारे में पूछता है और भगवान् कहते हैं कि जिस मनुष्य ने अपनी कामनामात्र का त्याग किया है और अपने अन्तः में सन्तुष्ट है, वही स्थितप्रज्ञ है -

दुःखेष्वनुद्विग्नमनाः सुखेषु विगतस्पृहः।

वीतरागभयक्रोधः स्थितधीर्मुनिरुच्यते॥

श्रीमद्भगवद्गीता 2/56

ऐसा व्यक्ति कछुए की भाँति अपनी इन्द्रियों को समेट लेता है। इसके विपरीत विषयों का ध्यान करने से मनुष्य के मन की उन विषयों के साथ आसक्ति हो जाती है। आसक्ति से काम और उसके प्रति हत होने से क्रोध उत्पन्न होता है और क्रोध से सम्मोह हो जाता है अर्थात् कार्याकार्य का विवेक नष्ट होकर स्मृति का नाश कर देता है और स्मृति विभ्रम से बुद्धि नष्ट हो जाती है एवं बुद्धि के नाश से मनुष्य नष्ट हो जाता है, अर्थात् श्रेय सम्पादन की शक्ति ही उसमें नहीं रहती–

ध्यायतो विषयान्पुंसः सङ्गस्तेषूपजायते।
सङ्गात्संजायते कामः कामात्क्रोधोऽभिजायते॥
क्रोधाद् भवति सम्मोहः सम्मोहात्स्मृतिविभ्रमः।
स्मृतिभ्रंशाद्बुद्धिनाशो बुद्धिनाशात्प्रणश्यति॥

श्रीमद्भगवद्गीता 2/62-63

यह आठ प्रकार का चक्र घूमाते हुए सांसारिक मनुष्यों को अपने कर्त्तव्य मार्ग से विच्युत कर देता है।

जो मनुष्य सभी कामनाएं छोड़कर अहन्ता और ममता को त्यागकर निस्पृह बनकर विचरण करता है वही शान्ति को प्राप्त करता है -

एषा ब्राह्मी स्थितिः पार्थ नैनां प्राप्य विमुह्यति।
स्थित्वाऽस्यामन्तकालेऽपि ब्रह्मनिर्वाणमृच्छति॥

श्रीमद्भगवद्गीता 2/72

हे पार्थ यह ब्राह्मी, स्थिति अर्थात् ब्रह्म को प्राप्त करने का साधन है, जो इस स्थिति को प्राप्त कर लेता है। उस पुरुष को कभी इस प्रकार का मोह नहीं होता, जैसे तुमको इस समय हो रहा है और ऐसा व्यक्ति समुद्र की भाँति हमेशा शान्त रहता है। इससे जो मनुष्य सब कामनाएं त्यागकर, निरहङ्कार, ममता छोड़कर तटस्थ रूप बरतता है वह शान्ति पाता है। यह स्थिति ईश्वर प्राप्ति की स्थिति है और यह स्थिति जिसकी मृत्युपर्यन्त स्थायी रहती है, वह मोक्ष प्राप्त कर लेता है। श्रीमद्भगवद्गीता योग को भलीभाँति प्रतिपादित करती है, इस प्रकार हम कह सकते हैं कि मनोविकार से मुक्त होने में योगशास्त्र की महती भूमिका है।

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यज्ञ का वैज्ञानिक महत्त्व

*डॉ. मीना कुमारी वर्मा**

वेद आर्य जाति के प्राण हैं। ये मानव मात्र के लिए प्रकाश स्तम्भ व शक्ति के स्रोत है। वेदों को विश्व को संस्कृति का ज्ञान देने का श्रेय प्राप्त है। वेद ही विश्वबन्धुत्व, विश्वकल्याण और विश्वशन्ति के प्रथम उद्घोषक हैं। वेद ही मानव मात्र के लिए विकास का मार्ग प्रशस्त करते हुए सुख और शान्ति की स्थापना कर सकते हैं। मनु की सारगर्भित उक्ति वेदों के विषय में इस प्रकार है—**'सर्वज्ञानमयो हि सः'**[1] अर्थात् वेदों में सभी विद्याओं के सूत्र विद्यमान हैं। चारो वेदों में यज्ञ का बहुत अधिक महत्त्व वर्णित है। इसका प्रमुख कारण यह है कि यज्ञ ही वह विधि है, जिसके द्वारा प्राकृतिक सन्तुलन बनाये रखा जा सकता है। यज्ञ के द्वारा पर्यावरण की सुरक्षा, वायुमण्डल की पवित्रता, विविध रोगों का नाश, शारीरिक और मानसिक उन्नति तथा रोग निवारण के कारण दीर्घायुष्य की प्राप्ति होती है। यज्ञ के द्वारा भू-प्रदूषण, जल-प्रदूषण, वायु-प्रदूषण और ध्वनि-प्रदूषण को दूर किया जा सकता है। अतएव वेदों में यज्ञ पर इतना बल दिया गया है।

यज्ञ या अग्निहोत्र वह वैज्ञानिक प्रक्रिया है, जिसके द्वारा वायुमण्डल में आक्सीजन (O_2) और कार्बन-डाईआक्साइड (CO_2) का सन्तुलन बना रहता है। प्रकृति में एक चक्र की व्यवस्था है, जिसके द्वारा प्रत्येक पदार्थ अपने मूल स्थान पर पहुँचता है। इसी के आधार पर ऋतुचक्र, वर्षचक्र, दिन-रातचक्र, सूर्यचक्र और चन्द्रचक्र आदि प्रवर्तित होते हैं। इस प्राकृतिक चक्र को ही यज्ञ कहा जाता है। यह प्राकृतिक चक्र विश्व में प्रतिक्षण चलता रहता है। ऋग्वेद और यजुर्वेद में इस प्राकृतिक यज्ञ का वर्णन करते हुए कहा गया है कि वर्ष चक्ररूपी यज्ञ में वसन्त ऋतु आज्य (घी) है, ग्रीष्मऋतु समिधा (लकड़ी) और शरद्ऋतु हव्य (हवन सामग्री) है।

यत् पुरुषेण हविषा देवा यज्ञमतन्वत।
वसन्तोऽस्यासीदाज्यं ग्रीष्म इध्मः शरद् हविः॥[2]

यह प्रक्रिया अणु, परमाणु से लेकर सूर्य, चन्द्र आदि तक सर्वत्र चल रही है, इसका ही नाम यज्ञ प्रक्रिया है। इसके द्वारा सृष्टि के प्रत्येक कण में नित्य परिवर्तन होता रहा है और सृष्टि चक्र चल रहा है। यज्ञ को यजुर्वेद में सृष्टिचक्र का केन्द्र कहा गया है—

अयं यज्ञो भुवनस्य नाभिः।[3]

ऋग्वेद में कहा गया है कि यज्ञ के द्वारा द्युलोक को प्रसन्न किया जाता है, जिससे वर्षा होती है, और वर्षा से पृथ्वी तृप्त होती है। यज्ञ से मेघ और मेघ से वर्षा होती है—

भूमिं पर्जन्या जिन्वन्ति, दिवं जिन्वन्त्यग्नयः।[4]

यजुर्वेद में, यज्ञ को उत्तम कृषि के लिए सर्वोत्तम बताया गया है। यज्ञ से बादल, बादल से वर्षा और वर्षा से उत्तम कृषि होती है—

कृषिश्च मे वृष्टिश्च मे यज्ञेन कल्पन्ताम्।[5]

यजुर्वेद में यज्ञ के महत्त्व का वर्णन करते हुए ऋषि कहते हैं कि यज्ञ से सभी प्रकार के सुखों की प्राप्ति होती है। यज्ञ से पृथ्वी, अन्तरिक्ष और द्युलोक के सभी दोष या प्रदूषण दूर होते हैं। यज्ञ शारीरिक, मानसिक और आत्मिक उन्नति का साधन है। यज्ञ का महत्त्व उपनिषदों में भी पाया जाता है। सामवेद से सम्बद्ध छान्दोग्योपनिषद् में यज्ञ को पर्यावरण-प्रदूषण के निराकरण का सर्वोत्तम साधन बताया गया है। इसमे यज्ञ के विषय में कहा गया है कि यह सब अशुद्धियों, दोषों या प्रदूषण को दूर करके पवित्र बनाता है, अतः इसी कारण इसे यज्ञ कहा जाता है।

एष ह वै यज्ञो योऽयं पवते,
इदं सर्वं पुनाति, तस्मादेष एव यज्ञः।[6]

ब्राह्मण ग्रन्थों में यज्ञ का बहुत ही विस्तार से महत्वपूर्ण वर्णन किया गया है। यज्ञ को सृष्टि का केन्द्र बताया गया है। समस्त जीवों का रक्षक होने के नाते यज्ञ को भुज्यु कहा गया है, क्योंकि यह सबकों सुरक्षा प्रदान करता है। संक्रामक रोगों से बचने के लिए भैषज्य यज्ञ किये जाते है। यज्ञ को पवित्रता प्रदान करने वाला एवं प्रदूषण दूर करने वाला कहा गया है।

यज्ञ में प्रयुक्त द्रव्य—अधिकांशतः यज्ञ में समिधा (लकड़ी) घृत (घी) सामग्री और स्थालीपाक का प्रयोग होता है जिसके लिए कुछ विशेष नियमों का विधान किया गया है जिसका पालन करना अत्यन्त आवश्यक है। शुल्बसूत्र ग्रन्थों में यज्ञ कुण्डों के बनाने की वैज्ञानिक विधि दी गई है। जितना बड़ा या छोटा यज्ञ करना होता है, उसी के अनुपात से बड़ा या छोटा यज्ञकुण्ड होता है। शुल्बसूत्रों का ज्यामिति की दृष्टि से बहुत बड़ा वैज्ञानिक महत्त्व है।

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*असिस्टेन्ट प्रोफेसर, वसन्त कन्या महाविद्यालय, वाराणसी (37/2, महामनापुरी कालोनी, आई.टी.आई. रोड, वाराणसी)

समिधा—यज्ञ में समिधा के लिए ऐसे वृक्षों का चुनाव किया जाता है, जिनसे कार्बनडाईआक्साइड की मात्रा बहुत कम निकलती है और वे शीघ्र जल जाते है। इन समिधाओं से कोयला नहीं बनता, वरन् राख ही बनती है। इनसे धुआँ भी बहुत कम निकलता है। कार्बनडाइआक्साइड की मात्रा कम बनने से हानि की संभावना कम रहती है। इस प्रकार के वृक्षों में आम, गूलर, शमी, पलाश, पीपल, बेल आदि का विधान है।

घृत—यज्ञ के समय गाय के (घी) घृत को सर्वोत्तम माना जाता है, क्योंकि घी यज्ञ का प्रधान द्रव्य है। इससे शरीर को तेज व बल मिलता है। यज्ञ में डाला गया घी रोग-निरोधक व वायुमण्डल को शुद्ध करता है। घृत को विषनाशक कहा जाता है। वेदों में ऐसा भी कहा जाता है कि पुराने घृत (घी) को सुंघाने से उन्माद रोग दूर होता है। अथर्ववेद में कहा गया है कि यज्ञ में घी का प्रयोग वायु प्रदूषण को दूर करने का उत्तम साधन है।

सामग्री—यज्ञ में डाली जाने वाली हव्य वस्तुओं को सामग्री कहते है। हव्य वस्तुएँ चार प्रकार की होती हैं—

सुगन्धित—इसके अन्तर्गत कस्तुरी, केसर, अगर, तगर, चन्दन, जायफल, जावित्री, इलायची आदि है, जो अग्नि में पड़ते ही वायु को सुगन्धित व वायुमण्डल को शुद्ध करते हैं।

रोगनाशक—यज्ञ में सोमलता, गिलोय, गूगल, अपामार्ग (चिरचिटा) औषधियाँ प्रयुक्त होती है। रोग नाशक होने के कारण यह विभिन्न रोगों को दूर करने में सहायक होते हैं।

पुष्टिकारक—यज्ञ में घृत के अतिरिक्त दूध, फल, कन्द, गेहूँ, चावल, उड़द तिल आदि पदार्थ प्रयुक्त होते हैं, जो मनुष्य मात्र के शरीर को हृष्ट-पुष्ट बनाते हैं।

मिष्ट पदार्थ—यज्ञ में मीठी वस्तुओं जैसे–गुड़, चीनी, किशमिश, छुहारा, द्राक्ष (अंगूर) प्रयुक्त होते हैं। मिष्ट पदार्थों में वायु मंडल को शुद्ध करने की असाधारण शक्ति होती है।

स्थालीपाक—कुछ यज्ञों में विशेष आहुतियों के लिए स्थालीपाक का उपयोग होता है। स्थालीपाक में लड्डू, खीर, मीठा चावल, मोहनभोग, बिना नमक की खिचड़ी, हलुआ अपूप (पुआ) आदि है। चावल, खिचड़ी आदि में घी डालकर ही आहुति देने का विधान है। स्थालीपाक की सभी वस्तुएँ रोगनाशक एवं वायु शोधक है।

उपर्युक्त चारों होम द्रव्य जब अग्नि में डाले जाते हैं तो अग्नि में सर्वप्रथम उनका विघटन होता है, जिससे वे अत्यन्त सूक्ष्म अणुरूप धारण कर लेते हैं। जिस प्रकार अणुबम अत्यन्त सूक्ष्म होते हुए भी प्रभावशाली होता है, ठीक उसी प्रकार ये चारों होम -द्रव्य सूक्ष्म रूप होकर वायुमण्डल को शुद्ध करते हैं। वास्तव में यह वैज्ञानिक तथ्य है कि जो पदार्थ जितना सूक्ष्म होता जाएगा, उतनी ही उसकी शक्ति बढ़ जाती है। यज्ञ में प्रयुक्त हव्य-पदार्थ अग्नि में पड़कर हलका हो जाता है। जो वायु की सहायता से सर्वत्र फैल जाता है। जहाँ-जहाँ तक यज्ञ की सुगन्धित वायु पहुँचती है, वहाँ-वहाँ तक की दूषित वायु नष्ट हो जाती है जिससे प्रदूषण का निवारण होता है।

वैश्विक उष्मा के निराकरण में यज्ञ की भूमिका—'ओज़ोन' सन्तुलन पर्यावरण संरक्षण के लिए अत्यन्त आवश्यक है, जो प्रदूषण से बिगड़ जाता है तथा हवन इत्यादि से व्यवस्थित व शुद्ध रहता है। ओज़ोन एक प्रकार की तीव्र ऑक्सीजन है या यूँ कहें ऑक्सीजन से भी अधिक शुद्ध वायु। हवन की वायु में भी ओज़ोन की मात्रा अधिक होती है। अतः हवन करने से अधिक ओजोन गैस का निर्माण होता है और फिर यह ऊपर जाकर ओज़ोन की परत में मिल जाती है। यही ओज़ोन हमारी पृथ्वी के लिए सुरक्षा कवच का काम करती है। ओजोन की परत सूर्य की किरणों को छानने का कार्य करती है।[8] पृथ्वी के अन्दर सूर्य की विषाक्त किरणों को जाने से रोकती है और लाभकारी किरणों को ही मनुष्य के जीवन के लिए पृथ्वी पर भेजती है, जिसके कारण पृथ्वी पर जीवन बना रहता है एवं बीमारियों का खतरा कम हो जाता है। किन्तु इसके विपरीत ओज़ोन परत के क्षीण हो जाने पर सूर्य की घातक किरणों द्वारा सम्पूर्ण चराचर के जन-जीवन पर बुरा असर पड़ता है। सम्पूर्ण मनुष्य-जाति एवं जीव-जगत् रोग-ग्रस्त हो जायेगी। अतएव प्रदूषण को कम करने से ही ओज़ोन परत को बचाया जा सकता है। अतः ओज़ोन परत को बचाये रखने में हवन का अधिक से अधिक प्रयोग अत्यन्त आवश्यक है। पृथ्वी पर जितने भी प्रदूषण होते हैं उसका धुआँ और गन्दगी भाप बनकर अन्तरिक्ष में एकत्रित होती रहती है, जिसे मलार्क के नाम से जाना जाता है। यज्ञ द्वारा अन्तरिक्ष के इस गन्दगी का विनाश भी सम्भव है। पौष्टिक, सुगन्धित व औषधीयुक्त पदार्थ घृत के साथ यज्ञ में जब डाला जाता है, तो ये औषधियाँ भापँ बनकर अन्तरिक्ष में चली जाती हैं और वहाँ पहुँचकर मलार्क के परमाणुओं से संयुक्त होकर विषैले परमाणुओं का विनाश कर देती है। जिस प्रकार हमारे शरीर के भीतर के रोगाणुओं को Antibiotics दवाईयाँ मारने में सक्षम हैं, ठीक उसी प्रकार यज्ञ से अन्तरिक्ष की भॉप शुद्ध हो जाती है और यही शुद्ध भॉप फिर शुद्ध बादलों के रूप में परिवर्तित होकर पृथ्वी पर बरस पड़ती हैं। पौष्टिकता एवं रोगनाशकता की क्षमता इन बादलों के जलों के भीतर अधिक होती है, जिससे हमारी खेती व फसलें पुष्टकारक होती हैं। इस प्रकार सम्पूर्ण पृथ्वी के वातावरण के चक्र को संयमित व सुरक्षित करने में हवन का यह वायुचक्र अत्यन्त सक्षम हैं जिससे जंगल की मौत नामक बीमारी से सूखते हुए जंगलों को बचाया जा सकता है।

यज्ञ करने का एक लाभ तो यह होता है कि सूखे जंगल हरे-भरे हो जाते हैं। जंगल बढ़ जाते हैं। जंगल बढ़ जाने से वायु-प्रदूषण कम जो जाता है, वायुमण्डल में ऑक्सीजन की

मात्रा अपने आप अधिक हो जाती हैं। अधिक जंगल अधिक वर्षा का कारण बनते हैं। इस प्रकार यह चक्र प्रवाह-सा प्रारम्भ हो जात है। शुद्ध वायुमण्डल के कारण ओज़ोन गैस का आधिक्य हो जाता है जिससे 'Global Warming' का खतरा नहीं रहता है।[8]

पृथ्वी की सतह पर किया गया यज्ञ पृथ्वी का सुरक्षा कवच बन जाता है यह किसी चमत्कार से कम नहीं है। अतएव यदि हमें पृथ्वी को हरा-भरा देखने की लालसा है, इस पर रहने वाले चर-अचर जीव-जन्तुओं को जीवन देने की तमन्ना है, और इस पृथ्वी को ग्लोबल वार्मिंग से बचाने की दृढ़ इच्छाशक्ति है, तो हमें यज्ञ को अपनाना अत्यन्त आवश्यक है। अथवा ऐसा भी कह सकते हैं कि हमें यज्ञ को अपनाना ही होगा।

यह यज्ञ किसी भी विशेष धर्म की बपौती नहीं है और ना ही किसी विशेष जाति, व्यक्ति की धरोहर। पृथ्वी पर रहने वाले प्रत्येक मनुष्य इसे स्वेच्छा से अपना सकता है। यह ईश्वर द्वारा निर्मित व्यवस्था का एक चक्र है। इसे कोई भी नहीं रोक सकता। रोकना अमानवता होगी, अकर्मण्यता रूपी अन्याय होगा एवं आलस्य रूपी पाप की बात होगी। ***'यज्ञो वै श्रेष्ठतमं कर्म'*** (यज्ञ एक श्रेष्ठतम कार्य है)। यज्ञ के लाभ का द्वार सबके लिए खुला है–हिन्दू, मुसलमान, सिख ईसाई कोई भी धर्म का व्यक्ति इसका लाभ ले सकता है। ईश्वर ने पृथ्वी पर विविध प्रकार के फल, फूल और औषधियाँ प्रत्येक मनुष्य के लिए बनाई है; उसने कभी भी किसी के साथ भेदभाव नहीं किया। सबको प्राप्त करने का समान अवसर प्रदान किया, साथ ही साथ उस ईश्वर का यह भी कहना है कि यज्ञ एक श्रेष्ठतम कार्य है। असत्य कैसे हो सकता है? भेदभावपूर्ण कैसे बन सकता है? जिस प्रकार हवा, पानी प्रत्येक प्राणी के लिए है, उसमें किसी प्रकार का भेदभाव नहीं है। ठीक उसी प्रकार उसे शुद्ध करने वाला यज्ञ-विशेष धर्म व विशेष वर्ग के लिए कैसे हो सकता है? ईश्वर द्वारा प्रदत्त हवा, पानी, आकाश, अग्नि आदि सम्पूर्ण वस्तुओं का उपभोग हम सभी प्राणी करते हैं अतः हम सबका भी यह कर्त्तव्य होना चाहिए कि उसका सदुपयोग करें, उसे साफ-सुथरा, स्वच्छ एवं सम्भाल कर रखने का एकमात्र साधन यज्ञ ही है। इस प्रकार ईश्वर प्रदत्त देन का मान-सम्मान एवं इस ऋण से उऋर्ण होने का एकमात्र साधन यज्ञ है। ग्लोबल वार्मिंग (वैश्विक ऊष्मा) का खतरा भारत के लिए ही नहीं वरन् सम्पूर्ण विश्व के लिए है जिसके निराकरण के लिए हम सबको तत्काल इस ओर कदम उठाना चाहिए।

यदि पर्यावरण को इसी तेजी से बिगड़ने दिया गया तो इसके परिणाम भी अत्यन्त भयंकर हो सकते हैं। जिससे प्रकृति का सन्तुलन बिगड़ सकता है और ऋतुचक्र में भी परिवर्तन हो सकता है। अतिवृष्टि का प्रकोप, भूकम्प, समुद्री तूफान एवं धरती के फटने की सम्भावनाओं से बचा नहीं जा सकता है। कैंसर के रोगियों की वृद्धि अधिक से अधिक होने की सम्भावनाएँ हैं कार्बन-डाई-ऑक्साइड एवं मोनो-ऑक्साइड आदि विषैले गैसों के दुष्प्रभाव से इतनी बर्फ पिघलेगी जिससे सामुद्रिक जल इतना बढ़ जायेगा जो सम्पूर्ण पृथ्वी को डूबो देने में समर्थ होगा। सम्पूर्ण आकाशमण्डल को ये विषैली गैंसे इस प्रकार ढ़क लेंगी जिससे सूर्य की किरणें पृथ्वी पर पहुँच ही नहीं सकेगी, जिससे पृथ्वी पर जीवन का कोई आसार ही नहीं दिखाई देगा। ऐसी भयानक चुनौतीपूर्ण परिस्थिति से निपटने के लिए यदि बचना है तो ऐसे उपाय करने होंगे जिससे प्रदूषण की समस्या का समाधान हो सके। अतः हमें फिर से आरण्यक सभ्यता का विकास करना होगा और अपनाना होगा—परम-पवित्र हवन-यज्ञ को। यज्ञ ही प्रकृति के सन्तुलन को बनाये रखने की क्षमता रखता है और वही उपद्रवों के शमन में सहायी हो सकता है। इसके लिए फिर से गोपालन की ओर ध्यान देना पड़ेगा।[10] क्योंकि गाय का घी यज्ञ का मुख्य हवि द्रव्य है। इस तथ्य को रुसी वैज्ञानिकों ने भी स्वीकारा है कि गाय के दूध में एटमिक रेडिएशन से रक्षा करने की सबसे अधिक शक्ति है। अगर गाय के घी को अग्नि में डालकर उसका धुआं पैदा किया जाय (जिसको भारतीय भाषा में हवन कहते हैं) तो उससे वायुमण्डल में एटमिक (परमाणु विकिरण) का प्रभाव बहुत कम हो जायेगा।[11]

अतः उपर्युक्त विवरणों से हम इस निष्कर्ष पर पहुँचते हैं कि यज्ञ प्रकृति के सन्तुलन को बनाये रखने में, प्रदूषण की मात्रा को कम करने में, पर्यावरण प्रदूषण से न केवल शारीरिक हानि अपितु मानसिक आत्महत्या जैसे दुर्विचार, मानसिक तनाव आदि रोगों को दूर करने में सहायक है। यज्ञ ही एक प्रकार है जो सभी प्रकार के बौद्धिक व मानसिक रोगों को दूर करके शान्ति, सद्भाव, निरोगता एवं शिवशङ्कल्प की भावना प्रदान करता है, जो आत्मशक्ति व इच्छाशक्ति को प्रबुद्ध करके मानसिक विकास की ओर अग्रसर करता है।

सन्दर्भ

1. मनुस्मृति–2.7
2. ऋग्वेद (पुरुषसूक्त)–10.90.6; यजुर्वेद–31.14,
3. यजुर्वेद–22.62
4. ऋग्वेद–1.164.51
5. यजुर्वेद–18.9
6. छान्दोग्य उपनिषद्–4.16.1
7. यज्ञ थैरेपी नामक पुस्तक से उद्धृत। पाणिनि प्रभा से साभार, मई-जुलाई, 2009, वर्ष 3, अंक-2, पृष्ठ सं. 12
8. यज्ञ थैरेपी नामक पुस्तक से उद्धृत। पाणिनि प्रभा से साभार, मई-जुलाई, 2009, वर्ष 3, अंक-2, पृष्ठ सं. 13
9. शतपथब्राह्मण–1.7.1.5
10. यह थैरेपी नामक पुस्तक से उद्धृत। पाणिनी प्रभा से साभार, मई-जुलाई, 2009, वर्ष 3, अंक-2, पृ.14

आधुनिक अस्त्रों के परिप्रेक्ष्य में आर्ष दिव्यास्त्र

पल्लवी त्रिवेदी एवं प्रो. विभा रानी दूबे***

अस्त्र-शस्त्र उतने ही प्राचीन हैं, जितनी की मानव सभ्यता। इनका जन्म मानव की अपनी सुरक्षा करने की भावना के साथ ही हुआ। समय के साथ-साथ और आवश्यकतानुसार इनका स्वरूप परिवर्तित और विकसित होता रहा है। आधुनिक अस्त्र प्राचीन अस्त्रों से प्रेरित हो विकसित हुए हैं। इन अस्त्रों पर चर्चा करने से पूर्व अस्त्रों का स्वरूप जान लेना आवश्यक है। शुक्रनीति में अस्त्र और शस्त्र का अन्तर स्पष्ट करते हुए अस्त्र का स्वरूप प्रतिपादित है कि मंत्र, यंत्र या अग्नि के द्वारा जो हथियार फेंककर चलाया जाये उसे अस्त्र तथा इससे भिन्न जिन्हें हाथ में रखकर प्रहार किया जाये उसे शस्त्र कहते हैं-

अस्यते क्षिप्यते यत्तु मन्त्रयन्त्राग्निभिश्च तत्।
अस्त्रं तदन्यतः शस्त्रमसिकुन्तादिकञ्च यत्।।[1]

आधुनिक युग के हथियारों में मिसाइल (प्रक्षेपास्त्र), रॉकेट, परमाणु बम, लेजर हथियार आदि हैं जो यंत्र एवं अग्नि से चलने के कारण अस्त्रों की कोटि में आते हैं। पुरातन काल में भी अनेक मारक शस्त्रास्त्रों का प्रयोग एवं उनकी शक्ति का वर्णन पुराणों[2], स्मृतियों, संहिताओं[3], महाभारत[4] एवं रामायण[5] में प्राप्त होता है।

पौराणिक ग्रन्थों में अनेक आश्चर्यजनक एवं अविश्वसनीय लगने वाले दिव्यास्त्रों की चर्चा है। प्रत्येक अस्त्र भिन्न-भिन्न देवों के अधिकार में है और विशेष मंत्रों की साधना अथवा गुरु एवं दैव कृपा से प्राप्त होते हैं जिन्हें दिव्यास्त्र कहा जाता हैं। आर्ष ग्रन्थ रामायण एवं महाभारत में अनेक प्रकार के दिव्यास्त्रों का प्रयोग युद्ध के अवसर पर वर्णित है, जिनमें से कुछ प्रमुख दिव्यास्त्र इस प्रकार हैं-

1. आग्नेयास्त्र[6]

अग्नि देव का यह अस्त्र युद्ध में अग्नि की वर्षा करता था। अर्जुन ने इसे अग्नि देव से प्राप्त किया था।[7] अङ्गारपर्ण गन्धर्व के साथ युद्ध में अर्जुन ने इस आग्नेयास्त्र का प्रयोग किया था।[8] धनुर्वेद संहिता में आग्नेयास्त्र के प्रयोग के विषय में कहा गया है-

आग्नेयं सम्प्रवक्ष्यामि यत्तः परभयं दहेत् ।
ओमग्निस्त्यता हृद्भूञ्च शिवं वनाश्चाविणि च।
हगादशरूपनः सद वे ति ततः क्रमात्।
हादति तोयति राम तथा मसो हित्वा वा न।।
सुसेदवेदया च वदेत् । अमुकादींस्ततो वदेत्।
पूर्वोक्तांश्च पुरश्चर्यां कृत्वा शस्त्रेभियोजयेत्।[9]

आग्नेयास्त्र से शत्रु भय का समूल नाश हो जाता है। आग्नेयास्त्र का प्रयोग करने के लिए 'ॐ अग्निस्त्यता हृद्भू शिवं वनाश्विविणि च। हगादशरूपनः सदवा हादति तोयति राममसो हित्वा वान! सुसेदवेदया च वदेत्' इस मंत्र का उच्चारण कर अमुकशत्रून (शत्रु का नाम) 'हन हन हुँ फट् इति' इस मंत्र को संयुक्त कर सम्पूर्ण मंत्र का दो लाख जप कर शस्त्र (बाण) को अभिमंत्रित करना चाहिये। बाण के संहरण के लिए इस मंत्र को उल्टी विधि से जपना चाहिये।

रामायण में राम द्वारा सुबाहु पर इस अस्त्र के प्रयोग का वर्णन है।[10]

2. ब्रह्मास्त्र

ब्रह्मा जी का यह अचूक अस्त्र, जो शत्रु को नष्ट करके ही छोड़ता था। इसका प्रतिकार दूसरे ब्रह्मास्त्र से ही सम्भव था। धनुर्वेद में इसकी मारक शक्ति का वर्णन है।[11] रामायण में मेघनाद द्वारा हनुमान पर[12] एवं राम द्वारा रावण पर[13] यह अस्त्र प्रयुक्त हुआ था। राम को यह ब्रह्मास्त्र अगस्त्य ऋषि ने प्रदान किया था।[14] एक बार इस अस्त्र का प्रयोग करने पर पुनः इसे बिना संहार किये वापस ले लेना सबके वश की बात नहीं थी। महाभारत में अश्वत्थामा द्वारा अर्जुन पर इस अस्त्र का प्रयोग किया गया जिसके प्रतिकार के लिए अर्जुन ने भी ब्रह्मास्त्र चलाया किन्तु ऋषियों एवं देवों के समझाने पर अर्जुन ने अपना ब्रह्मास्त्र वापस ले लिया किन्तु अश्वत्थामा ऐसा करने में असमर्थ था, अतः उसके इस ब्रह्मास्त्र ने उत्तरा के गर्भ को नष्ट कर दिया।[15]

3. पाशुपतास्त्र

यह भगवान शिव का दिव्यास्त्र है, जिसे उन्होंने अर्जुन को प्रदान किया था। महाभारत में स्वयं शिव ने इस अस्त्र के लिए कहा है-

न त्वेतत् सहसा पार्थ मोक्तव्यं पुरुषे क्वचित्।
जगद् विनाशयेत् सर्वमल्पतेजसि पातितम्।।
अवध्यो नाम नास्त्यत्र त्रैलोक्ये सचराचरे।
मनसा चक्षुषा वाचा धनुषा च निपातयेत्।।[16]

धनुर्वेद में पाशुपत अस्त्र के विषय में कहा गया है कि यह पाशुपतास्त्र सब शत्रुओं से रक्षा करने और उन शत्रुओं का विनाश करने में समर्थ है।[17]

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4. नारायणास्त्र

भगवान विष्णु का यह अस्त्र पाशुपत के समान ही विकराल अस्त्र था। इसका कोई प्रतिकार अस्त्र नहीं है। शत्रु कहीं भी हो यह अस्त्र वहाँ जाकर भेद करता ही है। अपने पिता द्रोण के वध से क्षुब्ध अश्वत्थामा ने पाण्डवों को सेना सहित नष्ट करने हेतु इसका प्रयोग किया था-

तथोक्त्वा द्रोणपुत्रस्तु वायुःपस्पृश्य भारत।
प्रादुश्चकार तद् दिव्यमस्त्रं नारायणं तदा।।[18]

तब श्रीकृष्ण ने इसकी शान्ति का उपाय बताया कि जो योद्धा अपने वाहनों से उतर कर अपने अस्त्र-शस्त्र भूमि पर रख देंगे और नम्रतापूर्वक इसके सामने झुक जायेंगे, उनको यह अस्त्र हानि नहीं पहुँचायेगा।[19]

इन अस्त्रों के अतिरिक्त ब्रह्मशिरा, वायव्य, पर्जन्य, पन्नग, वारुणास्त्र आदि अनेक अस्त्र हैं[20] जिनका वर्णन वर्तमान मनुष्य को चमत्कृत कर देता है। संभवतः इन्हीं अस्त्रों से प्रेरणा लेकर वैज्ञानिकों ने वर्तमान युग में अनेक अस्त्रों की सर्जना की है। ध्यातव्य है कि ये आर्ष दिव्यास्त्र स्वयं में सम्पूर्ण होते थे। उन्हें प्रक्षेपित करने के लिए किसी यन्त्र अथवा प्रक्षेपास्त्र की आवश्यकता नहीं होती थी। तात्पर्य यह है कि ये दिव्यास्त्र मंत्र रूप में होते थे जिसका योद्धागण जप द्वारा आह्वान कर प्रयोग करते थे। धनुर्वेद में भी कहा गया है-

वेदमात्रा सर्वशास्त्रं गृह्यते दीप्यतेऽथवा।[21]

अर्थात् सब अस्त्र वेद मात्रा युक्त हैं इनको जिस प्रकार ग्रहण किया जायेगा उसी प्रकार कार्य में दीप्यमान होंगे।

जबकि आधुनिक समय में विनाशक विस्फोटकों को किसी संवाहक यथा-विमान अथवा प्रक्षेपास्त्रों द्वारा प्रक्षेपित किया जाता है। अतः इस आधार पर हम वर्तमान अस्त्रों को दो भागों में विभाजित कर देख सकते हैं-

- प्रक्षेपास्त्र
- प्रक्षेपास्त्र द्वारा प्रक्षेपित विस्फोटक के रूप में।

- **प्रक्षेपास्त्र**[22]

प्रक्षेपित कर उपयोग में लाया जाने वाला अस्त्र। इसका प्रयोग दूर स्थित लक्ष्य को बेधने के लिए किया जाता है। इसकी सहायता से विस्फोटकों को हजारों किलोमीटर दूर के लक्ष्य तक पहुँचाया जा सकता है। प्रक्षेपास्त्र रासायनिक विस्फोटकों से लेकर परमाणु बम तक का वहन और प्रयोग कर सकता है। प्रक्षेपास्त्र के प्रकार-

गति नियंत्रण के आधार पर

1) **बैलिस्टिक**-पृथ्वी के गुरुत्वाकर्षण नियम के अधीन किसी खास लक्ष्य पर गिरने वाला।

2) **क्रूज**- गुरुत्वाकर्षण से नियंत्रित नहीं होता अपितु इसमें गति निर्धारित करने के लिए विशेष प्रणाली लगी होती है।

मारक क्षमता के आधार पर-

1) **छोटी दूरी का-**मारक क्षमता 100 किलोमीटर से 1000 किलोमीटर।

2) **मध्यम दूरी का-** मारक क्षमता 1000 किलोमीटर से 3000 किलोमीटर।

3) **लंबी दूरी का-** मारक क्षमता 3000 किलोमीटर से 5500 किलोमीटर।

4) **अंतर्महाद्वीपीय-** मारक क्षमता 5500 किलोमीटर से अधिक।

उपयोग पद्धति के आधार पर-

1) सतह से सतह पर मार करने वाला।
2) सतह से वायु में मार करने वाला।
3) वायु से वायु में मार करने वाला।
4) जल से जल में मार करने वाला।

भारत के कुछ प्रमुख प्रक्षेपास्त्र हैं-पृथ्वी, धनुष, ब्रह्मोस, अग्नि I, II, III, IV, V, अस्त्र, त्रिशूल, आकाश, प्रहार आदि।[23] इन प्रक्षेपास्त्रों द्वारा विभिन्न प्रकार के विस्फोटक युद्धानुसार प्रक्षेपित किये जाते हैं।

- **प्रक्षेपास्त्रों द्वारा प्रक्षेपित विस्फोटकों/बम**[24] का वर्गीकरण इस प्रकार है-

(I) **विखण्डक बम-** इसमें विशेष प्रकार के धातु के खोखले पात्र के अन्दर विस्फोटक पदार्थ भरा होता है। जब यह वायुयान अथवा रॉकेट से गिराने पर टकराता है तो धमाके के साथ फट जाता है। ये बम बड़े क्षेत्रों में गिराये जाते हैं।

(II) **अग्नि बम**-इसमें आग लगाने वाला पदार्थ एक विशेष प्रकार के प्रज्वालक के साथ भरा होता है। आग लगाने के लिए फास्फोरस नेपाम और थर्माइट इलेक्ट्रान जैसे रासायनिक यौगिक प्रयुक्त किये जाते हैं।

(III) **जीवाणु बम**-इस बम में जीवाणु, रोगकारक कीड़े भरे होते हैं। बम गिराने पर इसमें लगा फ्यूज जल उठता है और इसके कक्षों का ढक्कन खुल जाता है जिससे जीवाणु सर्वत्र बिखर जाते हैं और लोगों को संक्रामक रूप से हानि पहुँचाते हैं।

(IV) **नाभिकीय या परमाणु बम**[25]- परमाणु बम एक विस्फोटक युक्ति है जिसकी विध्वंसक शक्ति का आधार नाभिकीय अभिक्रिया होती है। यह नाभिकीय संलयन या

नाभिकीय विखण्डन या इन दोनों प्रकार की अभिक्रियाओं के सम्मिलन से बनाये जा सकते हैं। दोनों ही प्रकार की अभिक्रियाओं के फलस्वरूप थोड़े ही सामग्री से भारी मात्रा में ऊर्जा उत्पन्न होती है।

नाभिकीय विखण्डन की क्रिया के फलस्वरूप परमाणु बम एवं संलयन क्रिया के फलस्वरूप हाइड्रोजन बम बना जो परमाणु बम से 700 गुना अधिक शक्तिशाली होता है।

1945 में अमेरिका द्वारा जापान के हिरोशिमा और नागासाकी पर गिराये गये परमाणु बम द्वारा लगभग 1.5 लाख लोग मारे गये।

(V) न्यूट्रान बम[26]**-** न्यूट्रान बम भी नाभिकीय विस्फोटक है। इसके विस्फोट से न्यूट्रान और गामा किरणें निकलती हैं, जो जीवित प्राणियों के लिए घातक हैं। इसका भवनों, मीनारों और सैन्य सामग्री पर कोई घातक प्रभाव नहीं पड़ता।

इन प्राचीन दिव्यास्त्रों एवं आधुनिक अस्त्रों की समरूपता समझने के लिए दोनों की संहारक शक्ति का तुलनात्मक अनुमान लगाना आवश्यक है। द्वितीय विश्वयुद्ध में अमेरिका ने जापान के नगरों पर जो परमाणु बम गिराये जिससे लगभग डेढ़ लाख व्यक्तियों की मृत्यु हो गई, वह अश्वत्थामा द्वारा प्रयुक्त आग्नेयास्त्र से तुलनीय है, जिसने पाण्डवों की अक्षौहिणी सेना को नष्ट कर दिया।[27] परमाणु बम के एक प्रकार हाइड्रोजन बम की तुलना ब्रह्मास्त्र से की जा सकती है, जो सम्पूर्ण विश्व को विनष्ट करने की क्षमता रखता है।

इसी प्रकार वायव्यास्त्र, पर्जन्यास्त्र, वारूणास्त्र जो आँधी उत्पन्न करने वाले, वर्षा करने वाले, वर्षा रोकने वाले दिव्यास्त्र[28] थे, कि तुलना वर्तमान के मौसमी अस्त्रों (Weather weapon) से की जा सकती है। वर्तमान में रॉकेट से रासायनिक पदार्थों सिल्वर आयोडाईड, ड्राई आइस, लिक्विड प्रोपेन का छिड़काव (क्लाउड सीडिंग)[29] कर मौसम में बदलाव किया जा सकता है, जिससे वर्षा रोकी या करायी जा सकती है।[30] यूनाइटेड स्टेट ने वियतनाम युद्ध (1967-68) में इस तकनीक का प्रयोग कर कृत्रिम वर्षा करायी थी। सन् 2008 में ओलम्पिक खेलों में इसी प्रकार रासायनिक पदार्थों का प्रयोग कर वर्षा को रोका गया था।

जीवाणु बम की तुलना पन्नग अस्त्र से की जा सकती है। जहाँ जीवाणु बम से विभिन्न जीवाणु एवं रोगग्रस्त कीड़े इत्यादि निकलते हैं, वहीं पन्नग अस्त्र सर्प उत्पन्न करता था जो शत्रुओं को नष्ट करते थे।

आधुनिक जगत् का न्यूट्रान बम नारायणास्त्र का प्रतिरूप समझा जा सकता है, किन्तु सामूहिक विनाश में नारायणास्त्र न्यूट्रान बम से अधिक सक्षम था। आधुनिक न्यूट्रान बम की विशेषता है कि उसमें से गामा किरणें एवं न्यूट्रान निकलते हैं जो जीवित प्राणियों को निशाना बनाते हैं। इनसे सम्पत्ति या पदार्थ को अधिक क्षति नहीं पहुँचती किन्तु नारायणास्त्र इससे भी चार पद आगे था। सम्पत्ति या पदार्थ को तो नारायणास्त्र नष्ट करता ही नहीं था, जीवधारी में केवल मनुष्यों को और मनुष्यों में केवल समरभूमि में लड़ रहे सैनिकों को तथा सैनिकों में भी मात्र उन सैनिकों को जो अस्त्र शस्त्रों से सुसज्जित हों तथा युद्ध के लिए तत्पर हों को ही अपना निशाना बनाता था। युद्ध से विरत, अस्त्र शस्त्र और वाहनों से रहित सैनिकों को नारायणास्त्र कोई हानि नहीं पहुँचाता था।

इस प्रकार प्राचीन दिव्यास्त्रों का आधुनिक प्रक्षेपास्त्र प्रणाली के संदर्भ में विचार करने पर पाते हैं कि प्राचीन दिव्यास्त्र आधुनिक अस्त्रों की अपेक्षा कहीं अधिक सक्षम एवं संहारक थे। किन्तु इनका दुरुपयोग नहीं होता था। आवश्यकता पड़ने पर तथा आत्मरक्षा हेतु ही योद्धागण इनका प्रयोग करते थे। आग्नेयास्त्र, वायव्यास्त्र, वारूणास्त्र, पन्नगास्त्र आदि अस्त्रों के प्रतिकार अस्त्र भी थे जो इन अस्त्रों के प्रभाव को कम या समाप्त कर देते थे, जबकि आधुनिक प्रक्षेपास्त्र शत्रु पर संहार तो कर सकते हैं किन्तु शत्रु के प्रक्षेपास्त्रों से स्वयं की रक्षा करने का कोई कारगर उपाय अभी भी वर्तमान प्रक्षेपास्त्र प्रणाली के पास नहीं है। अभी यह रक्षात्मक प्रक्षेपास्त्र प्रणाली विकास के दौर में है। इस विषय में प्राचीन अस्त्र संहार एवं संरक्षण दोनों में सक्षम थे और प्राचीन काल में यह अस्त्र ज्ञान आत्मरक्षा एवं धर्मस्थापना में सहायक था न कि आतंक फैलाने में, धनुर्वेद संहिता में कहा गया है-

दुष्टदस्युचोरादिभ्यः साधुसंरक्षणं धर्म्मतः।
प्रजापालनं धनुर्वेदस्य प्रयोजनम्।।[31]

जबकि आधुनिक युग में यह आधुनिक अस्त्र आतंक का पर्याय बनते जा रहे हैं। स्वयं की रक्षा से अधिक दूसरों को भयभीत करने तथा उन पर अपनी शक्ति का प्रदर्शन करने हेतु इनका प्रयोग अधिक हो रहा है जो की उचित नहीं है। आवश्यकता है कि इन अस्त्रों के दुरूपयोग को रोका जाये।

वर्तमान में किसी भी देश के लिए अपनी सुरक्षा व्यवस्था, एकता एवं अखण्डता को बनाये रखने के लिए उच्चकोटि के तकनीकी कौशल एवं सक्षम सैनिक शक्ति की आवश्यकता होती है। आधुनिक अस्त्र न केवल सेना का मनोबल बनाये रखते हैं अपितु शान्ति स्थापना में भी उपयोगी हैं।

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वृष्टि विज्ञान में ग्रहों की भूमिका

दुर्गेश कुमार शुक्ल एवं डॉ0 सुभाष पाण्डेय***

वृष्टिमूला कृषिः सर्वा वृष्टिमूलं च जीवनम्।
तस्मादादौ प्रयत्नेन वृष्टिज्ञानं समाचरेत् ॥[1]

महर्षि पराशर जी का कथन है कि सम्पूर्ण कृषि का मूल कारण वृष्टि है एवं वृष्टि ही जीवन का भी मूल है, अत एव प्रारम्भ में प्रयत्नपूर्वक वृष्टि का ज्ञान करना चाहिए। गीता में भगवान कृष्ण भी कहते है-

अन्नाद्भवति भूतानि पर्जन्यादन्नसम्भवः।
यज्ञाद् भवति पर्जन्यो यज्ञः कर्मसमुद्भवः॥[2]

अर्थात् सम्पूर्ण प्राणी अन्न से उत्पन्न होते है। अन्न की उत्पत्ति वृष्टि से होती है, वृष्टि यज्ञ से होती है और यज्ञ विहित कर्मों से उत्पन्न होता है। ग्रहों के स्थिति के द्वारा आगामी कई वर्षों के वर्षा का ज्ञान किया जा सकता है। दूरगामी वर्षा भविष्य के लिए सूर्य का तथा आर्द्रा नक्षत्र में प्रवेश के समय के लग्न को आधार मानते है। इस लग्न से किस दिशा में कैसी वर्षा होगी, इसका पूर्वाभास होता है। वेदांग ज्योतिष में नभ-नभस्य मास वर्षा ऋतु के माने गये है। ज्योतिष की दृष्टि में सूर्य के आर्द्रा प्रवेश से वर्षा का आरम्भ माना जाता है। यही से मानसून की नियमित वर्षा शुरू होती है। कहा भी है-

प्रायो ग्रहाणामुदयास्तकाले समागमे मण्डल संक्रमे च।
पक्षक्षये तीक्ष्णकरायनान्ते वृष्टिर्गतेऽर्के नियमेन चार्द्राम्॥[3]

सामान्यतः आर्द्रा, पुनर्वसु, पुष्य, अश्लेषा, मघा, पूर्वाफाल्गुनी, उत्तरा फाल्गुनी, हस्त, चित्रा इन नौ निरमय नक्षत्रों में सूर्य के संचरण काल में वर्षा होती है। इस प्रकार आषाढ़ आदि चार महीने कुछ न कुछ वर्षा होती रहती है। सूर्य का आर्द्रा प्रवेश 21-22 जून को तथा चित्रा से निष्क्रमण 24 अक्टूबर के आस-पास होता है। जिस प्रकार मनुष्य के जन्म समय का जन्मांग चक्र बनाकर विभिन्न भावों में उदित राशियों और उनमें तत्कालीन ग्रहों की स्थिति के आधार पर जातक के भविष्य को मालूम करते है, उसी प्रकार सूर्य के आर्द्रा नक्षत्र में प्रवेश के क्षण को वर्षा ऋतु का जन्म मानकर उस समय का लग्न बनाकर वर्षा का भविष्य मालूम किया जाता है। जातक की कुंडली में विभिन्न भाव जीवन के विभिन्न पक्ष है, और आर्द्रा प्रवेश लग्न में यही भाव विभिन्न दिशायें है। जैसे जातक के जन्मांग में लग्न की प्रमुखता है वैसे ही आर्द्रा प्रवेश लग्न में भी लग्न में किस तत्व की प्रमुखता है, वहाँ कौन ग्रह है या किस ग्रह दृष्टि है, इसका प्रभाव होता है, इसके अतिरिक्त विभिन्न भावों (दिशाओं) में पूर्ण जल, पाद जल या निर्जल कौन-कौन राशियाँ और शुष्क, उष्ण, वायु तत्व या जलीय आदि कैसे ग्रह है, इनका अपना प्रभाव है। वर्षा ज्ञान में शुक्र मंगल की भूमिका विशेष विचारणीय रहती है। कहा भी है-

शुक्रो निसर्गतो वृष्टयै निग्रहाय निमित्ततः।
शोणितो निग्रहायैव वर्षणाय निमित्ततः॥[4]

अर्थात् शुक्र हमेशा स्वाभाव से ही वृष्टि करता है। किसी विपरीत निमित्त के होने पर वृष्टि रोकता है। किन्तु मंगल सदा स्वाभाव से ही वृष्टि विघातक है तथा किसी सुनिमित्त के आनेपर ही वर्षा करता है। इन्हीं दो ग्रह मंगल-शुक्र के आधार पर वृष्टि का विचार करना चाहिए। अन्य ग्रह इसके सहायक है।

बुध एवं शनि स्वाभाविक रूप से वायु पैदा करते हैं तथा शुक्र और वृहस्पति जल पैदा करते हैं, सूर्य एवं मंगल गरमी पैदा करते हैं। कहा भी है-

वायुं बुधशनि शुक्रगुरू जनयतो जलम्।
मंगलद्युमणी धर्मस्वाभावादिति च क्षत॥[5]

राशिगुण तालिका

राशि	तत्व
मेष	अग्नि
वृष	पृथ्वी
मिथुन	वायु
कर्क	जल
सिंह	अग्नि
कन्या	पृथ्वी
तुला	वायु
वृश्चिक	जल
धनु	अग्नि
मकर	पृथ्वी
कुम्भ	वायु
मीन	जल

*शोधछात्र, ज्योतिष विभाग, संस्कृतविद्या धर्मविज्ञान संकाय, काशी हिन्दू विश्वविद्यालय, वाराणसी
**असिस्टेन्ट प्रोफेसर, ज्योतिष विभाग, संस्कृतविद्या धर्मविज्ञान संकाय, काशी हिन्दू विश्वविद्यालय, वाराणसी

ग्रहगुण तालिका

ग्रह	मूलतत्व	गुण
सूर्य	तैजस्	शुष्क अतिउष्ण
चन्द्र	जल	पूर्ण जलीय
मंगल	अग्नि	दाहक-उष्ण
बुध	पृथ्वी	जलचर सहयोग से जलीय या उष्ण योग से शुष्क
गुरू	आकाश	जलीय ग्रहों का सहायक, शीत
शुक्र	जल	जलीय-वर्षाकारक
शनि	वायु	शुष्क-शीत

इन तालिकाओं से यह स्पष्ट होता है कि कर्क, मकर और मीन राशि में पूर्ण जलांश है।

वृष, धनु, कुम्भ- 50 प्रतिशत जलांश है।

मेष, तुला, वृश्चिक- 25 प्रतिशत जलांश है।

मिथुन, सिंह और कन्या जलांश शून्य है।

ग्रहों की तालिका से यह परिणाम निकलता है कि वर्षा के लिए चन्द्र-बुध गुरु और शुक्र वृष्टिकारक है। इनमें भी चन्द्र और शुक्र जल विशेष लाभदायक है। इनमें चन्द्र और शुक्र का मूल तत्व जल है इसलिए वर्षा के लिए ये विशेष शुभ है, उसके बाद पृथ्वी तत्व का बुध और आकाश तत्व का वृहस्पति है।

सूर्य-मंगल शुष्क और अग्नि तत्व के है इसलिए ये वर्षा के अवरोधक है। शनि वायुतत्व का ग्रह है। यह शुष्क भी है किन्तु ठण्डा भी है। अतः यह आँधी एवं वायु संचार करना है। तापमान गिरता है। इससे जल की आशा नहीं करनी चाहिए। ठंड उत्पन्न कर सकता है। सूर्य से सम्बन्ध हो जाय या मंगल से सम्बन्ध हो तो तूफान पैदा करना है। यदि साथ में चन्द्रमा का भी योग हो तो तूफान के साथ हानिकारक वर्षा भी कराता है।

मंगल अयन काल में, बुध संक्रान्ति काल में, वृहस्पति उदय के समय में, सूर्य के साथ अस्त होने के समय में और शनैश्चर तीनों (संक्रमण तथा उदय अस्त) कालों में वर्षा करता है। कहा भी है-

भौमेऽयने संक्रमे च बुधो जीवस्तथोदये।

शुक्रोऽस्तगमने वृष्टिं करोति च शनिस्त्रिषु॥[6]

बुध एवं शुक्र के विषय में कहा गया है-

गच्छन्नुदयमस्तं वा बुधः शुक्रश्च वर्षति।

शुक्रोदये ग्रहा अस्तं गता वर्षन्ति भूरिशः॥[7]

अर्थात् बुध-शुक्र ये दोनों ही उदय एवं अस्त होने के समय वर्षा करते हैं। शुक्र के उदय होने पर तथा अस्त हुए सभी ग्रह खूब वर्षा कराते है।

क्रूर ग्रहो के वक्री होने पर अल्प वर्षा कराते है तथा शुभ ग्रहों के वक्री होने पर अच्छी वृष्टि होती है। क्रूर ग्रह वक्री हो जाय और सौम्य ग्रह का अतिचार हो जाय तो वर्षा का अभाव होता है। वृहस्पति के अतिचार होने पर और शनि के वक्री होने पर अत्यन्त अनावृष्टि के कारण सब जगह पृथ्वी सूख जाती है, कादम्बिनी में कहा गया है-

अतिचारगते जीवे शनौ वक्रत्वमागते।

आत्यन्तिक्या त्वनावृष्टया पृथ्वी सर्वत्र शुष्यति॥[8]

वर्षा काल में सूर्य के आगे मंगल के रहने पर अनावृष्टि, शुक्र के आगे रहने पर गर्मी और बुध के आगे रहने पर वायु चलता है। मंगल का ग्रहों से सम्बन्ध होने पर अनावृष्टि होती है। बुध-शुक्र का योग सूर्य के पृष्ठ भाग में होने पर वर्षा कराते है और अन्य शुभ ग्रह सूर्य के आगे होने पर वर्षा करते है।

मेष राशि पर शुक्र-राहु का साथ बैठना दुर्भिक्ष करता है तथा मेष राशि पर ही सूर्य-मंगल-शनि और शुक्र का होना भी दुर्भिक्ष का कारण है। वृष राशि पर सूर्य-मंगल और शनि के होने से दुर्भिक्ष और अनावृष्टि होती है। शुक्र के क्षेत्र में बृहस्पति मंगल और शनि के होने से सुवृष्टि होती है। कहा भी है-

दुर्भिक्षायाप्यनावृष्टयै वृषेऽर्को मंगलः शनिः।

शुक्रक्षेत्रे सुवृष्टयै स्याद्विषणो मंगलः शनिः॥[9]

यदि वर्षाकाल में शुक्र से सप्तम राशि में (180 अंशों पर) स्थिति होकर चन्द्रमा शुभ ग्रह से देखा जाता हो तो वर्षा द्वारा जल का आगमन होता है। बृहत्संहिता में भी कहा है-

प्रावृषि शीतकरो भृगुपुत्रात् सप्तराशिगतः शुभ दृष्टः।

सूर्यसुतान्नवपञ्चमगो वा सप्तमगश्च जलागमनाय॥[9]

इस प्रकार हम देखते है कि ग्रहों के द्वारा वृष्टि के सम्बन्ध में हम पूर्ण जानकारी प्राप्त कर सकते है। इसके द्वारा सैकड़ों वर्ष पूर्व भविष्य का भी गणना करके पता लगाया जा सकता है कि कब, कौन से वर्ष में सूखा पड़ेगा, अतिवृष्टि होगी, अल्पवृष्टि होगी, किस वर्ष में सुकाल पड़ेगा तथा फसलें अच्छी होगी इसका पूर्व में पता लगाना भारतीय ज्योतिष के लिए कठिन कार्य नहीं अपितु संघ साध्य है।

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समाजविज्ञान में विज्ञान दर्शन की सुविधा : एक विश्लेषणात्मक अध्ययन

डॉ. दिनेश कुमार सिंह एवं ईश्वर स्वरूप सहाय***

विज्ञान इन दिनों बौद्धिक आक्रमण के दौर से गुजर रहा है। वर्तमान समय में विगत कुछ दशकों से विज्ञान की सत्ता व प्रतिष्ठा में गिरावट आयी है। पिछले चार दशकों से पूर्व विज्ञान के माध्यम से ही सत्य के निश्चित रूप तक पहुँचा जाता था। हम यह मानते हैं कि यह विज्ञान दर्शन ही है जिसने धर्मशास्त्रीय, तत्वशास्त्रीय, लोकशास्त्रीय, अवस्था से बौद्धिक विकास के परिणामस्वरूप प्रत्यक्षवादी दर्शन से सत्यता के दावे को प्रस्तुत किया। 19वीं तथा 20वीं सदी में यह मान लिया गया था कि वैज्ञानिकता के माध्यम से ही वास्तविकता के मूलाधार में पहुँचा जा सकता है। यूरोपीय परम्परावाद की जड़ों को समाप्त करते हुए 'आधुनिकता' व 'वैज्ञानिकता' दोनों एक दूसरे के पर्याय बन गये। सभी लोगों के माध्यम से इसकी औचित्यता के रूप में स्वीकार कर लिया गया।

सामाजिक विज्ञान अधिक विशिष्ट रूप में समाजशास्त्र ज्ञान का एक औपचारिक निकाय है, जो फला-फूला है, जिसका उद्विकास हुआ है, जिसने बुद्धिजीवियों के समुदाय को सृजित किया है और जिसने प्राज्ञता अथवा सीखने की विशिष्ट परम्परा को स्थापित किया है। यह संभव हुआ है क्योंकि सामाजिक यथार्थता का प्रेक्षण करने और ज्ञान के सुव्यवस्थित निकाय के निर्माण के अपने मार्गदर्शन में हुआ।

विज्ञान दर्शन का अभिप्राय आध्यात्मिक रूप में नहीं बताया जा सकता है। इसका अभिप्राय देखने और प्रेरक्षण करने के तरीके से है, सोचने के ढंग से है और तर्क करने तथा सच्चाई तक पहुँचने से है। समाजविज्ञानों में अन्वेषण की तर्क विधि क्या है? समाज के बारे में ज्ञान कैसे निर्मित होता है? तथा साहित्यिक शास्त्रों से समाजशास्त्रों में अनुसंधान कैसे भिन्न है? यह सभी मुद्दे विज्ञान दर्शन से जुड़े हैं।

समाजविज्ञान का वर्तमान परिदृश्य अत्यधिक गत्यात्मक स्वरूप को धारण करता जा रहा है। समाजविज्ञानों द्वारा विज्ञान दर्शन को अपनाने से ही सामाजिक बोध का दायरा परिमार्जित होता जा रहा है। प्राचीन पौराणिक कथाएं, लोक कथाएं, महाकाव्य, यात्रावृतांत और साहित्य ऐसे अनगिनत स्रोत हैं जिनसे हमें इस समाज के बारे में ज्ञान मिलता है लेकिन सामाजिक विज्ञान को इसकी विशिष्ट पहचान प्रदान होने के पीछे इसके शोध-विधि और ज्ञान प्राप्त करने के तरीके से है। इस तथ्य को समझने हेतु विज्ञान के आधारशिला को समझना होगा।

विज्ञान की आधारशिला

विज्ञान के बारे में सदैव ही चर्चा करते हुए यह तथ्य सार्वभौमिक रूप से मस्तिष्क में आते हैं कि विज्ञान तथ्यों पर आधारित होता है। विज्ञान के अन्तर्गत भावनात्मक या मनोभावात्मक निर्णय के स्थान पर तार्किक और निष्पक्ष विश्लेषण का समावेशन होता है। विज्ञान की आधारशिला की दार्शनिक परम्परा प्रमुख रूप से फ्रांसिस बेकन (1561-1626) तथा रेने डेस्कार्ट (1564-1650) के द्वारा अभिव्यक्त किए गये चिंतन पर आधारित है। 17वीं शताब्दी में इसके योगदान ने ही आधुनिक विज्ञान की आधारशिला रखी।[1]

फ्रांसिस बेकन ने इस तथ्य को व्यक्त करने की कोशिश की है कि किस प्रकार किसी पूर्वाग्रह या पक्षपात के यथार्थ का बोध हो सकता है। बेकन के अनुसार ऐसे बहुत से भ्रम होते हैं जो हमें सत्यता से परे करते हैं और अवरोधों के रूप में दिखाई देते हैं। बेकन के अनुसार इन भ्रमों को दूर करने के बाद ही आगमन विधि का प्रयोग किया जा सकता है। इन भ्रमों को फ्रांसिस बेकन ने मस्तिष्क की प्रतिमाओं (Idol of Minds) के रूप में अभिव्यक्त किया है। इन्होंने इसकी चार श्रेणियाँ बतायी है-

1. **जनजाति की प्रतिमाएँ-** ये मानवीय समूहों में समान रूप से पायी जाती है तथा मानवीय दुर्बलता से आर्विभूत होती है। बेकन का तर्क है मानव मस्तिष्क टेढ़े-मेढ़े दर्पण की भाँति है जो सच्चाई को भ्रमित करता है। इस प्रकार का प्रतिमाओं की वजह से अंधविश्वास और पूर्वाग्रह हमेशा मौजूद होते हैं, जो कि मनुष्य की भावनाओं को अतिसूक्ष्म तरीकों से और अनेक रूपों से समझ को भ्रमित कर वास्तविकता से दूर कर देती है।
2. **निजी कक्ष की प्रतिमाएँ-** ये जनजातिगत प्रतिमाओं की भाँति न होकर विशिष्ट व्यक्तियों के लिये अनोखी होती है। प्रत्येक व्यक्ति की स्वयं की ही निजी मनोवृत्ति और प्रतिमाएँ होती है। जैसे कोई व्यक्ति नवाचारवादी होता है तथा कोई पुरातनवादी होता है, कोई आशावादी तो, कोई निराशावादी। ये सभी विशिष्ट विशेषताएं व्यक्ति के देखने के ढंग को प्रभावित करती है और इस प्रकार सच्चाई को भ्रमित करती है।
3. **क्रय विक्रय की प्रतिमाएँ-** इस प्रकार प्रतिमाएं मानवीय अंत:क्रिया से उत्पन्न होती है और गंभीर भाषायी उलझनों को

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पैदा करती है। ये भाषायी उलझने बहुधा भाषायी यथार्थता को व्यक्त करने में अपर्याप्ता को सिद्ध करती है।

बेकन[2] ने कहा कि ''विद्वत्जों के महान और विचारशील तर्क वितर्क बहुधा शब्दों और नामों से जुड़ा शास्त्रार्थों में समाप्त हो जाते हैं।''

4. **नाटकगृह की प्रतिमाएँ**- यह वे प्रतिमाएँ हैं जो दर्शनशास्त्र की विशिष्ट पद्धतियों के विविध सिद्धान्तों से मनुष्यों के मस्तिष्क में घर कर चुकी होती है।[3]

बेकन ने इस प्रतिमाओं को अवरोधक के रूप में बताया है तथा इसको दूर करना आवश्यक बताया है तभी बिना किसी पक्षपात के इस संसार की वास्तविकताओं का अवलोकन सम्भव है। इन्होंने बताया है प्रकृति का अस्तित्व तो है ही, और हमारी भावनाओं और संवेदनाओं से अदूषित मात्र, शुद्ध अनुभववाद से ही प्रकृति को समझा जा सकता है। बेकन के अनुसार निरपेक्ष ज्ञान ही मानव प्रकृति पर प्रभुत्व स्थापित कर पायेगा। ज्ञान वास्तव में शक्ति है और ज्ञात और ज्ञान के बीच का सम्बन्ध तटस्थ और अवैयक्तिक हो जाता है। अनुसंधानकर्ता की स्वयं की दुर्बलता नियंत्रित हो जाती है तथा अन्वेषण का कार्य निष्पक्ष हो जाता है।

बेकन ने अनुभववाद को प्रोत्साहित किया था। सचवण्डत[4] ने अनुभववाद को व्यक्त करते हुए बताया कि, ज्ञानमीमांसात्मक सैद्धांतिक प्रभामण्डल में वह ज्ञान शामिल है जो इन्द्रियपरक अनुभव से शुरू होता है। सामाजिक विज्ञानों में विशुद्ध अनुभववाद में उस ज्ञान को शामिल किया जाता है जिसमें सामाजिक वास्तविकता और मानवीय क्रिया को निश्चित तथ्य के साथ परीक्षण कर सके और यह प्रमाणिकता को व्यक्त करता हो तथा अवलोकनीय रूप से यह प्राप्त हो तथा किसी भी प्रकार के वैयक्तिक निर्वचन से मुक्त हो।

बेकन ने जिस प्रकार अनुभववाद अथवा आगमन विधि से वास्तविकता को खोजने का प्रयास किया उसी प्रकार विज्ञान की आधारशिला को रखने वालों में रेने डेस्कार्ट, जिन्होंने वास्तविकता को खोजने हेतु निगमनात्मक विधि को प्रोत्साहित किया। डेस्कार्ट ने मानसिक और बुद्धिजीविता को विशेष माना है एवं तर्क दिया है कि केवल स्पष्ट विचारों अथवा विशुद्ध विवेकशीलता से व्यक्ति सभी अनिश्चितताओं को दूर कर सकता है तथा वास्तविकता तक पहुँच सकता है। इन्द्रिया ज्ञान का विश्वसनीय स्त्रोत नहीं है, इन्द्रियों से भी धोखा मिल सकता है। डेस्कार्ट[5] ने उन सभी बातों पर शंका व्यक्त की जिन्हें इन्द्रियों के माध्यम से सीखा था। इन्होंने चेतना के माध्यम से बुद्धिवाद को ज्ञान का स्त्रोत बताया है तथा इसी के माध्यम से वास्तविक ज्ञान तक पहुँचने पर बल दिया है।

इन दोनों ने आधुनिक विज्ञान को गतिमान किया है। वैज्ञानिक क्रांति ने ब्राह्मण्डीय सिद्धान्तों को बदल कर रख दिया। कापरनिकस (1473-1543) ने सूर्य केन्द्रित सिद्धान्त को दिया तथा पृथ्वीकेन्द्रित सिद्धान्त को खारिज किया। तत्पश्चात् गैलिलीयों ने आनुभविक तथ्यों के आधार पर सूर्य केन्द्रित सिद्धान्त का समर्थन किया। इनके द्वारा इस ब्राह्मण्डीय दावों को चर्च द्वारा विरोध किया गया क्योंकि उस समय यूरोपीय समाज दो प्रमुख धर्म-सम्प्रदायों के संघर्ष के मध्य जूझ रहा था। जिनका सरोकार काल्विन और कैथोलिक के मध्य था।[6]

न्यूटन (1642-1727) ने आनुभविकता को अपनाते हुए आगमन विधि को स्वीकार किया। इन्होंने प्रयोगात्मक एवं अवलोकनात्मक पद्धति को विकसित किया तथा गुरुत्वाकर्षण एवं गति के तीन नियमों को प्रतिपादित किया। इनके विचारों ने विज्ञान को और अधिक विकसित किया तथा सामाजिक विज्ञानों में अवलोकन, प्रयोगात्मक पद्धतियों का प्रयोग भी बाद में होने लगा।[7]

डेस्कार्ट की निगमनात्मक पद्धति ने बुद्धिवाद के माध्यम से सिद्धान्तों से उपकल्पनाओं का निर्माण कर निष्कर्षों तक पहुँचने की बात कही है। डेस्कार्ट के शब्दों में ''मेरा अस्तित्व इसलिए है क्योंकि मैं सोचता हूँ।'' डेस्कार्ट ने इस तथ्य को स्थापित किया है कि ''ईश्वरीय तत्व या भगवान उससे जीत नहीं सकता।'' डेस्कार्ट का दर्शनशास्त्रीय आंदोलन बुद्धिवाद के रूप में जाना जाता है जिसमें तर्क (Reasoning) को ही ज्ञान के प्राथमिक स्त्रोत के रूप में जाना जाता है। संक्षेप में अनुभववाद तथा बुद्धिवाद ने दो प्रकार के तर्कों की नींव रखी जो कि निगमन पद्धति तथा आगमन पद्धति के रूप में जानी जाती है।[8]

प्रबोधन युग एवं ब्रिटिश अनुभववाद- सामान्यतः आनुभविक अभिमुखन को 16वीं तथा 17वीं सदी में वैज्ञानिकों तथा ब्रिटिश अनुभववादियों द्वारा व्यापक तौर पर समर्थन मिला है जिसमें लॉक, बर्कले, ह्यूम तथा मिल का नाम उल्लेखनीय है। इनके दार्शनिक अनुभवों ने शास्त्रीय तथा तार्किक प्रत्यक्षवाद पर व्यापक प्रभाव डाला जो कि 19वीं तथा 20वीं शती में उभरकर सामने आया।

अनुभववादियों के अनुसार सभी प्रकार का ज्ञान अनुभव के माध्यम से ही आता है। ब्रिटिश अनुभववाद के प्रतिपादक जानलॉक (1632-1704) अपने तावुलारासा Rabula Rasa की अवधारणा से प्रसिद्ध है, जिसमें उन्होंने व्याख्या की है कि मानव मस्तिष्क बिल्कुल कोरा होता है जिसमें अनुभव के माध्यम से ही ज्ञान सृजित होता है।[9]

डेविड ह्यूम (1711-1776) के लॉक के विचारों को तार्किक ढंग से लागू किया और यह तर्क रखा कि हर तरह की सोच साधारण और अलग-अलग प्रभावों से बनती है। डेविड ह्यूम का तर्क है चूंकि मनुष्यों का जीवन यापन और कामकाज दरअसल भौतिक जगत में होता है इसलिए हमें यह अवलोकन करना चाहिए कि किस प्रकार ऐसा होता है। छवियों की हमारी मानसिक विषय-वस्तुओं में सावधानीपूर्वक किये गये अंतर से ह्यूम मानव आस्था का विश्लेषण शुरू करता है। ये छवियां तत्काल अनुभव की प्रत्यक्ष,

जीवंत और प्रभावशाली उपज है। विचार इन मौलिक छवियों की प्रतिलिपियां मात्र है।

क्योंकि प्रत्येक विचार की व्युत्पत्ति पहले हुए छवि में होती है, ह्यूम का मानना है कि यह हमेशा सार्थक है कि विचार विशेष के मूल में जाने के लिये पूछा जाये कि इस प्रकार की उत्पत्ति कौन-सी छवि पर आधारित है। एक विचार का दूसरे विचार से सीधा जोड़ सदैव ऐसे तालमेल का परिणाम है जो कि व्यक्ति स्वयं निर्मित करता है। मानसिक प्रक्रिया को तीन तरीकों से अनुभववाद में शामिल होती है- समरूपता (Resemblance), समीपता (contiguity) तथा कारण व प्रभाव (cause & effect)। संक्षेप में ह्यूम ने न्यूनीकृत संशयवाद को उचित स्थिति में माना तथा ज्ञान के स्रोत के रूप में साधन माना है जिसमें अनुभववाद को स्वीकार करने पर ह्यूम ने बल दिया है।

जे0एस0 मिल (1806-1873) 19वीं शताब्दी में प्रमुख ब्रिटिश अनुभवशास्त्रियों में से एक है, जिनको आगमन कारणात्मक विश्लेषक के रूप में जाना जाता है। मिल के कारणात्मकता को निर्धारित करने की कुछ विधियाँ दी जिनको शोध कार्य में प्रयोग लिया जाता है।

सहमति की विधि (Method of agreement) - जब विषम जातीय समुच्चयों का परीक्षण किया जाता है तो उसमें भी कुछ परिणाम एक जैसे प्राप्त होते हैं जो कि कुछ केसों पर समानरूप से लागू होता है तथा कारणात्मक विश्लेषण में कुछ सामान्य कारण अवलोकित होते हैं जिसमें सभी की सहमति होती है।

विभेद की विधि (Method of difference)- जब दो समूहों को तुलनात्मक विधि से अवलोकित किया जाता है एवं दोनों की समान विशेषताएँ भी मौजूद होती है फिर भी एक कारण या चर पर परिणाम में भिन्नता होती है जो सामान्यतः परिलक्षित होती है।

सहवर्ती भिन्नता की विधि (Method of concomitant variation) - जब परिणामों में भिन्नता या विचरण होता है तो असमानता के साथ के कारण, कारण को भी दर्शाते हैं।

अवशेष की विधि (Method of residuces) - जब हम जानते हैं कि किसी घटना के पीछे निश्चित कारण है, तो सामान्यतः घटना के कारणों से दूसरे कारणों को आपस में सम्बद्ध करके देखा जाता है, जो अवशेष रह जाते हैं।

मिल की इस विधि के अनुसार ऐसी स्थितियाँ कभी स्वाभाविक रूप से चाहे अनचाहे रूप से कभी नहीं पैदा हो सकती है और चूंकि व्यापकीय नियमों के बनाने हेतु ऐसी स्थितियाँ जरूरी थी, सामाजिक विज्ञान में इस तरह की तुलनाएं संभव नहीं हो पाई लेकिन फिर भी कुछ सीमा तक अवलोकनीय रूप से यह तथ्य है कि एक चर में परिवर्तन होने पर विभिन्न चरों पर कुछ न कुछ प्रभाव तो निश्चित रूप से पड़ेगा।[10]

इमानुअल कांट (1724-1804) ने अनुभववाद एवं बुद्धिवाद की सुलह पर कार्य किया। उन्होंने यह व्यक्त किया कि मनुष्य के पास पूर्व निर्धारित एवं स्वयंसिद्ध (A priori) अंतज्ञान होता है जिसमें मानव मस्तिष्क सभी अनुभवों के सामान्य या सार्वभौमिक समुच्चयों को प्रस्तुत करता है। काण्ट का यह दावा है कि मस्तिष्क सभी अनुभव को सृजित करता है। काण्ट के लिये ज्ञान का स्रोत अनुभव है लेकिन मस्तिष्क से सार्वभौमिक समुच्चयों का श्रेणियों के रूप में यह रचित होता है। काण्ट ने अनुभव व निगमनात्मक विधि को मिलाकर विज्ञान के दर्शन को नवीन दिशा प्रदान की है।[11]

प्रबोधनवादी प्रोजेक्ट के माध्यम से विज्ञान की उत्तरोत्तर वृद्धि को एक सार्थक दिशा मिली। यूरोपीय समाज में 18वीं सदी में दार्शनिक एवं सामाजिक आंदोलनों ने वैज्ञानिक क्रांति को फलने-फूलने हेतु एक आधार मिलनी शुरू हो गयी। वाल्टेयर (1694-1778), माण्टेस्क्यू (1689-1755), एडम स्मिथ (1729-1790) ने प्रबोधनवादी प्रोजेक्ट पर एक जैसी भाषा तो नहीं व्यक्त की लेकिन प्रबोधनवादी प्रोजेक्ट निम्न विचारों पर बल देता है-

- मानव प्राणी में तर्क करना प्रमुख विशेषता है।
- ज्ञानमीमांसा अनुभव से सम्बन्धित है जो निश्चितता एवं आधार की तलाश करती है। (जैसे- बुद्धिवाद, अनुभववाद, प्रत्यक्षवाद)
- सामाजिक एवं नैतिक विकास
- मानवतावाद प्रमुख राजनीतिक लक्ष्य।

प्रबोधनवाद तथा आधुनिकतावाद दोनों सामान्यतः एक पर्याय के रूप में समझे जाते हैं। होलिस[12] ने इस पर अपनी प्रतिक्रिया व्यक्त करते हुए कहा है कि प्रबोधनवाद एक ऐसा प्रोजेक्ट है जिसमें प्रकृति के सभी छुपे हुए रहस्यों को उजागर करने का सम्पूर्ण वृहद प्रयास है जिसमें मानवतावाद भी प्रमुखतः शामिल है। इमानुअल काण्ट[13] ने लिखा है कि ''हमारा युग एक विशेष कोटि में है, यह समालोचना का युग है और हर बात की समालोचना होनी चाहिए।'' किसी की बात को यू ही नहीं मान लेना चाहिए। इस समालोचनात्मकता ने एक नई गति प्रदान की और मनुष्यों को बंद या रूढ़िगत सोच के पिंजरे से बाहर निकालने में सक्षम किया और अंत में तर्क स्वतंत्रता, विज्ञान और सच्चाई के बीच के सकारात्मक सम्बन्ध को प्रत्यक्ष किया।

इस समालोचनात्मकता की प्रकृति अनिवार्यता नकारात्मक नहीं थी। दरअसल, जहाँ इसने तोड़ा, वही इसने जोड़ा। इसने ईसाई धर्म की गूढ आध्यात्मिकता और नीतिशास्त्रीयता का खण्डन नहीं किया। इसने केवल ईसाई धर्म की बंद और रूढ़िगत विशेषता का ही खण्डन नहीं किया, बल्कि धर्म निरपेक्ष/उदारवादी विश्वदृष्टि

के आधार पर नये विश्व की नींव डाली। दूसरे शब्दों में आधुनिकता की जड़े यानि वैज्ञानिकता, तर्कसंगतता और व्यक्तिगत विशेषताओं को सम्मान करने वाला प्रकल्प प्रबोधन के प्रोजेक्ट में शामिल था। यह प्रगतिशील था, इसकी आस्था रैखिक/ऐतिहासिक प्रगति में थी जिसमें ज्ञान, नवीनताओं और प्रयोगों की खोजबीन के लिये नई गति की प्रदान की।

विज्ञान दर्शन पर पुनः चिन्तन

विज्ञान की प्रकृति को लेकर बौद्धिकों के मध्य काफी बहस हो रही है। विज्ञान को किस प्रकार का होना चाहिए इस पर वाद-विवाद का दौर प्रमुख रूप से विगत तीन दशकों से हो रहा है। अब विज्ञान की प्रकृति पर भी प्रश्न चिन्ह लग रहे हैं, विज्ञान को भी वैचारिकीय, विषयगत एवं अविश्वसनीयता का ठप्पा लग रहा है यह तर्क प्रस्तुत किया जा रहा है कि कोई भी वैज्ञानिक समुदाय के सैद्धांतीकरण को देखा जाये तो ज्ञात होता है कि इसमें स्वयं आधारिकाएं है इनके अलावा ये कुछ भी प्रतिबिम्बित नहीं करती लेकिन सांस्कृतिक विचारों से प्रभावशालीनता को प्रदर्शित करते है। विज्ञान की दुविधा में यह भी तर्क दिया जा रहा है कि यह तथ्यों को हेरफेर करके प्रस्तुत करता है तथा पुनः सार्वजनिक लोगों के भरोसों को भी चालाकी से मोड़ देते हैं। इस प्रकार के परिवर्तनों की मात्रा में वृद्धि हुई है, जो संपोषित हो रही है।

आलोचनाओं के बावजूद विज्ञान ने सार्वभौमिक तथ्यों को न प्रस्तुत करने के सन्दर्भ में स्वयं की साख को बनाए रखने के लिए सापेक्षिता का सहारा लिया जिसमें आज किसी भी घटना या संस्कृति की व्याख्या सापेक्षिता के आधार पर की जा रही है। वैश्विक दृष्टि से एवं सांस्कृतिक दृष्टिकोण से आज यह निरंतर एक इस प्रकार की बहस को सामने ला रहा है जिसमें संसाधनों तथा ज्ञान की संस्थाओं के प्राधिकार है। विज्ञान के मानकों एवं वैज्ञानिक गतिविधियों को सांस्कृतिक जामे में तौल पर राजनीति के माध्यम से ज्ञान की संरचना को निर्धारित किया जा रहा है।

हमें यह कैसे ज्ञात होता है कि नवीन वैज्ञानिक दावे वैध एवं सर्वमान्य है। इसको प्रमाणिकता विशेषज्ञों का संकुल प्रदान कराता है। लेकिन क्या यह सभी लोगों पर सामान्य रूप से लागू होगा यह विचारणीय है ? इसका उत्तर ढूढने के लिये हम उसकी संस्थाओं का प्रतिष्ठानों पर देखना शुरू कर देते हैं। अगर कोई अनुसंधान नेचर पत्रिका में प्रकाशित हुआ और कोई अनुसंधान कार्य किसी सामान्य कोटि के अखबार में प्रकाशित हुआ तो उसमें हम उस पत्रिका के दावे को मंजूरी देते हैं। जो कि उच्च कोटि का है।

जो कि औचित्यात्मक है। ये सभी तथ्य विज्ञान की प्रकृति पर पुनःचर्चा को व्यक्त करते हैं। इस संदर्भ के प्रमुख वैज्ञानिक दार्शनिकों कार्ल पॉपर (1902-1994), थामस कुन (1922-1996), पाल फेयर बैंड (1924-1999) का नाम उल्लेखनीय है, जिन्होंने इसकी प्रकृति पर पुनः चर्चा प्रस्तुत की है।

कार्ल पॉपर (1902-1994) ने प्रत्यक्षवाद तथा मार्क्सवाद को गहन रूप से अध्ययन किया और विज्ञान की विशेष वैचारिकी को सभी के समक्ष प्रस्तुत किया। आइनस्टीन के सापेक्षिता के सिद्धांत से वे बहुत प्रभावित थे। इनका मानना था कि दो शताब्दी तक अपना प्रभुत्व कायम रखने वाले न्यूटनवादी भौतिकशास्त्र पर अनेक प्रश्न उठाए जा सकते हैं। उन्होंने विज्ञान की सापेक्ष प्रकृति की विवेचना की और कहा कि विज्ञान कोई ठोस और स्थायी चितरंजन रूप में मान्य वस्तु नहीं है। पॉपर ने यह अभिव्यक्त किया है, कि विज्ञान अटकलों का विषय है जिसमें मिथ्यासिद्धीकरण और खंडन का बोलबाला है। जैसा कि पॉपर[14] ने कहा था, ''एक सिद्धान्त की वैज्ञानिक प्रस्थिति इसके मिथ्यासिद्ध होने या खंडन के योग्य होने, या परीक्षण योग्य होने पर निर्भर करती है। ऐसा सिद्धांत जिसका किसी संकल्पनीय घटना से खण्डन नहीं किया जा सकता। पॉपर के अनुसार अवैज्ञानिक है।'' इनका कहना है कि ज्ञान के किसी विशेष स्रोत की अखण्डता या पवित्रता को सिद्ध करना जरूरी नहीं है, चाहे वह बेकन का अनुभववाद हो या डेस्कार्ट या बुद्धिवाद हो और यह तो कभी न सोचा जाये कि इसके द्वारा अर्जित ज्ञान निश्चितता का क्षेत्र है। इससे हठधर्मिता का विकास होता है और एक मिथ्यापूर्ण विश्वास पैदा हो जाता है कि संसार विद्यमान सिद्धांत के सत्यापन से परिपूर्ण है। पॉपर ने इस हठधर्मी विचारधारा की आलोचना की और तर्क दिया कि विज्ञान केवल खुली या मुक्त संस्कृति के साथ ही प्रगति कर सकता है, जिसमें उसकी खंडनीय (refutability) और मिथ्यासिद्धीकरण (falsifiability) की स्फूर्ति को बढ़ावा देना होगा।[15]

केवल समालोचनीय बुद्धिवाद की संस्कृति से ही विज्ञान प्रगति करता है। विज्ञान स्वयं में समालोचनात्मक और लोकतांत्रिक होता है। परीक्षण और त्रुटि, अनुमान और खण्डन से ही विज्ञान हमेशा प्रगति करता है। लेकिन नकली विज्ञान हठधर्मी होता है, यह अपनी व्याख्यात्मक शक्ति के प्रति आश्वस्त होता है, यह केवल पुष्टि और सत्यापन की अपेक्षा करता है। विज्ञान की इस समझ से पॉपर ने तार्किक प्रत्यक्षवाद, निश्चवाद और मार्क्सवाद की आलोचना की। दूसरे शब्दों में कार्ल पॉपर ने विज्ञान को एक नया अर्थ प्रदान किया। उसने विज्ञान को प्रत्यक्षवादी निश्चितताओं से मुक्त कराने का प्रयास किया है। उसके लिए विज्ञान सापेक्ष है, विज्ञान मिथक बनाने जैसा है। संज्ञानात्मक निश्चितता से उत्पन्न घमंड विज्ञान का संवर्धन नहीं करता, बल्कि विज्ञान की वृद्धि विनम्रता की उस भावना से होती है। मिथ्यासिद्धीकरण और खंडनीयता की संभावनाओं को प्रोत्साहित करें।

थामस कुन (1922-1996) ने भी वैज्ञानिक दर्शन पर कार्य किया है। इनके लिये सामान्य विज्ञान ऐसे निदर्शन की केन्द्रीयता पर निर्भर करता है जिसे कोई विशेष वैज्ञानिक समुदाय सत्य मानता है। कुन के शब्दों में, ''निदर्शन (Pradigm) तो वास्तविक वैज्ञानिक आचार के कुछ स्वीकृत उदाहरण है जैसे

कानून, सिद्धांत, अनुप्रयोग और क्रियान्वयन आदि। ये निर्देशन एक ऐसा मॉडल प्रदान करते हैं, जिनसे वैज्ञानिक शोध की सुसम्बद्ध परम्परा विशेष का विकास होता है। निदर्शन की केन्द्रीयता, इसके प्रति प्रतिबद्धता और इसकी विशिष्टता विज्ञान को ठोस आधार प्रदान करती है। इसकी दिशा निर्धारित करती है, इसमें अखण्डनीयता या मिथ्याकरण नहीं होता है।''[16]

पाल फेयर बैंड (1924-1999) ने वैज्ञानिक विधि के आधिपतय की आलोचना की। इनके लिये कोई भी विधि, यहाँ तक कि सर्वाधिक विधि भी दूसरी विधियों को अपने अधीन नहीं कर सकती और उसको हाशिये पर नहीं रख सकती है। इन्होंने वैज्ञानिकवाद को अपनी स्वीकृति नहीं दी, जिनकी यह मान्यता है कि विज्ञान ही ज्ञान का वैध रूप है। इसके स्थान पर इन्होंने विज्ञान की राजनीति, शक्ति के साथ इसके सम्बन्ध और प्रचार तथा अन्य युक्तियों से इसके द्वारा ज्ञान के सभी वैकल्पिक रूपों की हत्या करने रहस्योद्घाटन किया। इन्होंने जोरदार ढंग से कहा है कि वैज्ञानिकवाद लोकतांत्रिक समाज की भावना के विरूद्ध काम करेगा क्योंकि लोकतंत्र में ज्ञान, पद्धतियों, विधियों और शोध की परम्पराओं में बहुलता होती है। फेयरबैण्ड के अनुसार प्रत्येक परम्परा, प्रत्येक दंत कथा की अपनी वैधता होती है। कुछ भी मृत या अर्थहीन नहीं है।[17]

पॉपर के लिए विज्ञान उस अनुमान की भाँति है जिसका खण्डन हो, कुन के लिये विज्ञान संरक्षणवादी है यह इसलिए व्याप्त है क्योंकि लोगों के अन्य समूहों की तरह वैज्ञानिकों पर समकक्ष समूह और अन्य समाजीकरण की शक्तियों का दबाव पड़ता है। फेयरबैंड के लिये विज्ञान के आधिपत्य और हिंसा का अपना इतिहास है।

उत्तर आधुनिकतावादी चिंतन ने विज्ञान की सत्ता को सांस्कृतिक सन्दर्भों को लेते हुए इसे धराशाही करने का कार्य किया है। प्रत्यक्षवादी दर्शन की जगह समाजविज्ञानों में गैर प्रत्यक्षवादी दर्शन का प्रवेश होता जा रहा है तथा विज्ञान को इस संदर्भ में स्वयं को स्थापित करना इसकी सबसे बड़ी दुविधा है। सांस्कृतिक विविधता होने के परिणामस्वरूप विज्ञान दर्शन में ऐसा कोई प्रारूप अभी तक विकसित नहीं हो पाया जो कि वैश्विक स्तर पर प्रयोग हो जो कि एक समान रूप से ज्ञान का निर्माण कर सके। इन सांस्कृतिक तथा मानवीय व्यवहार की जटिलताओं ने सामाजिक विज्ञान में विज्ञानदर्शन की चुनौतियों को प्रस्तुत किया है। जो कि गत्यात्मक स्वरूप की भविष्यवाणी करने की पूर्ण रूप से सार्थक नहीं हो पा रहा है, सामाजिक विज्ञानों में विज्ञान स्वयं को किस प्रकार स्थापित कर पायेगा यही इसके दर्शन की सबसे बड़ी दुविधा है।

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दक्षिणी उत्तर प्रदेश के पुरापाषाणिक उपकरणों का तकनीकि विश्लेषण

*डॉ॰ सुजाता गौतम**

पाषाण उपकरणों का निर्माण एवं उनका उपयोग प्रागैतिहासिक कालीन मानव जीवन की सबसे महत्वपूर्ण उपलब्धि थी। इन उपकरणों के प्रयोग से वह शारीरिक बल में सभी पशुओं से निर्बल होने के बावजूद उन पर अपना प्रभुत्व स्थापित कर सका। प्रागैतिहासिक मानव ने प्रारम्भ में उपकरण निर्माण के लिए पाषाण के अतिरिक्त सम्भवतः हड्डी तथा लकड़ी का भी उपयोग किया होगा। किन्तु पत्थर की अपेक्षा दोनों ही अल्पस्थायी एवं नाश्वान हैं, जिसके कारण प्रस्तर उपकरणों का पाषाण युगीन संस्कृतियों का अध्ययन करने के लिए महत्त्व और अधिक बढ़ जाता है। पाषाण युगीन संस्कृतियों को प्रमुखतः तीन कालों में विभाजित किया जाता है–

1. पुरापाषाण काल
2. मध्यपाषाण काल
3. नवपाषाण काल

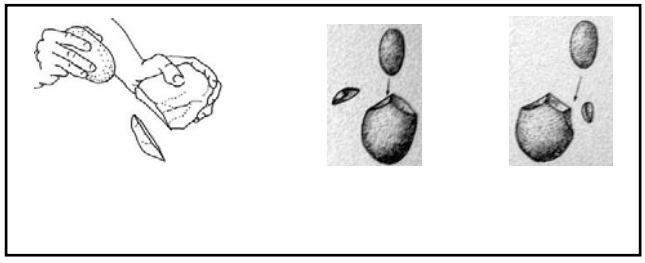
प्रस्तुत शोध-पत्र में दक्षिणी उत्तर प्रदेश के पुरापाषाणिक उपकरणों की निर्माण तकनीकि का विश्लेषण करने का प्रयास किया गया है। भौगोलिक रूप से दक्षिणी उत्तर प्रदेश के अन्तर्गत इलाहाबाद तक का यमुना का दक्षिणी भाग तथा गंगा का दक्षिणी भाग (जो पूरब में वाराणसी जिले तक विस्तृत रूप से फैला है) आता है। दक्षिणी उत्तर प्रदेश में प्रमुख रूप से जिला-झाँसी, जिला-ललितपुर, जिला-हमीरपुर, जिला-बांदा, इलाहाबाद जिले का दक्षिणी भाग, जिला-मिर्जापुर, जिला-सोनभद्र एवं वाराणसी जिले की चकिया तहसील तक का क्षेत्र सम्मिलित है।

19वीं शताब्दी के उत्तरार्द्ध में दक्षिणी उत्तर प्रदेश के क्षेत्र में पाषाण युगीन संस्कृतियों को खोजने का कार्य एच॰ रिवेत्त कार्नक[1], ए॰सी॰एल॰ कार्लाइल[2] तथा जे॰ कॉकबर्न[3] ने प्रमुख रूप से किया। प्रागैतिहासिक अध्ययन के क्षेत्र में समय-समय पर विभिन्न पुराविदों, भूतत्त्वविदों, पुरावनस्पतिशास्त्रियों एवं नृतत्त्वशास्त्रियों द्वारा महत्वपूर्ण शोध कार्य किए जाते रहे हैं। अभी तक हुए अनेक शोध कार्यों से स्पष्ट हो चुका है, कि पुरापाषाणकालीन उपकरणों को बनाने के लिए अनेक निर्माण तकनीकों का प्रयोग किया जाता था। यही कारण है, कि पुरापाषाणकालीन उपकरणों को उनकी निर्माण तकनीकि, प्रारूपकी एवं स्तरीकरण के आधार पर मुख्य रूप से तीन उपकालों में वर्गीकृत किया जाता है :-

1. निम्नपुरापाषाण काल
2. मध्यपुरापाषाण काल
3. उच्चपुरापाषाण काल

पुरापाषाण कालीन मानव का सम्पूर्ण जीवन प्रकृति पर ही निर्भर था। पाषाण उपकरणों का निर्माण प्रागैतिहासिक मानव की सबसे महत्त्वपूर्ण कृति थी। प्रागैतिहासिक मानव ने उपकरण निर्माण के लिए विशेषतः उन्हीं पत्थरों को चुना जो अपेक्षाकृत अधिक सूक्ष्मकण के तथा कठोर प्रकृति के होते थे।[4] पुरापाषाणकाल में मानव ने फ्लिन्ट (Flint), चर्ट (Chert), ऑब्सीडियन (Obsidian), स्फटिकाश्म (Quartzite), सिकताश्म (Sand Stone), डोलेराइट (Dolerite), ओपल (Opal), जैस्पर (Jasper) आदि पाषाणों का प्रयोग उपकरण बनाने के लिए बहुतायत से किया था। पत्थरों को उपकरण का स्वरूप प्रदान करने के लिए सर्वप्रथम मुख्य पाषाण खण्ड (Core) से आवश्यकतानुसार फलक (Flake) निकाले जाते थे। इन फलकों को निकालने के लिए प्रारम्भ में सम्भवतः विभिन्न प्रयोग किए गए होंगे जिसके परिणामस्वरूप फलकीकरण की अनेक प्रविधियों का आविष्कार हुआ।

निम्नपुरापाषाण कालीन ज्ञात उपकरणों में पेबुल (Pebble), हैण्डेक्स (Handaxe) एवं क्लवीर (Cleaver) प्रमुख हैं। निम्नपुरापाषाण काल के मानव द्वारा निर्मित उपकरण प्रारम्भ में अनगढ़ (Irregular), आकार में बड़े एवं भारी थे और कुछ पर कॉरटेक्स (Cortex) भी विद्यमान थी। सम्भवतः इन उपकरणों का निर्माण निर्बाध फलकीकरण (Free Flaking Technique) तकनीक के द्वारा किया गया होगा। इस तकनीक के अन्तर्गत जिस पाषाण खण्ड को फलकीकृत करना है उसे किसी स्थिर निहायी (Anvil) के ऊपर पटका जाता है। इस तकनीक को ब्लॉक-ऑन-ब्लॉक तकनीक (Block-on-Block Technique) भी कहते हैं **(चित्र सं॰-1)**। चूँकि फलकीकरण की इस विधि में नियन्त्रण की कमी थी अतः जो फलक मुख्य पाषाण (Core) से अलग हुए वह वजन में भारी तथा आकार में बड़े एवं उनका अर्धशंकु (Bulb of Percussion) अधिक विकसित है। आघात-स्थल (Striking Platform) और अर्धशंकु के बीच बने फलक का कोण प्रायः 100° से 120° का होता है।



चित्र सं॰-1

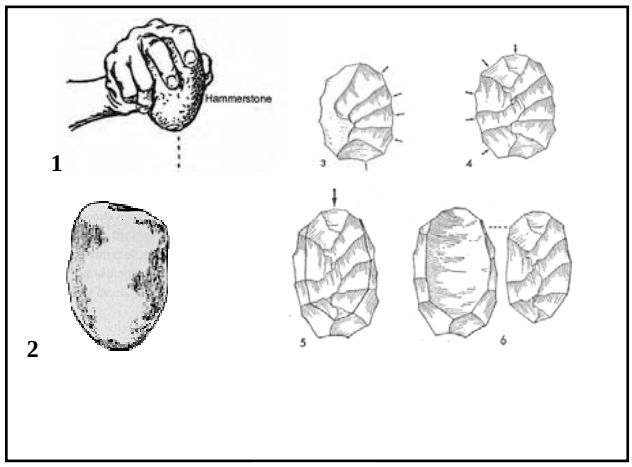
*असिस्टेन्ट प्रोफेसर, प्रा.भा.इ.सं. एवं पुरातत्त्व विभाग, कला संकाय, काशी हिन्दू विश्वविद्यालय

फलकीकरण की एक अन्य तकनीक नियन्त्रित फलकीकरण (Controlled Flaking) भी है। इस तकनीक में हथौड़ा चलायमान तथा नियन्त्रित होता है। जिसके कारण फलकीकरण की प्रविधि पूर्व की तुलना में नियन्त्रित होने लगी और धीरे-धीरे उपकरणों का स्वरूप सुगढ़ होता चला गया। इस प्रविधि से निकले फलकों पर अर्धशंकु अविकसित एवं सपाट तथा फलक चिह्न छिछले होते हैं। नियन्त्रित फलकीकरण में कोमल अथवा बेलनाकार हथौड़े (Soft or Cylendrical Hammer) का प्रयोग किया जाता है। हथौड़ा कठोर लकडी, हड्डी एवं मुलायम पाषाण का हो सकता है।

दक्षिणी उत्तर प्रदेश के लहचुरा (उ॰प्र॰ के जिला-झाँसी एवं हमीरपुर तथा म॰प्र॰ के जिला-छतरपुर के त्रिकोणीय संगम के समीप स्थित), बनगाँव (झाँसी के समीप उ॰प्र॰-म॰प्र॰ की सीमा पर स्थित), बेलहरका (जिला-बांदा), गोपीपुर (जिला-बांदा), निहि (मानिकपुर के समीप स्थित), परसिधिया (जिला-इलाहाबाद), महुगढ़ (जिला-मिर्जापुर), ललितपुर एवं सिंगरौली बेसिन (जिला-सोनभद्र) से निम्नपुरापाषाण कालीन संस्कृति के प्रमाण ज्ञात हुए हैं।[5] यहाँ से सोहन संस्कृति (पेबुल उपकरण) और एश्यूलियन संस्कृति (हैण्डेक्स, क्लीवर) के उपकरणों की प्राप्ति हुई है। दक्षिणी उत्तर प्रदेश से एश्यूलियन संस्कृति के प्राप्त उपकरणों के आधार पर यह कहा जा सकता है, कि एक वर्ग में हैण्डेक्स के साथ पेबुल उपकरणों की उपस्थित 12 से 20 प्रतिशत है और दूसरे वर्ग में पेबुल उपकरण या तो अनुपस्थित हैं या उनका प्रतिशत सीमित (5 प्रतिशत) है। इन दोनों वर्गों में हैण्डेक्स तथा क्लीवर प्रमुख उपकरण हैं। लहचुरा से पेबुल उपकरणों की प्राप्ति हुई है। ये पेबुल उपकरण क्वार्टजाइट के हैं। यहॉ से ग्रेनाइट, ओपल, जेस्पर एवं क्वार्ट्ज के पेबुल उपकरणों की भी प्राप्ति हुई है। उपकरण प्रकारों में चॉपर-चॉपिंग की बहुलता है। चॉपर-चॉपिंग के निर्माण के लिए मुख्य रूप से ब्लॉक-ऑन-ब्लॉक तकनीक का प्रयोग किया गया है।[6]

एश्यूलियन उपकरण उद्योग के प्रमाण गोपीपुर, निहि, परसिधिया, महुगढ़, ललितपुर, सिंगरौली बेसिन आदि से प्राप्त हुए हैं। गोपीपुर से हैण्डेक्स (8.8%), क्लीवर (13.6%), चॉपर (15.9%), साधारण फलक, आंशिक रूप से तैयार कोर आदि की प्राप्ति उल्लेखनीय है। यहाँ से सीमित संख्या में ऐसे फलक भी प्राप्त हुए हैं जिनसे स्पष्ट होता है, कि इस क्षेत्र में उत्तम फलकीकरण के लिए लेवालॉयस् तकनीक का प्रारम्भ हो गया था। निहि से लेवालॉयस् तकनीक से निकाले गए फलकों की संख्या में वृद्धि दिखाई पड़ती है।

प्रागैतिहासिक मानव ने फलक निर्माण के लिए एक विशिष्ट तकनीकि का भी उपयोग किया जिसे लेवालॉयस् तकनीक के नाम से जाना जाता है। इस तकनीक से फलक निकालने के लिए सर्वप्रथम कोर को तैयार किया जाता है। इसके लिए चुने हुए पाषाण खण्ड के चारों तरफ हल्के हथौड़े (Soft Hammer) से केन्द्रोन्मुख संघात (Centrally Directed Percussion) के द्वारा छोटे-छोटे फलक निकाले जाते हैं। केन्द्रोन्मुख संघात विधि के परिणामस्वरूप फलक चिन्ह कोर के मध्य में एक दूसरे से मिल जाते हैं। फलक का कोण प्रायः 90° के बराबर या उससे कम का होता है। इस प्रकार जब पेबुल/पाषाण खण्ड की ऊपर की सम्पूर्ण सतह प्रमुख फलक निकालने के लिए तैयार हो जाती है, तो फलक को मुख्य पाषाण से अलग करने के लिए आघात स्थल (Striking Platform) तैयार किया जाता है। जिस पर कोमल हथौड़े (Soft/Cylendrical Hammer) से प्रत्यक्ष या अप्रत्यक्ष संघात कर मुख्य फलक प्राप्त किया जाता था। प्राप्त फलक पर कोरटेक्स (यानी पाषाण की प्राकृतिक सतह) विद्यमान नहीं होती है। इस तकनीक से निकाले गए मुख्य फलक का स्वरूप कच्छप (Tortoise) जैसा होता है। जिस कोर से लेवालॉयस् प्रकार के फलक निकाले गए थे, उसे कच्छप कोर (Tortoise Core) भी कहते हैं। इस तकनीक के द्वारा एक बार में एक ही प्रमुख फलक निकाला जा सकता था। दूसरा फलक प्राप्त करने के लिए सम्पूर्ण प्रक्रिया को पुनः कोर तैयार करने के लिए प्रयोग करना आवश्यक था। लेवालॉयस् तकनीक से निकले फलक छोटे और पतले होते थे तथा अर्धशंकु (Bulb of Percussion) अविकसित एवं सपाट होता है। इस तकनीक का नामकरण फ्रांस के पेरिस के उपनगर लेवालॉयस् पैरेत (Levallois Perret) के नाम पर पड़ा। फलक उपकरण निर्माण तकनीकों में लेवालॉयस् तकनीक से निकले फलक, फलक उपकरणों की सबसे विकसित अवस्था को प्रदर्शित करते हैं **(चित्र सं॰-2)**। इस प्रविधि का प्रयोग निरन्तर उच्च पुरापाषाण काल तक विभिन्न परिवर्तित रूपों में देखने को मिलता है।



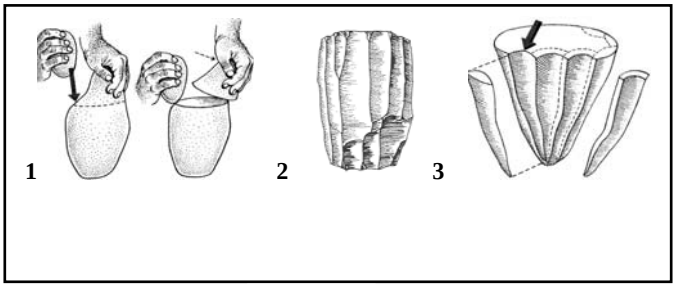
चित्र सं॰-2

परसिधिया से प्राप्त उपकरणों को तकनीक और प्रारूपकी के आधार पर निम्न और मध्य पुरापाषाण काल में रखा गया है। यहाँ से निम्नपुरापाषाण कालीन उपकरण समूहों में हैण्डेक्स, क्लीवर के साथ स्क्रेपर की भी प्राप्ति हुई है। इन सभी उपकरणों का निर्माण क्वार्टज पाषाण खण्डों से प्राप्त बड़े-बड़े फलकों पर हुआ है। महुगढ़ नामक गाँव से भारी एवं बड़े हैण्डेक्स तथा चौड़े एवं लम्बे फलकों की प्राप्ति हुई है। महुगढ़ से कुछ विभिन्न प्रकार के पार्श्व

स्क्रेपर (Side Scraper) भी प्राप्त हुए हैं। यहाँ के उपकरणों के निर्माण में लेवालॉयस् तकनीक को अधिक महत्ता दी गई थी। सिंगरौली बेसिन[7] से चॉपर-चॉपिंग (सीमित संख्या), क्लीवर, फलक तथा कोर उपलब्ध हुए हैं। सिंगरौली से ज्ञात पाषाण उपकरण, उपकरणों के निर्माण में प्रोटो लेवालॉयस् एवं लेवालॉयस् तकनीक की प्रधानता को प्रदर्शित करते हैं। इसके अलावा बेलन, केन एवं सोन नदी के ग्रेवल जमाव से भी निम्न पुरापाषाण कालीन उपकरणों के प्रमाण हैण्डेक्स एवं क्लीवर के रूप में प्राप्त हुए हैं।

दक्षिणी उत्तर प्रदेश से मध्यपुरापाषाण कालीन संस्कृति के उपकरण भी ज्ञात हुए हैं। इस काल के प्रमुख उपकरण स्क्रेपर था। इन उपकरणों के साथ पूर्ववर्ती संस्कृति के उपकरण चॉपर एवं चॉपिंग की प्राप्ति सीमित रूप से होती है। मध्यपुरापाषाण काल से सम्बन्धित उपकरण लहचुरा, परसिधिया, चैनपुरा (परसिधिया के समीप स्थित), बैठकवाँ (जिला-इलाहाबाद) तथा सिद्धपुर (जिला-बांदा) से प्रकाश में आए हैं। लहचुरा से प्राप्त पत्ती के आकार (Leaf Shaped) का उपकरण लेवालॉयस् तकनीक के प्रयोग का महत्वपूर्ण प्रमाण प्रस्तुत करता है। दक्षिणी उत्तर प्रदेश में मध्यपुरापाषाण काल के पाषाण उपकरणों का प्रसार विस्तृत क्षेत्र में था। इस संस्कृति से सम्बन्धित उपकरण सोन, केन, बेलन एवं स्योति नदियों के ग्रेवेल जमावों से भी उपलब्ध हुए हैं। इन उपकरणों के निर्माण में लेवालॉयस् तकनीक की प्रधानता दिखाई देती है। केवल सिद्धपुर से ज्ञात उपकरणों में इस तकनीक का आभाव है। इस संस्कृति के उपकरण निर्माण के लिए क्रिप्टोक्रिस्टेलाइन सिलिका (Cryptocrystalline Silica) पाषाण का प्रयोग किया गया। फ्रांस में डेन्टिक्यूलेट मुस्तेरियन (Denticulate Mousterian) का अनुपात नोच्ड़ (Notchd) की तुलना में जहाँ उच्च से बहुत उच्च रहा है, तो वहीं दक्षिणी उत्तर प्रदेश के पाषाण उपकरणों में यह अनुपात मध्यम औसत का है। स्तरीकृत रूप से मध्य पुरापाषाण काल एश्यूलियन स्तर के ऊपरवर्ती जमाव से मिलता है। साथ ही इसकी सबसे महत्वपूर्ण विशेषता यह है, कि इस काल में उपकरण निर्माण के लिए लेवालॉयस् तकनीक का प्रयोग वृहद् स्तर पर हुआ।

उत्तर प्रदेश के दक्षिणी क्षेत्र से ज्ञात उच्च पुरापाषाणकालीन उपकरण विविध विशेषताओं को प्रदर्शित करते हैं। फिर भी यह काल तकनीक-प्रारूपकी के आधार पर पूर्ववर्ती संस्कृति से जुड़ा हुआ है। दक्षिणी उत्तर प्रदेश में उच्च पुरापाषाणकालीन उपकरण दैया (स्योति नदी के दाहिने तट पर स्थित), लहरियाडीह[8] (जिला-मिर्जापुर), लेखहिया[9], मोरहान पहाड़[10], बेघइखोर[11], अइंचवारा (जिला-बांदा), लोधवारा (जिला-बांदा) एवं सिद्धपुर आदि से प्राप्त हुए हैं। इस काल के उपकरणों में प्रमुख रूप से ब्लेड, ब्यूरिन (सीमित रूप से), ब्लेडलेट, पोइंट के साथ स्क्रेपर, लेवालॉयस् फलक, डेन्टिक्यूलेट्स, बोरर आदि की प्राप्ति भी उल्लेखनीय है। इस काल के उपकरणों के निर्माण के लिए साधारणतः लेवालॉयस् तकनीक का प्रयोग किया जाता था। किन्तु विशिष्ट प्रकार के लम्बे ब्लेड की प्राप्ति के लिए प्रेशर तकनीक (Pressure Technique) का प्रयोग इस काल में उल्लेखनीय है। इस तकनीक के अन्तर्गत तैयार कोर पर प्रत्यक्ष या अप्रत्यक्ष रूप से हल्के हथौड़े द्वारा दबाव डाला जाता था और जिसके परिणामस्वरूप लम्बे एवं पतले ब्लेड फलकों की प्राप्ति की जाती थी **(चित्र सं॰-3)**। उपकरण निर्माण के लिए क्रिप्टोक्रिस्टेलाइन सिलिका पाषाण के साथ-साथ इस काल में क्वार्टजाइट एवं सेण्ड स्टोन का भी सीमित प्रयोग देखने को मिलता है।



चित्र सं॰-3

इस प्रकार उपरोक्त अध्ययन से स्पष्ट है, कि दक्षिणी उत्तर प्रदेश से ज्ञात पुरापाषाणकालीन उपकरणों के निर्माण में मुख्य रूप से ब्लॉक-ऑन-ब्लाक तकनीक (Block-on-Block Technique) / स्थिर निहायी तकनीक (Anvil Technique), चलायमान हथौड़ा तकनीक (Stone Hammer Technique), लेवालॉयस् तकनीक (Levallois Technique) एवं प्रेशर तकनीक (Pressure Technique) का प्रयोग किया गया है। इन तकनीकों में लेवालॉयस् तकनीक का प्रयोग प्रमुख रूप से मध्यपुरापाषाण काल में किया गया था। किन्तु इस तकनीक का प्रारम्भ निम्नपुरापाषाण काल में सीमित रूप से दिखाई पड़ता है और इसके प्रयोग की निरन्तरता उच्च पुरापाषाण काल तक देखी जाती है।

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11. वही।

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अर्जुन वृक्ष की अंतर्व्यथा

*डॉ. श्रीधर द्विवेदी**

मैं अर्जुन हूँ,
आपका शाश्वत हदय मित्र,
बहुमूल्य तत्वों से परिपूर्ण,
प्रतिवर्ष अपना वल्कल,
तुम्हारे दिल की मजबूती के लिए,
सहर्ष उतारता हूँ मैं।
पर तुमने लोभवश मेरी पूरी चमड़ी उधेड़ दी,
छलनी कर दिया मेरा सम्पूर्ण शरीर,
मै निर्वस्त्र जल भोजन से वंचित,
पत्रहीन सूख कर काँटा हो गया हूँ।
एक क्षण सोचा होता,
जब तुम्हारी हृदय नलिकाएं,
चिकनाई के ढेर से अवरूद्ध होंगी,
हृदय चीत्कार कर रहा होगा,
तुम्हारा चिरंतन सखा,
त्वचाविहीन, तत्वविहीन
ठूठ अर्जुन क्या देगा तुम्हें?
वाह रे लोभ,
तुमने मुझ जैसे मूक निरीह
अस्त्रहीन शस्त्रहीन प्राणी पर,
आघात कर,
अर्जुन पर नहीं,
अपने ही हृदय पर कुठाराघात किया,
प्रकृति की गोद से हरे-भरे वृक्ष को छीन कर,
अपना ही सर्वनाश किया।
अच्छा होता हम इसे समझ लेते,
अर्जुन की अंतर्व्यथा,
प्रतीक है प्रकृति की मार्मिक पीड़ा,
उसके अवसाद का।
प्रकृति से यह खिलवाड़ न करें,
अपितु उसका सान्निध्य साहचर्य,
साकार स्वीकार अंगीकार करें।

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*डीन एवं प्रिंसिपल, हमदर्द मेडिकल इंस्टिट्यूट एंड रिसर्च, नई दिल्ली

भारतीय त्रिस्कन्ध ज्योतिष का वैज्ञानिकत्व –एक समीक्षा

*प्रो. सच्चिदानन्द मिश्र**

1. संहितोक्त प्रभाव ज्ञापन

इसके अन्तर्गत बृहत्संहितोक्त नक्षत्रविद्या सौरमण्डलीय संचार एवं इनके भूपृष्ठ दृश्य वर्ण एवं राशिगत संचार तथा बिम्बलक्षण एवं उदयास्तादि से होने वाले प्रभावों की समीक्षा की गयी है। यथा— नक्षत्र+ग्रह के योगज प्रभाव के अन्तर्गत आदित्यचार, चन्द्रचार, राहुचार, भौमचार, बुधचार, गुरुचार, शुक्रचार, शनिचार एवं केतुचार के अनुसार दिव्यप्रभाव का भौमरूप एवं उसके स्वरूप को बृहत्संहिता में विधिवत् दर्शाया गया है।[1] नक्षत्रों के अचल प्रभाव ग्रहों के संचारादि से भौमयोग से किस तरह पृथ्वी तथा इसके विभिन्न भूभागों को प्रभावित करते है, इसकी समीक्षा भी इसमें यथा साध्य की गयी है। इसके कई निष्कर्ष खगोल भौतिक तथा महाकाशविज्ञान के इतनी प्रगति के बाद भी अभी भी प्रयोग से बहिर्भूत है। नक्षत्र, ग्रह, संचरण, बिम्बलक्षण, वर्ण आदि की सापेक्षता से किन-किन भूखण्डों में कब किस तरह के प्रभाव घटित होंगे, एतदर्थ परीक्षण एवं गणितीय सत्यापन के समन्वय से ऋषियों द्वारा प्रदत्त विशिष्ट मार्ग का लाभ इस शताब्दी में भारत तथा विश्व ले सकता है। यदि आज भी संगठित अन्वेषण से संहितोक्त धाराओं को फिर से भारत में प्राचीन नवीन योग से संगठित कर संचालित किया जाये।

- भूसापेक्ष दिव्य प्रभाव प्रमाण के अन्तर्गत अगस्त्यचार, सप्तर्षिचार, भी नक्षत्रों के दिव्य प्रभाव के नमूने हैं। यहाँ एक तथ्य ध्यातव्य है, कि अनन्त नक्षत्रों की सत्ता स्वीकार करने पर भी 54 नक्षत्रपुञ्जों के, उनमें भी 28 नक्षत्रपुञ्जों के मुख्यप्रभाव भूमध्यभाग पर विषुवत् से दोनों ओर 0^0 से 66.5^0 अक्षांश तक मुख्यरूप से माने गये हैं । उससे उत्तर दोनों ध्रुव तक ध्रुवीय एवं तदासन्न के प्रभाव अधिक एवं उत्तरी ध्रुवासन्न उत्तरी-गोलार्द्ध के एवं दक्षिणी ध्रुवासन्न दक्षिणी गोलार्द्ध के नक्षत्र दूरस्थ होने पर भी वे अधिक प्रभावी होते हैं । भूमध्य क्रान्तिक्षेत्रीय नक्षत्र भी सूर्य सापेक्ष दोनों ध्रुवों को एवं आसन्न भूभागों को प्रभावित करते हैं।[2]
- नक्षत्रों के अचल प्रभाव का अर्थ यह है कि इनके आकर्षण जन्य प्रभाव साक्षात् पृथ्वी पर नहीं होते, लेकिन वहाँ नक्षत्रों के आकर्षण प्रभाव से हमारा सूर्य साक्षात् सम्बद्ध हैं। अतः इनके अचलवत् विकिरण-ग्रहसंचार वर्णादि योग से नानाविध प्रभावोत्पादक होते हैं। ये सभी तथ्य प्रकारान्तर से बृहत्संहितादि में दिव्य प्रभाव के अन्तर्गत पठित हैं। आज के खगोल भौतिकादि के परीक्षण यद्यपि उसी दिशा में कदम बढ़ा रहा है। अनन्त महाकाश में जैसे-जैसे दिग्देशकालाति-क्रमण क्षमता बढ़ती जायेगी, उसे सदिश रखने पर ही वैदिक लक्ष्य प्राप्त हो सकेगा।[3]

2. भूखण्डविभाग एवं भगोलीयसम्बन्ध विचार

कूर्म विभाग—वस्तुतः यह नक्षत्र सापेक्ष भू विभाग को दर्शाता है। सम्पूर्ण पृथ्वी के मध्य में प्रयाग को क्यों रखा तथा इसकी मध्यदेश संज्ञा कर कृत्तिकादि 3-3 नक्षत्र 3, 4, 5 पूर्व-पूर्व क्रम से चक्रीय दृष्टि से स्थापित कर उससे पूर्व 6, 7, 8 संख्यक नक्षत्र एवं 9, 10, 11 अग्निकोण के देश क्रम से समग्र पृथ्वी को नक्षत्र प्रभाव की सापेक्षता से विभाजित किया है। क्या कभी मध्य देश में सुमेरू (उत्तर ध्रुव स्थान) था? या भूमध्य था? या इस मूल से कई- कोई और रहस्य जुडे है?

इनके प्रमाणों पर अन्वेषण जरूरी है। प्रत्यक्ष घटना से कारण तक पहुँचने में विलोम विधि के आश्रय से पहुँचना होगा। जिस प्रकार कूर्म विभाग पृथ्वी का है, उसे भारत वर्ष के मध्य में प्रयाग को निवेशित कर उसके चारों ओर के देश बृहत्संहिता में पठित हैं। यह भारतवर्ष के विस्तृत सीमा का संकेत तथा देश प्रभावज्ञापन के लिए महत्वपूर्ण प्राचीन (मध्यकालोद्धृत) संकेत है। कूर्मगत नक्षत्र-पापग्रह से पीड़ित, केतु पीड़ित तथा अशुभफलद होने पर जगल्लग्न, वर्षलग्नादि प्रमाण के क्रम से कूर्म सम्बद्ध देशविशेष को पीड़ित करते हैं।[4] कूर्म में पृथ्वी का नौखण्ड एवं वर्ष (देश या राष्ट्र) भारत वर्ष के हिसाब से पठित हैं। वर्ष का 9 खण्ड, 27 उपखण्ड भूमध्य सापेक्षता से तथा भारतवर्ष की सापेक्षता से एवं नक्षत्रव्यूह समस्त 32 श्लोकों में वराह ने विभिन्न भूपृष्ठीय पदार्थ, जीव, जन्तु एवं वनस्पत्यादि को कृत्तिकादि नक्षत्रवर्गों में सामूहिक रूप से वर्गीकृत किया है। प्रत्येक ज्ञान, कर्म तथा सम्बद्ध पदार्थ को नक्षत्रवर्ग में वर्गीकृत करना, गुणसाम्य के अनुसार प्रकृति के त्रिगुणात्मक तथा पांचभैतिक सम्बद्धता का द्योतन करता है। पञ्चमहाभूत एवं त्रिगुणमयी प्रकृति प्रभाव प्रकटीकरण का प्रत्यक्ष हेतु है। पञ्चमहाभूतानि योनिरिति पाराशर वराह तथा बल्लालसेनादि के प्रमाण से ज्ञात होता है।[5]

3. देश पदार्थ एवं जैव जगत की ग्रहप्रभाव सम्बद्धता

ग्रहभक्ति—इसके अन्तर्गत 42 श्लोकों में ग्रह से सम्बद्ध एवं प्रभावित देशविशेष गणविशेष, पदार्थ एवं जीवविशेष की सम्बद्धता एवं शुभाशुभत्व भेद से इनके ह्रास वृद्धियादि प्रभाव कारण के रूप में दृष्टिगोचर होते हैं ।[6]

ग्रहयुद्ध—इससे उनके लक्षण एवं प्रभाव का वर्गीकरण तथा

*प्रोफेसर, ज्योतिष विभाग, संस्कृत विद्या धर्म विज्ञान संकाय, काशी हिन्दू विश्वविद्यालय, वाराणसी

इनके प्रयोग से दो देश, व्यक्ति या परिवार के युद्धादि के निर्धारण के संकेत एवं नगरादि जन्य विपत्ति आदि के निर्धारण के संकेत संहिता स्कन्ध की सीमा को और अधिक महत्व पूर्ण बना देता है । जिस नक्षत्र की सापेक्षता से ग्रहों के युद्धादि होते हैं, उसी की सापेक्षता से देश, नगर, ग्राम, समाज, परिवार तथा व्यक्ति तक पर कैसे निर्धारण हो, एतदर्थ संहिता के साथ स्वरशास्त्र, (नरपतिजयचर्या आदि) तथा प्रश्नतन्त्र (प्रश्नमार्गादि) भी द्रष्टव्य हैं।[7]

मनसतत्त्व तथा चन्द्रप्रभाव सम्बद्धता

शशिग्रह समागम— (ग्रह+चन्द्र सापेक्षिक युति तथा संचरण) इससे सुभिक्षादि प्रभाव देशभेद से कैसे होते हैं? चन्द्र + ग्रह के प्रमाण से निर्धारण करने के संकेत भी नक्षत्रों की सापेक्षता से पृथ्वी पर देश भेद से कैसे होते है? एतदर्थ बृहतसंहितादि ग्रन्थ. प्रमाण भूत हैं। वर्षेश भेद से प्रभाव भेद के संकेत भी प्राप्त होते हैं। चन्द्रमा मन का कारक है। सम्बन्ध त्रिगुणात्मक है, फिर भी भौतिक प्रभावमूल सत्यापनीय। चन्द्र सोम,जल तथा औषधिआदि का कारक. है।[8]

संचरित सापेक्षिक ग्रहर्क्षाकृतियों का मानवशरीर मन तथा मानवीय सम्बन्धों पर नियत प्रभाव - ग्रहशृंगाटक—

सूर्यास्त से सूर्योदय के मध्य-ग्रह आकाश के जिस भाग में परस्पर संस्थान तथा गति से जिधर, जिस तरह का दृश्य नाभस आकृति विशेष का निर्माण करते हैं, उससे विभिन्न शुभाशुभ प्रभाव द्योतक संकेत एवं लक्षण भी नक्षत्रों की सापेक्षता से भूपृष्ठीय खण्डानुरोध से बृहत्संहितादि में नियतपठितांक के रुप में प्राप्त होते हैं। ग्रहसंवर्त, ग्रहसमागम, ग्रहसंमोह, ग्रहसमाज, ग्रहसंन्निपात तथा ग्रहकोश के अनुसार नक्षत्र सापेक्ष देश एवं मानवीय प्रभाव निर्धारण के प्राचीन संकेत आज भी उपेक्षणीय नहीं अपि तु सत्यापनार्थसंघीय अन्वेषण अपेक्षित हैं। क्योंकि वे उपर्युक्त सन्दर्भ दिव्यप्रभाव से भी सम्बद्ध हैं। इस युग में दिव्य अन्वेषण का प्रथम चरण ही अभी अनावृत हुआ है। अतः नवीन सम्बद्धता से आज की तकनीकि में इनका परिणामन एवं प्रयोग भविष्य के लिए चमत्कारी सिद्ध होगा।[9]

4. मौसमविज्ञान-वृष्टिवातावरण एवं पर्यावरण वायु एवं वर्षा तथा जलीय स्त्रोत

संहिता स्कन्ध में वृष्टि, वातावरण, वातसंचार, तापक्रम, भूकटिबन्धभेद, सौर चान्द्र एवं ग्रहों के प्रभाव आदि के द्वारा इस विज्ञान का कुछ आधार भूमि हमें प्राप्त है। वृष्टिविज्ञान में भी दिव्य तथा नाभस प्रभाव युक्त होते हैं। द्यु तथा नभ सापेक्ष भूगोलीय कटिबन्धभेद तापक्रमभेद तथा वातसंचार भेद से वृष्टिविज्ञान के समस्त मौलिक सिद्धान्त इसमें प्राप्त होते हैं। जैसे-1. वृष्टिगर्भलक्षण, 2. गर्भसम्भवलक्षण, 3. गर्भोत्पात, 4. पापग्रहप्रभाव, 5. पुष्टगर्भ, 6. वायुसंचार, 7. सूर्यराशिसंचार, 8. मेघसंचार एवं गर्भधारण, 9. विशेषगर्भलक्षण, 10. पञ्चविधनिमित्त के अन्तर्गत दिव्य, नाभस, भौम, एवं योगज एवं 11. ग्रहर्क्षोत्पन्न योगों के साथ 12. अष्टविधनिमित्तों के भी प्रयोग होते थे, यह संहिताओं से हमें ज्ञात होता है।[10]

प्रवर्षण के अन्तर्गत गर्भधारित मेघ के समस्त विधान प्राप्त होते हैं। रोहिणीयोग, आषाढीयोग, स्वातीयोग वातचक्र एवं सूर्यसापेक्ष तापक्रम तथा चन्द्रसापेक्षसोमतत्त्व परीक्षण एवं सद्योवर्षणादि परीक्षण विधान में बृहत्संहितोक्तादि वृष्टिविद्या में सम्यक् प्राप्त होते हैं।[11]

वृष्टि, सुभिक्ष, दुर्भिक्ष आदि के दीर्घकालीन योग जहाँ ग्रहयोग एवं निरयणगर्भीय सूक्ष्मगणना से गम्य हैं ,वहाँ विभिन्न तात्कालिक परीक्षण की सापेक्षता से होने वाले तात्कालिक एवं दूरगामी प्रभावों की समीक्षा भी संहितोक्त परीक्षण में जरूरी है।[12]

वातावरण लक्षण एवं वनस्पति प्रमाण से वृष्टयादिप्रमाण परीक्षण

इसमें कुसुम लता एवं सन्ध्या लक्षण (भौम) भूगोलीय अन्तरिक्ष के विषय एवं प्रभाव संहिता प्रमाण से जाने। आज भी मौसम विज्ञान विभाग 36 घण्टों में अधिक का ठीक-ठीक निर्धारण नहीं कर पाता, जबकि उपग्रहादि एवं सूक्ष्मयन्त्रों से परीक्षण होता है। अतः संहितोक्त मौसमविज्ञान से इसका समन्वय आवश्यक हैं।[13]

5. पृथ्वी के भीतर से होने वाले परिवर्त्तन जन्य उत्पात एवं बाहरी प्रभाव–भूकम्पादि

भूकम्प लक्षण के अन्तर्गत नक्षत्रों के प्रभाव, ग्रहों के प्रभाव, दिग्देशकाल एवं स्थान निर्धारण, भूगर्भीय परिवर्तन, पृष्ठीयलक्षण, भूकम्पदर्शकग्रहयोग तथा भूकम्प के पूर्वलक्षण के विमर्श भी बृहत्संहितादि में प्राप्त होते हैं। इसके अनुसार नक्षत्रों के वर्गीकरण वायव्य मण्डल, अग्निमण्डल, इन्द्रमण्डल तथा वरूण मण्डल के रूप में मिलते हैं। भूपृष्ठीय खण्डों के विचलन एवं टक्कर से ज्वालामुखी के विस्फोट से, भूगर्भीय वाष्प के साथ-लावा के निःसारण से भूकम्प होने में त्रिगोलीय कारण एवं भूपृष्ठीय निमित्तों के ठीक-ठीक निर्धारणार्थ वर्त्तमान परीक्षण अपेक्षित हैं। वायव्यकम्प वातजन्य (आकर्षण विकर्षण-जन्य) होते हैं। अग्निमण्डल के कम्प में अग्नितत्व के विक्षोभ से तथा सौरतरंगों के विक्षोभ से पृथ्वी तथा सौरमण्डलीय विभिन्न पिण्डों पर भूकम्प होते हैं। पृथ्वीअग्निगर्भा है, अतः भूगर्भीय अग्नि के विक्षोभ से यह कम्प सम्बद्ध है। इन्द्रमण्डल में इन्द्र तत्त्व तथा दिव्यतत्त्व (अन्तरिक्षजन्य) में विक्षोभ हेतु होता है।

वरूण मण्डलीय कम्प में जलतत्व तथा समुद्री आन्तरिक कारणों से कम्प होते हैं। चूकि आज भी जब भूकम्प होने लगता है, तभी अर्थ क्वीक इन्डिकेटर सिस्टम के अन्तर्गत भूकम्पग्राही रेक्टोमीटर सक्रिय होता है, फलतः जान माल की क्षति नहीं रूक पाती। अतः प्राचीन भूकम्प विद्या तथा निमित्त लक्षणों का समन्वय सर्वकल्याणार्थ जरूरी होने से यहाँ संकेत मात्र किया गया है। Moment magnitude scale भूकम्प ज्ञान में काफी सहायक है,

फिर भी भूकम्प की ठीक ठीक भविष्यवाणी हेतु प्राचीन नवीन समन्वय से संघीय उद्यम अपेक्षित है।[14]

6. अन्तरिक्ष जन्य प्रभाव

नाभसविद्या- इसके अन्तर्गत उल्का लक्षण, परिवेष, इन्द्रधनु, गन्धर्वनगर, प्रतिसूर्य, धूलकण, निर्घात आदि भूगोलीय अन्तरिक्ष जन्य विभिन्न परिवर्तन की चर्चा की गयी है। इसके विभिन्न कारणों के संकेत भी मिलते हैं। ये सब नाभस विज्ञान के अन्तर्गत परिगणित किये गये है। यहाँ इसकी चर्चा मात्र की गयी है। बृहत्संहितादि संहिताग्रन्थों में नाभसप्रभाव सविस्तर प्राप्त होता है। इसके अनेक तथ्य भौतिक परीक्षण से गम्य है।[15]

7. वास्तु एवं वातावरण प्रभाव

इसके विस्तृत वास्तुविद्या-वनविद्या, काष्ठच्छेदन, दकार्गल, उपवनविधान, औषधीयवनस्पतियाँ, वापी, कूप, तड़ाग, बोरिंग एवं चापाकल, मृदुलजल के स्रोत, वृक्षों की चिकित्सा, प्रसादभेद, गृहभेद, वास्तुशिल्प एवं स्थापत्य भेद, विभिन्न धातु, प्रस्तर, काष्ठ आदि की योजन विधि, चित्रकला, मूर्तिकला एवं प्रतिमाकला, देवमन्दिर, गृहादि के समीप रोपणीय वृक्ष, प्रतिमाप्रतिष्ठा एवं ग्रामवास भूमिचयन से प्रारम्भ कर गृहादि निर्माण तक, ग्राह्य काष्ठादि विधान, गृहारम्भ से गृहप्रवेश तक तथा गृहालंकरण एवं भूमि भेद से मरूस्थलीय दुर्ग, पर्वतदूर्ग, जलदूर्ग, नगरविधान, सेतुनिर्माण आदि समस्त तथ्य संहितोक्त वास्तुविद्या के अंग के रूप में सार्वभौमिक तथ्य है। वास्तुसंहिताओं में सरल रीति से वास्तु प्रयोज्य, वृक्षायुर्वेद प्रयोज्य, प्रासादलक्षण, वज्रलेप, प्रतिमा, वनसम्प्रवेश, प्रतिमाप्रतिष्ठापन के विस्तृतसंकेत किये गये हैं। विशेष अभिज्ञानार्थ वास्तु के प्राचीन अष्टादश प्रवर्त्तकों से प्रारम्भ कर नवीन कालखण्ड तक के वास्तुविज्ञानियों के अन्वेषण द्रष्टव्य हैं। डॉ. द्विजेन्द्रनाथ शुक्ल का समराङ्गसूत्र आदि वास्तु एवं स्थापत्य, प्रतिमा, चित्रकला आदि पर किया गया कार्य भारतीय वास्तुविद्या के विभिन्न पक्ष का हिन्दीभाषा में उपलब्ध सबसे बड़ा दस्तावेज है।[16]

8. शुभशकुन

गोलक्षण अन्य पशुपक्षियो के लक्षण— अमृताहार स्रोत की मातृ संकल्पना सत्यापन एवं प्रमाण बृहत्संहितादि प्रमाणग्रन्थों में द्रष्टव्य हैं। गो जाति को मातृ जाति में सर्वोत्कृष्टत्व एवं सर्वदेवमयत्व उपर्युक्त त्रिगोलीय सम्बद्धता से त्रिकालिक सत्य है। इसके अन्तर्गत पशु, पक्षी, कीट, पतंग, ग्राम्य तथा वनचरभेद, जलचर, थलचर, दिवाचर, रात्रीचर, उभयचर के भेदोपभेद, आकृति, प्रकृति, चेष्टा, कालखण्ड, आदि के आधार पर बृहत्संहिता, शकुनबसंतराज आदि ग्रन्थों में विस्तार से किये गये हैं। पंचविधनिमित्तों के साथ वातावरणदि एवं कालप्रमाण का भी इसमें विमर्श प्राप्त होता है। उच्चस्तरीय अन्वेषण के लिए नवीन जीवविज्ञान का समन्वय अपेक्षित है। शुभशकुन जीव, पशुपक्षी, वातावरण, काल एवं विविध जैवचेष्टओं तथा अष्टविधनिमित्तों पर आधारित होनें से प्रयोग बाह्य हो रहे हैं।[17]

मानवीय प्रभाव – इसके निर्धारण के लिए त्रिगोलीय सापेक्षता से पुरुषलक्षण, उन्मानादि क्रम से तथा पञ्चमहापुरुष लक्षण से सौरमण्डलीय मानवीय प्रभाव क्रम में पुंस्त्रीलक्षण, वस्त्र, राज्योपकरण, गन्ध, पुरुष-स्त्री समागम, शय्या, शकुन, शकुनोत्तर, तिथिकर्म एवं गुण, नक्षत्रगुण एवं सम्बद्ध कर्म एवं जातक आदि प्रमाण निष्कर्षतः दिये गये हैं। इसकी सहायता से इन तत्वों को विधिवत् जानकर अपने जीवन को सुखमय एवं शान्तिमय किया जाना इसके समन्वय से आज भी निर्दुष्टत्वेन संभव है। यह आयुर्विज्ञान के साथ कामविज्ञान में भी सहायक तथा सफल दाम्पत्य का आधार भी प्रस्तुत करता है।[18]

9. ज्योतिष संहिताओं के व्यवहारिक प्रयोग

दैवज्ञकामधेनु भी संहिता एवं व्यवहारिक त्रिस्कन्ध ज्योतिष का अद्वितीय ग्रन्थ है। भारतीय बौद्ध परम्परा में भी महर्षि अनवम दर्शी का यह ग्रन्थ बृहत्संहिता की तरह नक्षत्र सापेक्ष ग्रहसंचार के प्रमाण को भूपृष्ठाभिप्राय से दर्शाता है। इसके 12वें अध्याय से होरा, 16वें से सामुद्रिक, दकार्गल एवं नक्षत्र संज्ञाएँ अ. 22 पाप नक्षत्र, सूर्य सापेक्ष नक्षत्र प्रभाव-सूर्य शूलनक्षत्र तथा ग्रह, नक्षत्र विषघटी एवं इनका परित्याग, अ. 23 मुहूर्त्तविद्या का वर्णन इस ग्रन्थ को मानव केन्द्रिक प्रभाव विधायक बनाता है। अगर श्री लंका सिंहल द्वीप भरत खण्ड के बुद्धमतावलम्बी अनवम दर्शी तथा जैनमत में मुनिभद्रबाहु नहीं होते तो संभवतः ज्योतिष की उदात्त समवेत धारा के लाभ से ये दोनों योगमूलक भारतीय सम्प्रदाय के लोग इस उत्तम अन्वेषण से वंचित होते।[19]

- **बृहद्दैवज्ञरञ्जन-त्रिस्कन्धज्योतिष निष्कर्ष ज्ञापक** -संहिता स्कन्ध का यह महत्वपूर्ण संग्रह ग्रन्थ है। इसके लेखक पं. रामदीन काशीराज के आश्रय में विक्रम संवत् 1954 में इसे बनाये। इसमें 88 प्रकरण हैं। इसमें समस्त वर्णित विषयों का संक्षिप्त विवरण प्रस्तुत है। इसका वर्षाप्रकरण-ग्रहयोग, ग्रहोत्पात, परिवेष, भूकम्प, उल्का, अयन, मास, तिथि, नक्षत्र, प्रकरण दिव्यनाभस तथा भौमप्रभाव को वर्गीकृत कर मानवीय व्यवहारिक पक्ष को सुदृढ़ करता है। नक्षत्रप्रकरण में 182 श्लोकों में नक्षत्रों के गुण, कर्म तथा प्रभाव वर्णित हैं। ये सभी प्राचीन अन्वेषण के निष्कर्ष हैं। वस्तुतः गुण, कर्म, प्रकृति एवं प्रभाव के अनुसार अन्वेषण करने पर मूलतत्व एवं हेतु निर्धारित करना अन्वेषण गम्य संघ साध्य तथ्य है। आज अनेक तथ्य उद्घाटित हैं, अनेक अन्वेषणान्तर्गत हैं, फिर भी नक्षत्रविज्ञान का अधिकांश भाग आज भी अगम्य हैं।[20]

इसके विभिन्न विमर्शों के अन्तर्गत गुण धर्म एवं प्रभाव आदि विचार के अन्तर्गत कृत्तिकादि 27 नक्षत्रों के व्यापक प्रभाव वर्गीकृत किये गये हैं। नक्षत्रों से सम्बन्धित वृक्ष, नक्षत्रोत्पन्न तथा सम्बद्ध पदार्थ नक्षत्रव्यूह के अन्तर्गत वर्गीकृत किये गये हैं । नक्षत्रों के वर्ण, कर्म, गुण, पुण्य नक्षत्रों की प्रशंसा, रोहिणी शकटभेदन, विभिन्नयोग, मुहूर्त्तविचार, ताराविचार, सर्वौषधिविचार, मुहूर्त्तविचार

तथा इनके भेद, भार्गवमुहूर्त्त विचार, नक्षत्रनाडी विचार तथा उनके प्रभाव, दिन भेद से नाडी संज्ञाएँ तथा प्रभाव-बृहस्पति मुहूर्त्त विचार तथा इनके नाडियों की संज्ञाएँ तथा उनके प्रभाव, अहोरात्र प्रभाव बाधक शिवामुहूर्त्त विचार, जन्मकालिक मुहूर्त्त का प्रभाव, त्रिगोलीय निष्कर्षावगमन के सिद्धान्त, विभिन्न शुभाशुभ योग, आनन्दादि 28 योग एवं इनके प्रभाव, सिद्धियोग, अर्धयाम, कुलिक, उपकुलिक, अन्य दुष्टमुहूर्त्त, सन्धिप्रकरण, विभिन्न मुहूर्त्तों में नक्षत्रों का शुभाशुभत्व, जातकर्मादि संस्कारों के मुहूर्त्त, गण्डनक्षत्रविचार तथा जातकप्रभाव, गण्डशान्तिविधान, उपनयनादि मुहूर्त्तविचार, सप्तशलाका विचार, विद्यारम्भप्रकरण, क्षुरिकाबन्धन, खड्गधारण, विवाह विचार में वरकन्या मेलापक, विवाह में विभिन्न गुण तथा दोष विमर्श, द्विरागमन, वधूप्रवेश वाटिका, कृषि, रोग, केवल प्रश्न से भी विभिन्न गुणदोषादि का ज्ञान, अग्न्याधान, दीक्षा, राज्याभिषेक, वास्तु, देवमन्दिर, प्रतिमाप्रतिष्ठा, जलविचार, पापनक्षत्र दोहद **यात्रा में विजयप्रदयोग,** गृहप्रकरण, भूमिशोधनादि, गृहारम्भ, वास्तुविद्या-नुरोधेन से इसमें संकेतित हैं। विषय विस्तार की दृष्टि से मूल ग्रन्थ का अनुशीलन अपेक्षित है। एक-एक विषय इतना विस्तृत है,कि सैकडों विस्तृत शोधनिबन्धों से ये गम्य हैं। आधुनिक जगत को सूचनार्थ उपर्युक्त तथ्यों की जानकारी मात्र दी गयी है।[21]

नक्षत्र विषयक विमर्श में मुहूर्त्तचिन्तामणि के नक्षत्रप्रकरण के निष्कर्ष तथा नक्षत्रों की ध्रुवादि संज्ञाओं के ऊपर भी अन्वेषण जरुरी है। नक्षत्रों की संज्ञाएँ, देवाधिपत्य, संस्कारादि-प्रकरण से वास्तुप्रकरण तक प्रयुक्त मुहूर्त्तविचार में नक्षत्र प्रभाव के संकेत भी दिये गये हैं। इन नाक्षत्रप्रभावों के सत्यापन से मुहूर्त्तविज्ञान भी पूर्णवैज्ञानिक विद्या बन सकती है।[22]

स्वरविद्या – यह अनेक स्वतन्त्र वैज्ञानिक विद्याओं का समवेत रुप है। इसमें भी दिव्यसम्बन्ध तथा नक्षत्र प्रभाव, नक्षत्रस्वर एवं सर्वतोभद्रादि चक्र तथा शतपदादि 84 चक्रों में भी नक्षत्रादि प्रयोग प्राप्त होते हैं। इस सन्दर्भ प्रयोग का भी केवल संकेत मात्र किया जा रहा है। सर्वतोभद्र, शतपद, पृथ्वीचक्र, सप्तनाडी तथा त्रिनाडीचक्र एवं भूपृष्ठीय क्षेत्रभेद से जगल्लग्न, वर्षलग्न, सूर्य, चन्द्र तथा ग्रहों के राशि तथा नक्षत्र संचार निरयण भूगर्भीय गणना से **पूर्ण परीक्षित त्रैलोक्यज्ञापक विधान** हैं। इनके प्रयोग से सभी प्रकार की भूपृष्ठीय आपदाएँ, सुभीक्ष, दुर्भिक्ष तथा वृष्टि एवं कृषि प्रभृति के **निर्धारण संभव** है। लेकिन समग्र पृथ्वी की दृष्टि से निर्धारणार्थ संघीय निवेश अपेक्षित है, क्योंकि ये सभी उपर्युक्त विद्याएँ संहिता स्कन्ध का अंग एवं अवयव होने पर भी स्वतन्त्र विद्याएँ हैं। इन सभी में कोई एक व्यक्ति सक्षम नहीं हो सकता, अतः समुचित निष्कर्षार्थ संघीय निवेश **शैक्षिक**, **अन्वेषणात्मक** एवं **व्यवसायिक** स्तर पर भी समन्वित कमान गठित करने की जरूरत है।[23]

10. भविष्यगत कर्त्तव्यता

भारतीय ज्योतिष नक्षत्र विद्या के भाग-3 में नक्षत्र प्रभाव सम्बन्धी मुख्य तथ्य वैज्ञानिक पद्धति से मूल रूप में समीक्षित किये गये हैं। भारतीय ज्योतिष नक्षत्र विद्या के भाग-1 तथा भाग-2 में वर्णित एवं समीक्षित विषयों का क्रम विषय निरुपण में देखें । उनके वर्ण्य एवं समीक्ष्य तथ्य यहाँ क्रम से निष्कर्षतः समुपस्थापित किये गये हैं । विषयविस्तार भय से विभिन्न संकेतों को प्रस्तुत करते हुए इसे संक्षिप्त रखने की चेष्टा की गयी है। इसके आलोक में मूल ग्रन्थों से नक्षत्र एवं ग्रह प्रभाव विधान को और अधिक विधिवत् जानकर लोक व्यवहार तथा अन्वेषण की समवेत धारा के निर्माण में इकाई बन सकते हैं।[24]

वस्तुतः त्रिस्कन्ध ज्योतिष की परस्पर सम्बद्धता एवं विषयान्तर सम्बद्धता के राह में यह लघु प्रयास है, जो नवीन प्राचीन ज्योतिर्विज्ञान में समन्वयार्थ किया गया है। प्राचीन समस्त निष्कर्ष बीज रूप है, अतः सहेतुक बोध के लिए समन्वयात्मक अन्वेषण की आवश्यकता को भी दर्शाया गया हैं। मेरे अन्य कार्य भी उसी दिशा में एक कड़ी मात्र है। [25]

भारतीय ज्योतिषस्य साम्प्रतिकत्वम्

विश्वेश्वरानन्द वैदिक शोधसंस्थान—विश्व संस्कृत होशीयरपुर, पंजाब से संक्षिप्त रूप में 'भारतीय ज्योतिषस्य साम्प्रतिकत्वम् के रूप में शोध निबन्ध 1995 में प्रकाशित हुआ। उसमें शान्तिकल्प के प्राचीन महत्व को भी मैंने दर्शाया था। बाद में अन्वेषण क्रम में पता चला कि **चिकित्सकीय ज्योतिष की** एवं आयुर्वेद, ज्योतिष तथा धर्मशास्त्र की समवेत परम्परा वीर सिंहावलोक 14 वीं शताब्दी तक जीवित थी। उसके बाद इस 20वीं शताब्दी में गुरुप्रवर पं. शुकदेवचतुर्वेदी को प्रणाम पुष्पाञ्जलि अर्पित करता हूँ, जिन्होंने प्रथमतः अपने शोध द्वारा तत्पश्चात् चिकित्सकीय ज्योतिष तथा वास्तुशास्त्र की स्वतन्त्र शिक्षण-प्रशिक्षण तथा शोध की प्रक्रिया यू.जी.सी. की सहायता से दिल्ली में प्रारम्भ कराकर अद्वितीय सूत्रपात किया हैं। 14 वीं शताब्दी के बाद चिकित्सकीय ज्योतिष पर अध्ययन तथा शोध का प्रारम्भ होना भविष्य के लिए शुभ संकेत है।[26]

11. नवीन विकास का मूलाधार एवं निगमागम पक्ष

आज का विज्ञान भी बुद्धिवादी तर्क तथा प्रयोग के आश्रय से पञ्चमहाभूतात्मकचक्र का विश्लेषण कर नीत-नव सिद्धान्त का निर्माण प्राकृतिकचक्र के अनुकरण से जीवन के प्रत्येक क्षेत्र में कर रहा है। जिस मन तथा बुद्धि के संयोग से विश्व रहस्यावगमनार्थ सभी उद्यत हैं, उस मन तथा बुद्धि के रहस्यमय आवरण को योग तथा तन्त्रागम से ही विधिवत् अनावृत किया जा सकता है। मानसिकविकास तथा बौधिकविकास के परमोत्कर्ष इससे ही सम्भव है। योग की निश्चित दृढ़ सीमा के बाद विस्तार की प्रक्रिया प्रारम्भ होती है। अतः अष्टाङ्गयोग का प्रयोग स्व-स्व अभिप्राय से सभी शास्त्रों में प्रत्यक्ष तथा परोक्षरूप से देखा जा सकता है। **आत्मविद्या रूप अध्यात्म** के **अभाव में** विनाशकारी परम्पराएँ पनपती हैं। ऐतिहासिक दृष्टान्त इसके साक्ष्य हैं। भौतिकविज्ञान से भी पञ्चमहाभूतात्मक पदार्थकारण

परक विज्ञान के अभाव में किसी घटना का सकारण अन्वेषण नहीं किया जा सकता। वैसे भी व्यक्तविश्व पाञ्चभौतिक है, तथा मूल आदि कारण अव्यक्तविभुकाल तथा महाकाश के अनाद्यनन्तत्व का हेतु या तदीश्वर परमब्रह्म परमात्मा। अतः भारतीय दृष्टि से योगमहाविज्ञान मानवीय सर्वांगीण विकास का मूल है ।यथा साध्य विकसित बुद्धि की निष्पत्ति से गणित, तर्क, गोल तथा यन्त्र की सापेक्षता से दिग्देशकाल एवं पात्र के विविध आयाम विभिन्न कालखण्डों में दृष्टिगोचर होते हैं। स्वरविद्या में संस्कृतशब्द + ज्योतिष + योग + भूबल + स्वरबल + मन्त्र तन्त्र यन्त्र एवं औषधि का समवितरुप बी.सी 3000 पूर्व के दिव्य अन्वेषण के निष्कर्ष हैं। समवेत प्रशिक्षण तथा संघीय अन्वेषण से इस वर्त्तमान कालखण्ड में इन्हें सत्यापन के लिए समन्वित करना जरुरी है।[27]

1. जैवक्रम विकास में जीवाणु तथा पदार्थक्रम विकास में परमाणु की उत्पत्ति एवं संरचना ज्ञानार्थ अध्यात्मिनिष्ठा से रसायनविज्ञान तक का महत्व भी प्राचीनकाल से स्वीकृत है। यथान्वेषित नवीनक्रम क्रमबद्ध तथा संगठित है, जब कि प्राचीनक्रम सांकेतिक तथा आख्यानात्मक हैं। अध्यात्मिक तथा भौतिकसिद्धान्तों का समन्वय एवं प्रयोगान्तर्गत व्यवहारिक उपयोग-भारतीयज्यौतिष का मूल प्रतिपाद्य रहा है।[28]

2. अतिन्द्रियविधान - पञ्चज्ञानेन्द्रियाँ पाँचकर्मन्द्रियाँ तथा उभयनिष्ठ मन की शक्ति को एक निश्चित सीमा तक विकसित करना ही अतीन्द्रिय विधान है। प्राचीनकाल में एतदर्थ दो प्रकार के विधान प्रयुक्त थे। प्रथम प्रकार योगशास्त्रीय विधान था। इसके अनेक विध साधनविधान से प्राप्त दिव्यशक्ति के कारण अष्टविध प्रमुख सिद्धियाँ 24 प्रकार की उपसिद्धियाँ तथा नवनिधियों को प्राप्त कर सम्पूर्ण विश्वरहस्य का ज्ञान तथा दिग्देश कालातिक्रमण, की शक्ति प्राप्त करने का विधान प्रयुक्त था। द्वितीय विधान तन्त्रागम का था। इसमें तीन मार्ग थे।

1. मन्त्रात्मक, 2. तन्त्रात्मक, 3. यन्त्रात्मक

1. मन्त्रात्मकअतीन्द्रियता — इसमें योगसाधना तथा मन्त्रशक्ति से दिव्यत्व तथा अतीन्द्रिय क्षमता प्राप्त करने का विधान शरीरनिष्ठ प्रयोगशाला के माध्यम में प्रयुक्त होता था ।यह प्रक्रिया अनेकजन्मसंसिद्धि ततो याति परां गतिं के गीतोक्त प्रमाण से सद्यः साध्य तथा गम्य नहीं रह गया। महाभारत काल के बाद अध्यात्मिकह्रास का ह्रासोन्मुख रुप इसका दृष्टान्त है।[29]

2. तन्त्रात्मकअतीन्द्रियता—तन्त्रात्मकविधान में योगसाधना के साथ लघुमन्त्र तथा बीजमन्त्रों के साथ पदार्थों के सूक्ष्मगुणों के प्रयोग से शक्ति विस्तार तथा दिव्य अतीन्द्रियक्षमता प्राप्त करने में मानवीय क्षमता तथा वस्तु के सूक्ष्मप्रभाव का समन्वयात्मक रूप प्रयुक्त था। 12वीं शताब्दी तक इसकी परम्परा मिलती है ।आगम के सैकडों ग्रन्थ आज भी उपलब्ध हैं। वामाचार के कारण यह परम्परा भी निर्दुष्ट नहीं रह सकी। कर्पुरमंजरी में इसका स्पष्ट संकेत तथा सनातनविरोधी सम्प्रदायों के उदय में वामाचार की अहं भूमिका रही।[30]

3. यन्त्रात्मकअतीन्द्रियता—इसमें पदार्थाश्रित स्थूलयन्त्र-प्रक्रिया के शक्तिचालित तथा प्रतीकात्मक स्वरूप प्रयुक्त थे । यन्त्रों के द्वारा अतीन्द्रिय क्षमता प्राप्त करने का विधान एवं अनेक विध आपत्तियों से रक्षा तथा मन्त्रात्मक, तन्त्रात्मक तथा यन्त्रात्मक समन्वय इस प्रक्रिया का प्रतिपाद्य था। आज भी ये तीनों अंशतः प्रचलित है। इसका स्थूल रूप भौतिकयन्त्र विधान है। वैदिकवाङ्मय के अन्तर्गत स्थूल भौतिकयन्त्रविधान से मानवीय क्षमता बढ़ाने,तथा दिग्देशकालातिक्रमण जनित प्रयोग विश्वकर्मा से तथा भारद्वाज के यन्त्रसर्वस्वं से प्रारम्भ कर भोजराज तक का समराङ्गणसूत्रधार के रूप में मानवीयक्षमताबर्धक, सुख सुविधावर्धक अनेक विध यन्त्रविधान आज भी आख्यानात्मक रूप में प्राप्त हैं। इस प्रकार सूक्ष्म तथा स्थूल दोनों प्रकार के यन्त्र के संकेत तथा विधान प्राचीन वर्णन क्रम में मिलते हैं। **प्राचीनविज्ञानेषु यानविद्या** में प्राचीन परम्परा की समीक्षा की गयी है।[31]

4. आधुनिक भौतिकयन्त्र एवं अभियान्त्रिकी इसी कड़ी के साम्प्रतिक स्वरूप प्रदर्शित करते हैं। इस प्रकार योगप्राप्त-तन्त्रागम प्राप्त तथा भौतिकयन्त्र से प्राप्त अतीन्द्रिय क्षमता में प्रथम में पूर्ण दिव्यत्व तथा स्वातन्त्र्य है। द्वितीय में दिव्यत्व तो है, पर स्वकीय स्वतन्त्रता के साथ वस्तु गुण पर भी निर्भर है। तृतीय में मानवीय क्षमता पराश्रयत्व से संचालित होती है। 1 2 3 के अनुपात में प्रथम तथा द्वितीय भेद आज असंभव तथा कल्पित प्रतीत होते हैं, लेकिन वस्तुस्थिति इससे भिन्न है। यन्त्रनिष्ठविकास के इस काल में अध्यात्मिक तथा तान्त्रिक क्षमता घटनें तथा तद् विषयक विशेषज्ञ आज नगण्य हैं तथा अपवाद स्वरूप हैं, उनकी क्षमता भी काफी घट गयी है, मुख्य कारण जो भी हो। तृतीयक्षमता भौतिकयान्त्रिक अतीन्द्रियता आज प्रधान है। मानव इस दिशा में मुख्यतः प्रगतिशील है।[32]

5. योगशास्त्रीयपरीक्षण- इसमें 'यत्पिण्डे तद् ब्रह्माण्डे' की युक्ति से अपने शरीर को प्रयोगशाला बनना पड़ता हैं, वहाँ तन्त्रागम में शरीर तथा विश्व दोनों का समन्वय करना पड़ता है। केवल यन्त्रविद्या में प्राकृतिक विश्वचक्र का आद्योपान्तपरीक्षण तथा अनुकरण में गणिताश्रित तर्काश्रित तीक्ष्ण एकाग्र बौधिकक्षमता की अपेक्षा होती है। अतः आज यान्त्रिकयुग में मानवीय बौधिक क्षमता यान्त्रिक आविष्कार के माध्यम से हर समस्या का समाधान चाहती है, परन्तु यान्त्रिक विधान स्थूल है। इससे सूक्ष्म तन्त्र तथा सर्वाधिक सूक्ष्मतम प्रभेद मन्त्रात्मक है। भारतीयवाङ्मय में त्रिविध विधानों का समन्वय प्राप्त होता है।[33]

अतः दर्शनात्मिका शक्ति—निश्चित सीमा तक सूक्ष्मतम, तथा दूरस्थ बृहत्तम को देखना। सूक्ष्मदर्शी, दूरदर्शी यन्त्र नवीन पूरक तथा मानवीय क्षमता बर्द्धक है।

श्रवणशक्ति–दूरश्रवण, ध्वनिविज्ञान, शब्दध्वनि वाक्शक्ति । वे तार का तार, ध्वनि तरंग प्रेषण, प्रकाश + शाब्दतरंग संयोजन के

भी तीनों रुपों में आज यन्त्राश्रित मुख्य है। गमनात्मिकाशक्ति, दिग्देशकालातिक्रमण-सामर्थ्य, जलीयगति, स्थलीय गति, वायुमध्यगति नभसंचरण अन्तर्ग्रहीय तथा नाक्षत्रपिण्डों पर यात्रा प्रभृति। ये क्षमताएँ जीवाणु एवं परमाणु तरंग मापन तक प्राप्त है। प्राचीन विधान सुप्त है।[34] सर्वविधकर्म सम्पादन में देश तथा कालातिक्रमण में तीव्रगति प्रदान करनें हेतु विश्व के लाखो वैज्ञानिक लगे हैं। उत्तरोत्तर तकनीकि सुधार तथा विकास का योग विकासोन्मुख है।

विद्युन्मानस शास्त्र रूप यान्त्रिकविधान से मानसिककार्य को गतिशील करना यान्त्रिक विकास के नवीन दृष्टान्त हैं। परन्तु इन सबके मूल में मानवीय क्षमता है तथा अन्त में भी।

अतः भारतीयज्यौतिष-योग-तन्त्र तथा शिल्प की सुप्त तथा कीलित धारा को जाग्रत तथा गतिशील करने हेतु अध्यात्म तथा ज्यौतिष के साथ-साथ तत्सम्बद्ध नवीन प्रयोगात्मकविद्याओं से जोड़ना, प्रदूषण मुक्ति के लिए इस युग की आवश्यकता है। नवीन तथा प्राचीनत्तम प्रयोगात्मकविद्याओं के समन्वयात्मक महत्व की उपेक्षा करना विमर्शतः पहले भी आत्मघाती कदम के रूप में रहा है, तथा आगे भी रहेगा।[35]

भारतीय प्रयोग परम्परा का प्राचीनस्वरूप सम्बद्ध नवीन समन्वयाभाव से उत्तरोत्तर आख्यानात्मक होते होते लुप्त होते जायेंगे। आख्यानात्मक रूप से वर्णित चमत्कार केवल कथा कहानी बनकर रह जायेगी। उत्कर्ष क्षीण होता जायेगा। क्षीणावस्था को प्राप्त अनेक प्राचीन प्रयोगाश्रित विद्याएँ एवं परम्परा व्यक्ति साध्यता के रहने पर भी लुप्त होती जायेगी। जो नष्ट हो गयी हैं, वा लुप्त हो गयी हैं, वहाँ जो आख्यानात्मक रूप हमें प्राप्त हैं, वे भी उचित समन्वयात्मक अध्ययन तथा अन्वेषण के अभाव में इतिहास की वस्तु बनकर रह जायेगी।[36]

6. ज्यौतिषसंहिता गत अनेक प्रयोगात्मकविद्या शाखाएँ

ऐतिहासिक कारणों से पहले ही प्रयोग बाह्य हैं। ह्रासोन्मुख क्षीणावस्था को प्राप्त रही-सही परम्परा भी वर्त्तमान समन्वयाभाव तथा उपेक्षा से लुप्त हो जायेगी। अध्यात्मिक अनुशासन का ह्रास अपने चरम अवस्था में नष्ट होने पर केवल भौतिक विकास का जड़वादी क्रम भी विनाशकारी सिद्ध होगा। कुछ-कुछ लक्षण अभी से दृष्टिगोचर हो रहे हैं। अनेक अन्वेषित सिद्धान्त जो आज आख्यानात्मकरूप में उपलब्ध हैं, उनकी उपेक्षा से वे भी नष्ट हो जायेंगे। तत्पश्चात् सत्तात्मकब्रह्माण्ड से उन्हें पुनः अन्वेषित कर निरूपित करने में सहस्त्रों वर्ष लग जायेंगे। महाभारत से पूर्व, महाभारतकाल से आगे आधुनिक काल तक की स्थिति भी इस तथ्य को उद्घाटित करते हैं। सत्तात्मक वेद ब्रह्माण्ड ही है। शतपथ ब्राह्मण में याज्ञवल्क्य के आख्यान से भी अन्वेषण क्रम का क्रमिक तथा गतिशील रहना आवश्यक सिद्ध होता है। नवीन अन्वेषण क्रम भी इसी तथ्य का संकेत प्रदान करता हैं । अतः भारतीयज्यौतिष के त्रिस्कन्ध सम्बद्ध सैद्धान्तिक पक्षों को प्रयोगात्मक तथा व्यवहारागम्य बनाने हेतु प्राचीन तथा नवीन क्रम में स्व-स्व सम्बद्धता तथा क्रमिकता के अनुरोध से विषय को संगठित करना आज की सर्वप्रथम प्राथमिक आवश्यकता है।[37]

ऐतिहासिक वैज्ञानिक पक्ष के दृष्टान्त -वैदिक मूल से प्रारम्भ कर इस वाङ्मय से प्रारम्भ कर बी.सी 3000पाराशर,व्यास,जैमिनी क्रम से आर्यभट वाराह, लल्ल, ब्रह्मगुप्त, मुंजाल, श्रीपति, नरपति भास्कर, वल्लालसेन, गणेश, जयसिंह प्रभृति भारतीय महान अन्वेषकों के अन्वेषणनिष्कर्ष क्रमिकरूप में स्वतन्त्र विज्ञानात्मकशाखा के रूप में पल्वित-पुष्पित हो सकेगा। आधुनिक अन्वेषकों के तत्सम्बद्ध अन्वेषण खण्डित कड़ी एवं अग्रिम कड़ी जोड़ने में अत्यधिक उपयोगी सिद्ध हो सकेंगे। क्योंकि भारतीयों का समस्त ज्ञान विज्ञान काल विधायक ज्योतिर्विज्ञान, कालप्रभाव निरूपक विधान, तथा योगशास्त्रीय असीम दिव्यक्षमता, तन्त्रागमोक्त असीम विस्तार भी महाभारत युद्ध के बाद ह्रासोन्मुख होता गया।[38]

बौधों के उदय से पूर्व से हीं उत्थान पतन के अनेक चक्रों में भारतीय महाद्वीप बाधित हुआ। 600 ई.पूर्व के पश्चात् आचार्य शंकर[39] का उदय से समग्र भारतीय विद्याक्रम को अद्वैत में समन्वित कर एक महान कार्य सम्पन्न किया गया। जो मौलिकसिद्धान्त आज भी हमारे पूर्वज अन्वेषकों की मूल थाती के रूप में उपलब्ध हैं, उनका तात्कालिकीकरण तथा व्यवहारिक स्वरूप प्रदान करना राष्ट्रियसामूहिकउद्यम के समवेत प्रयोग से ही संभव है। लुप्त तथा नष्ट वैज्ञानिक सिद्धान्त भी नैसर्गिक रूप में प्रकृत्यान्तर्गत होने से आज भी क्रमशः गम्य है। पाश्चात्यों का अन्वेषण भी **सत्तात्मकब्रह्माण्ड** को **आधारभूत** मानकर आज सर्वाग्रगण्य है। वैसे सस्वर मन्त्रों को छोडकर समस्त आख्यान तथा संकल्पना के रूप में वेदादि सभी विद्याएँ साक्षात् वा अनुवाद के रूप में उनके अन्वेषण क्षेत्र में स्वीकृत हैं। उदाहरणार्थ- 'पौराणिक अन्तर्ग्रहीय यात्रा के आख्यान 1959 तक कल्पना समझी जाती थी। जब अन्तर्ग्रहीय यात्रा का नवीनारम्भ हुआ तब भी भारतीय प्राचीन सत्याख्यानों तथा प्रतीकों में अनास्था करने वालों का भ्रम खण्डित नहीं हुआ। अनेक भारतीय तथा कुछ पाश्चात्यवैज्ञानिक अन्वेषक संस्कृतवाङ्मय में निहित विद्याशाखाओं के सार्वकालिकत्व तथा वैज्ञानिकत्व पर विस्तृत मन्तव्य प्रदान किये हैं। स्वतन्त्र विषय के रूप में इस तथ्य का विवेचन करना अधिक अच्छा रहेगा।[40]

वर्त्तमानयुगीय नव्य अन्वेषण पाञ्चभौतिक सत्तात्मकविश्व को आधार बनाकर तीव्रता से विकासोन्मुख है। योग तथा चिकित्साविज्ञान के योग से मनोविज्ञान से परामनोविज्ञान तक की यात्रा तथा भौतिक विज्ञान में सौरशक्ति तथा योगमहाविज्ञान के समन्वय से आज फिर से नव्य महाकाशविज्ञान गतिशील है। पिण्ड से पिण्डीय परमाणु तक तथा परमाणु से परमाणु तरंग तक तथा अनन्त की ओर विज्ञान की यात्रा विश्व के मूलस्त्रोत के तलाश में फिर से अग्रसर है। वाष्पशक्ति, से परमाणुशक्ति तथा सौरशक्ति तक का बदलता स्वरूप, सौरविद्युत

का अन्वेषण वेदोक्त सौरांशुचालित चतुर्विध (भूचर, जलचर, स्थलचर, नभचर एवं नक्षत्रपिण्डीय) यान की संरचना को निकट भविष्य में पूर्ण करना सार्थक हो सकेगा। क्योकि वाष्प इंजन से उपग्रह तक की यात्रा उपग्रहप्रक्षेपण, टेलीफोन तथा वायरलेस (Radio, T.V. or Computer Science) विद्युन्मानसशास्त्र का विकास तथा निकट भविष्य में विज्ञानक्षेत्र में होने वाले विकास की संभावनाएँ प्राचीनआख्यानों के चक्रीय पुनरागमन को नहीं दर्शाते क्या? डॉ जायसार के अनुसार 33 देवविद्याओं में से निरन्तर अन्वेषण कर 5 देवविद्याओं को गम्य बना दिया फलतः इस प्रकार का चमत्कार सरहस्य ज्ञात होने लगे हैं। इतना पर भी भारतीय वाङ्मय को अवैज्ञानिक तथा अन्धविश्वास एवं कल्पना पर आधारित मानने वाले को उनके अविश्वास से उन्हें कोई नहीं डिगा सकता।[41]

पाञ्चभौतिकपिण्ड, गुरुत्वाकर्षण, गति कक्षासंस्थान, तापक्रम, वातावरण, बिम्बीयसंरचना विकिरण तथा बिम्बान्तरीय सापेक्षिक सम्बन्ध के न्यूनाधिकत्व से परिमाण, मात्रा, प्रभृति न्यूनाधिकान्तर से विभिन्नरूपक प्राकृतिकअन्तर,गुणान्तर तथा प्रभावान्तर प्राचीन निष्कर्ष तथा नवीन परीक्षण से भी प्रत्यक्ष है।[42] भूपृष्ठ का वातावरण भी इसका प्रत्यक्ष दृष्टान्त है। प्राकृतिक शाश्वतनियम, संरचना, घटनाचक्र प्राकृतिकनिर्माण तथा क्षरण का शाश्वत संस्थान तथा संचारादि के रूप से योगज तथा स्वतन्त्र सापेक्षता के अनुरोध से अनवरत परीक्षण के फलस्वरूप वैज्ञानिक अविष्कार तथा यन्त्रों का आविष्कार दिग्देशकालाभिप्राय से आवश्यकता के अनुरूप ही होता रहना प्राचीन तथा नवीन प्रमाणों से ज्ञात होनें पर भी आज अधिकांश भ्रमित है। क्योंकि प्राचीनतम काल से ही इसका दृष्टान्त तथा युगान्तर से बदलता स्वरूप अनुशीलन से प्रत्यक्ष है।[43] आख्यानात्मकविवरणों की तुलना में पुरातात्विकअवशेष नगण्य है। प्राकृतिक गुणधर्म के अनुकरण से युगीय आवश्यकतानुरूप आविष्कार की परम्परा भी क्रमबद्धता पर ही आधारित है। प्राकृतिकसंसाधन तथा वैज्ञानिक सामर्थ्य मूलभूत अवयव हैं। कालान्तर में यन्त्रगत स्वरूपान्तर भी होता है। भारतीयज्यौतिष में वेध परम्परा तथा अन्वेषणक्रम अनेक उत्थानपतन तथा अवरोध के बाद भी जयसिंह तक प्रत्यक्ष है। तत्पश्चात् हम से सभी(शेष विश्व के विकसितदेश) आगे बढ़े गये। उसके बाद का भारतीय अन्वेषण पराश्रयत्व में गतिशील हुआ। भारतीय ज्योतिष काल विधायक है, अतः खगोलीय, मेट्रोलोजिकल तथा चिकित्सकीय ज्योतिष सम्बद्ध तीन प्रयोगशालओं की समन्वित आवश्यकता को नकारा नहीं जासकता।[44]

12. नवीनजाग्रण के गुणदोष तथा प्राचीन प्रायुक्तिकी विधान

चीन में छापाखाना का अविष्कार, चाणक्य निर्मिततोप का मध्य एशिया में सामरिक विकास तथा यूरोप में औद्योगिक क्रान्ति, गैलेलियो का दूरवीक्षण यन्त्र तथा न्यूटन का गुरुत्वाकर्षण तथा थामसएडिशन का विद्युत, महामानव आईन्स्टाईन का सापेक्षवाद, मारकोनी का वेतार का तार, डॉ. जगदीश वसु का जीवविज्ञान सम्बन्धी खोज, डॉ. रमन का सूर्यविज्ञान नक्षत्रभौतिकी के नाम पर अन्वेषण, इंग्लैण्ड में कम्प्यूटर का अन्वेषण भौतिक के क्षेत्र में कण,तरंग,आकर्षण प्रभृति अनेक क्रान्तिकारी अन्वेषण से उत्पन्न परिवर्त्तन से विश्व इतिहास में 5000 वर्षों के बाद नये युग का आरम्भ हुआ है। भौतिकविज्ञान तथा रसायनविज्ञान से पाञ्चभौतिक एवं त्रिगुणात्मक विश्वनियमों के विभिन्नरूपक व्याख्यान तथा प्रयोग से अनेक वैज्ञानिकशाखाएँ अपने नवीन कलेवर में विकासोन्मुख हैं। दिग्देशकालातिक्रमण, दूरदर्शन, दूरश्रवण, जलस्थलनभगमन क्षमता उत्तरोत्तर अग्रसर है। गणितज्यौतिष, योग, तन्त्र तथा अन्य प्रयोगाश्रित विद्याओं के मूलाधार पर आश्रित, एवं आधुनिक क्रमिक विकास में नवीन अन्वेषकों के महान उद्यम का परिणाम है,यह विकास। यह अनन्त सत्तात्मक विश्व तथा मानवीय बौधिक क्षमता के संयोग से हीं संभव हो सका है।[45] भारतीय मूलविद्याओं में प्रयोगाश्रित विद्याओं की भूमिका सार्वकालिक हैं। नवीनविकास क्रम भी उन मौलिक सिद्धान्तों से आधार ग्रहण कर पल्वित पुष्पित हुआ तथा आज भी उन सिद्धान्तों पर क्रमिक अन्वेषण दिग्देशकालाभिप्रायिक पाञ्चभौतिक संरचना से लेकर टेलीपैथी तक का अद्यतन विवरण तथा प्रायोगिक स्वरूप में नवीन अन्वेषकों के प्रयास स्तुत्य है। अगर भारतीयवाङ्मय का संघीय निवेश सम्बद्ध प्रायोगिक स्वरूप नष्ट न हुआ होता[46] तो नवीन प्रयोग से प्राकृतिक प्रदूषण से वातावरण नष्ट होने का जो भय उपस्थित है,उससे सद्यः मुक्त होते। आज आधुनिकविकास से प्राचीन आख्यानों को एक निश्चितसीमा तक अंशतः समझने की स्थिति में हम फिर से आ गये हैं। धरती पर प्रदूषणमुक्त विकास हर हाल में चाहिए। प्राचीन आख्यान तथा प्रमाण सत्यापन के क्षेत्र में जीवन के प्रतिक्षेत्राभिप्राय से संघीय निवेश जरुरी है।[47]

• कालांश एवं क्षेत्रांशरूप भारतीय प्रभावशास्त्र

याज्ञवल्क्य वैदिकयुग के अन्तिम महावैज्ञानिक ऋषि शतपथब्राह्मण के मूल अन्वेषक एवं संग्राहक भी थे। बी.सी.3000 द्वापरान्तकालीन महाभारतयुद्ध के बाद हुए अध्यात्मिक ह्रास एवं युद्धजन्य विभिषिका तथा अनेक सामाजिक तथा राजनैतिक परिवर्त्तन जन्य कारणों से वैदिकविज्ञानवाद ह्रासोन्मुख हो गया। न केवल अध्यात्मिक+भौतिक साधना की उपेक्षा अपितु अहंकार एवं व्यसन जन्य आसक्तिभाव के प्राधान्य भी कारण माने जा सकते हैं।[48] युगान्तर से अध्यात्मिक शक्ति क्षीण होने के संकेत महाभारत में भी मिलते हैं। द्वापर कलियुग सन्धिरूप अन्धकारकाल के बाद यास्कादि क्रम से प्रच्छन्न वैदिकज्ञान फिर संगठित होने लगा। काल क्रमगत अनेक प्राकृतिक तथा समाजिकपरिवर्तन स्वरूप वेदादि विद्याओं का संगठन तथा विघटन विकास तथा ह्रास का क्रम महर्षि यास्क (बी.सी.800) के बाद स्पष्ट है।[49] यह अलग तथ्य है कि कुछ भ्रान्त मुस्लिम आक्रान्ताओं के कारण जो क्षति हुई उसे नहीं भारत में नहीं शेषविश्व में कहीं भी अभी तक पूर्ण नहीं किया जा सका है। प्राचीन अवशेषों में से प्रयोग की दृष्टि से बचे खुचे ढाँचों में से अंग्रेज हमारे शिल्प उद्योग एवं आर्थिक ढ़ाँचे को ध्वस्त किये, वहाँ कुछ निरपेक्ष

पाश्चात्य अन्वेषक प्राच्य विद्या की पाण्डुलिपियों के पुनरूद्धार में काफी प्रशंसनीय कार्य किये।[50] आज फिर समस्त प्रयोगात्मकविज्ञानों का मूल ज्यौतिषशास्त्र को नये सिरे से संगठित करने की जरूरत है। प्राचीन त्रिस्कन्धात्मक या पञ्चस्कन्धात्मक ज्यौतिषक का विस्तार अत्यधिक है तथा आधुनिक विकासधारा से जोड़ने पर और अधिकविस्तृत हो जायेगा, वहाँ समस्त ज्ञान व्यक्ति साध्य भी नहीं है। अतः सर्वमूल का निर्धारण कर शाखागत विभाग करना आज की प्राथमिक आवश्यकता है। ज्यौतिषशास्त्र की एक-एक शाखा आज फिर से आधुनिक अन्वेषण से स्वतन्त्र विज्ञानात्मक शाखा बनती जारही है। अतः इस पर विचार करना वैज्ञानिक परिप्रेक्ष्य में आवश्यक है। गणित तथा सिद्धान्तस्कन्ध की मूल भूमिका संहितास्कन्ध के विश्वाभिप्रायिक प्रभावनिर्धारण में उपर्युक्त विश्लेषण से प्रत्यक्ष है।[51]

आज तक संहितास्कन्ध का स्वतन्त्र इतिहास

1. विषयवस्तु का परिचय, 2. विषय सम्बन्धित ग्रन्थ, 3. ग्रन्थों का परिचय (लेखक-सम्पादक-सम्पादन-प्रकाशक-प्रकाशनकाल) आदि के उल्लेख के साथ, 4. संहिता ग्रन्थों पर मुख्य-मुख्य टीकाकार तथा उनकी मुख्य टीकाएँ, 5. लेखक (ग्रन्थकार) परिचय, भारतीयज्यौतिष के परिप्रेक्ष्य में संकेतमात्र लिखा गया है। विकास की स्थिति तथा आधुनिक संभावनाओं पर भी न के बराबर विचार हुआ।

शंकरबालकृष्ण दीक्षित जैसे भारतीयज्यौतिष के समालोचक लेखक का पुरा श्रम तथा समय सिद्धान्तज्यौतिष में लग गया । वे संहिता का संक्षिप्त विवरण प्रस्तुत कर सन्तुष्ट हो गये।[52]

डॉ. नेमिचन्द्र शास्त्री संहिता स्कन्ध के नाम पर मुहूर्त्त भाग पर ही अधिक विचार किये।[53] डॉ. गोरखप्रसाद का विवेचन भी गणितस्कन्ध पर प्राप्त होता है।[54] पं. रामरत्न ओझा फलितविकास में होरा का विवेचन तथा विकास प्रस्तुत किये।[55] म.म.प. गुरु प्रवर सुधाकर द्विवेदी गणकतरंगिणी[56] में आर्यभट्टादि अन्वेषकों का परिचय प्रस्तुत कर बृहत्संहिता की उन्होंने सम्पादकीय टीका कर दी। अतः संहितास्कन्ध का विवेचन अपेक्षित हो जाता है। प्रस्तुत वैज्ञानिक शोधसमीक्षा में ज्यौतिष के समस्त स्वरूप नवीनसम्बद्धता सहित प्रदर्शित करने का लघुप्रयास कितना सार्थक हुआ तथा आगे कर्त्तव्य कार्य की कितनी समीक्षा हो सकेगी, यह विशेषज्ञों के विचारार्थ प्रस्तावित है।

मानवजीवन तथा कालविधान

संहिता स्कन्ध समग्र त्रिगोल के केन्द्र में पृथ्वी को प्रभावशास्त्र की दृष्टि से निवेशित कर मानव तथा पृथ्वी पर पडनें तथा होने वाले समग्र परिवर्त्तन को सकारण मानता है।[57] इस स्कन्ध का सुरक्षा एवं शान्ति स्थापना से लेकर दुर्भिक्षशमन, प्राकृतिक आपदा से शान्ति तक में प्रयुक्त होनें के अनेक प्रबल प्रत्यक्ष प्रमाण आज भी विद्यमान हैं।[58] न केवल राष्ट्र से इसका सम्बन्ध है, अपि तु राष्ट्र के प्रत्येक इकाई एवं व्यक्ति से भी इसका सम्बन्ध है। कहा भी गया है कि शब्दज्ञान एवं अंकज्ञान में समस्त ब्रह्माण्डीय सत्ता विधायक वेद के त्रिविध रूप में निरूपण से यह चक्षुरूप कालविधान शास्त्र है। वसुधैव कुटुम्बकम् को अगर स्थापित करना है, तो संहिता को संगठित एवं व्यवस्थित फिर से करनें की जरुरत है। जो नवीनक्रम गतिशील है, वह भौतिक है। अन्तरिक्षयात्रा से आधिभौतिक,तथा नक्षत्रपिण्डीय यात्रा से आधिदैविक तथा गीतोक्त ज्ञानकर्मभक्ति निष्ठ योगसाधना से अध्यात्मिक विकास के प्रचीन निरूकर्ष सत्यापनीय हैं।[58]

पञ्चमहाभूतात्मक पिण्ड एवं ब्रह्माण्ड का कालसम्बन्ध कालांश तथा क्षेत्रांश के हिसाब से प्रत्यक्ष है। दूरदृष्टि, अन्तर्दृष्टि, ब्रह्माण्ड-से पिण्ड भेद तक, दूरध्वनिश्रवण, अन्तर्ध्वनिश्रवण, दूरगमन, तापबाधा निवारण एवं शीतचक्र वातदाव एवं वातावरण के सघनत्व एवं विरलत्व विधायक विधान, ध्वनि एवं ज्योति का समन्वयात्मकस्वरूप एवं स्वतन्त्र अस्तित्व प्रभृति अनेक तथ्य प्रयोगात्मक प्रभेद हैं। ज्योतिर्विज्ञान अनेक प्रयोगात्मक विद्या शाखाओं का समवेत नाम है।[59]

सौरमण्डल तथा पृथ्वी अपने नियतपिण्ड, संस्थान तथा संचारादि विशेष के कारण अक्षविशेष में अवस्थित है तथा सूर्यकेन्द्रिक वार्षिकसंचार पूर्ण करती है। ऋतुचक्र में तापशीत का समीकरण के साथ खगोलीय क्रान्तिक्षेत्र एवं भूगोलीय क्रान्तिक्षेत्र का तापाधिक्य तथा उच्च अक्षांश तथा ध्रुवप्रदेश का शीताधिक्य सुनियोजित प्राकृतिक नियम के फलन मात्र हैं। पिण्डों के परस्पर गुरुत्वाकर्षण तथा विकिरण सम्बन्ध पिण्डकेन्द्रिक शक्त्यानुरोध से अतिमन्द गति से परिवर्त्तनशील हैं। सृष्ट्यादि में गुरुत्वाकर्षण ताप एवं विकिरण गत निष्पति आज से काफी अलग (परिवर्त्तित) रही होंगी। सृजन में विगवैंग की नव्य संकल्पना इसी चिन्तन का परिमाण है। वैदिक साहित्य में सृष्टि विकास में हिरण्यगर्भसिद्धान्त 5वी स्थिति है।[60]

पृथ्वी की अपने अक्ष पर स्थिति विशेष सौरकेन्द्रिक गुरुत्व सम्बन्ध, स्वांगभ्रमण तथा अन्य ग्रहों तथा उपग्रहों के गुरुत्वविक्षेपबल तथा विभिन्न खगोलीयपिण्डों से विकिरण सम्बन्ध, के कारण पृथ्वी के विभिन्न पृष्ठ पर प्राकृतिक विभिन्नता दृष्टिगोचर होती हैं। सूर्य तथा सूर्यादि दो से अधिक पिण्डों के स्वतन्त्र प्रभाव तथा सापेक्षिक प्रभाव के कारण ही भूपृष्ठस्थ ऋतुचक्र वातावरण तथा जलवायु का विभिन्नत्व भूपृष्ठीय भेद से दृष्टिगोचर होता हैं। स्वांगभ्रमण के कारण एक ही सूर्य विभिन्न गोलीय पिण्डों पर अहोरात्र भेद सम्पादित करता है। ब्रह्माण्डीय, नक्षत्रमण्डलीय, सौरमण्डलीय, ग्रहमण्डलीय, केतुमण्डलीय तथा भूगोलीय संस्थान एवं संचार से होने वाले विश्वव्यापी प्रभाव का आकलन अनेक वैज्ञानिकों क्षेत्रों के समवेत व्यापक बहुक्षेत्रीय एवं सर्वाभिप्रायिक संघीय अन्वेषण से ही संभव है। योगजप्रभाव से एक को अन्य तत्त्व से अलग करना कठिन होने पर भी असंभव नहीं है। क्योंकि प्राचीनचार्यों ने संहितास्कन्ध में निष्कर्ष रूप जो अद्भुत अन्वेषण संकलित किये वे आज भी कम

आश्चर्योत्पादक तथा महत्व पूर्ण नहीं है ।[61]

इस के अन्तर्गत 35 मूल वैज्ञानिक शाखाओं का आज भी प्राप्त होना इस वैज्ञानिक युग में भी आश्चर्योत्पादक हैं। मुख्यतः तीन वर्ग भेद हैं यथा—1.दिव्यप्रभाव, 2. नाभसप्रभाव, 3. भौमप्रभाव।

मानव भौम पृष्ठवासी है। इसके साथ मेदनीयज्यौतिष,वृष्टि वातावरणविज्ञान, वास्तुस्थापत्य, स्वरविज्ञान, मुहूर्त्तविज्ञान, सामुद्रिकविज्ञान, समुद्रविज्ञान, खनिविद्या, धातु एवं रत्न, दकार्गल, उपवन, वन, कृषि, सुभिक्ष, दुर्भिक्ष, अर्घ, प्रभृति 35 विज्ञानात्मक शाखाओं का समवेत नाम संहितास्कन्ध है। संहिता के भूगोल, खगोल, नक्षत्रमण्डल, गत विश्वाभिप्रायिक मुख्यविभाग के अतिरिक्त ये विभाग स्वतन्त्रविज्ञानात्मक शाखा का रूप ले चुके हैं।[62]

त्रिगोलीयसंस्थानों की बिम्बीयसंरचना एवं संचार से योगज एवं स्वतन्त्र विश्वाभिप्रायिक प्रभाव का आकलन संहिता के मुख्य विषय हैं। पिण्ड एवं ब्रह्माण्ड गत समन्वय के अनेक प्रयोगात्मक दृष्टान्त आज भी मिलते हैं।[63] आज संयोग से भारतीय संहिता ज्यौतिष के वैज्ञानिकस्वरूप का ह्रास होते-होते बल्लालसेन के पश्चात् ज्यौतिष संहितास्कन्ध का एक खण्ड मुहूर्तविज्ञान ही समाज में मुख्य हो गया है। ये सभी काल देश दिशा तथा पाञ्चभौतिक स्वतन्त्र तथा योगज प्रभाव विधायक हैं ।[64] प्राचीन भारतीयज्यौतिष संहिताशास्त्र में विभिन्न वैज्ञानिक विद्या शाखाओं का सतर्क सप्रमाण वैज्ञानिक विवेचन मिलता है। संस्थानविशेष गुरुत्व, संचार, बिम्बीयसंरचना विकिरण वर्ण, युति, भेद प्रभृति प्रभावोत्पादक है। अतः गणिताश्रित ज्योतिर्विज्ञान के गणित सिद्धान्तस्कन्ध तथा संहितास्कन्ध पूर्णतः वैज्ञानिक हैं। वराह नें कहा भी है– ज्योतिः शास्त्रमनेंकभेद विततं स्कन्धत्रयाधिष्ठिाम्। तत्कार्त्तस्र्योपनस्य नाम मुनिभिः संकीर्त्यते संहिता। स्कन्धेऽस्मिन्नादितेन या ग्रहगतिस्तन्त्राभिधानास्त्वसौ। होराख्यों विनिश्चयश्च कथितःस्कन्धस्तृतीयोपरः।।1।।[65]

पञ्चभूतात्मक पिण्डों के विशेष अन्वेषण से अनेक वैज्ञानिक शाखाओं का अस्तित्व मानवीय ज्ञान जिन-जिन धाराओं के अजस्त्र स्रोत को दर्शाते है, भारतीयज्यौतिष संहिताओं में प्रयोगाश्रित उन समस्त विद्या शाखाओं का समावेश था। उन्हें आज भी साधार सतर्क एवं नवीन वैज्ञानिकपरीक्षण में वे (प्रदूषण मुक्त होनें से) स्वतन्त्र महत्व विधायक हैं। 1200 ई. के बाद आज तक संहिता के व्यापक विज्ञानात्मक मूलोद्धरणों एवं सिद्ध निष्कर्षों पर विभिन्न तात्कालिक कारणों से अन्वेषण अवरूद्ध रहा। आधुनिक अन्वेषण में भारतीयपद्धति का समावेश यथार्थ परिप्रेक्ष्य में न होने से जो क्षति हुयी उसकी पूर्ति निकट भविष्य में संभव नहीं है । वैसे भी आधुनिक यान्त्रिकविकास एवं खगोलीय प्रयोगशाला तथा खगोलीयान्वेषण में रत उपग्रहादि के क्षेत्र में हम अभी भी विकसित देशों से काफी पिछे हैं। इतना अधिक विकास हो जाने के बाद भी संहिता के अनेक भौतिकाश्रित वैज्ञानिकपक्ष प्रयोगान्तर्गत एक सीमा तक ही आ पाये हैं। अनेक आधिभौतिक, आधिदैविक तथा अध्यात्मिक पक्ष आज भी उपेक्षित हैं। कुछ अगम्य है। [66]

13. मुहूर्त्त विज्ञान एवं पञ्चाङ्ग का वैज्ञानिकत्व एवं प्रायुक्तिकी विधान

आज अधिकांश भारतीय ज्योतिर्विद मुहूर्त्तविज्ञान में प्रत्येक कार्य का आरम्भ निर्धारणार्थ प्रयुक्त कालखण्ड के शुभाशुभत्व निरूपक विधान मात्र मानकर चल रहे हैं। भारतीय पञ्चाङ्गकार आज भी मुहूर्त्तादि का निरूपण अपने पञ्चाङ्ग में करते हैं । इस भाग को मुख्य मानने में अनेक हेतु हैं। एक (दिन + रात्रि) अहोरात्र में विभिन्न पिण्डीय सापेक्षता से भूसापेक्षिक योगादि से उत्पन्न कालखण्ड विशेष के विभिन्न रूपक प्रभाव का निरूपण मुहूर्त्त है। नक्षत्रमण्डल, ग्रह तथा पृथ्वी के सम्बन्ध से भूगोलीय क्षितिज में खगोलीय तथा भगोलीय पिण्डों का उदयास्तादि सम्पन्न होते है। काल जहाँ एक ओर अव्यक्त एवं निरपेक्ष है, वहाँ व्यक्त एवं सापेक्षिक खण्डकाल विभिन्न प्राकृतिक गोलीय पिण्डों के संयोजन से शुभाशुभप्रभाव युक्त होते है। प्रदत्त निष्कर्षों का परीक्षण भौतिक एवं जैविक समन्वयात्मक परीक्षण आज आवश्यक तथा संभव है। इस दिशा में कार्यारम्भ 1902 ई. में हो चुका है।[67] निरवयव काल पिण्डीय सापेक्षता से योगज एवं स्वतन्त्र प्रभावानुरूप सावयव शुभाशुभप्रभाव वाला हो जाता है। यह तथ्य भौतिक तथा रसायनादि से सिद्ध प्राय है।[68] इस खण्ड में अहोरात्र को मानक प्रमाण व बृहत्तमखण्ड मानकर लघुकालखण्ड द्वारा, पिण्डीय प्रकृत्यन्तर एवं खण्ड प्रकृत्यन्तर द्वारा कार्यगत शुभाशुभत्व का निर्धारण किया जाता है। कुछ प्रभाव तुरन्त गम्य हैं, कुछ कालसापेक्ष। खण्डकाल की प्रकृति विभिन्नपिण्डों के स्वतन्त्र तथा योगजप्रभाव से अनेक मुहूर्त्तात्मक काल क्रूर, मध्य, सौम्य, अतिक्रूर, मिश्रित, एवं शुभाशुभ हो जाते है। कार्यप्रकृति मानव विशेष की प्रकृति कालप्रकृति एवं प्रयोगारम्भ में कार्य साम्य का अन्वेषण मुहूर्त्त का विषय है। इस प्रकार यह खण्ड भी पूर्ण वैज्ञानिक है।[69]

दिन, तिथि, नक्षत्र, योग, करण, ग्रहर्क्षों के उदय, अस्त, चन्द्रसंचार, लग्न, स्पष्टग्रह तथा अन्य त्रिगोलीय सन्दर्भों के संयोग से विभिन्न रूपक प्रभाव स्वतन्त्र रूप में तथा योगजरूप में विभिन्न दिग्देशकाल खण्डों में विभक्त विभिन्न आधारों में प्रकट होते हैं। ये नैसर्गिक प्राकृतिक प्रभाव प्रकृत्यान्तर एवं त्रिगोलीय संचार से परिवर्त्तनशील हैं। तिथ्यादि की परिभाषा करण ग्रन्थों में स्पष्ट हैं। ये कालांश, क्षेत्रांश एवं भूसापेक्षस्थिति से योगजप्रभाव को दर्शाते हैं।[70]

निरयणस्थिति तथा प्रभाव सम्बद्धता

भूमध्यदृश्य मध्यस्थित क्रान्तिवृत्तीय राशिचक्रस्थ नक्षत्रपुञ्जों का प्रभाव भी व्यक्तिगत जीवन से जुड़ा है। क्रान्तिवृत्तीय पुञ्जात्मकनक्षत्रपुञ्ज से दक्षिणोत्तर अवस्थित नक्षत्रपुञ्जों के प्रभाव युगान्तकारी होते है। क्षितिजवृत्तीय भूपृष्ठीय संस्थान में क्षितिजभेद से त्रिगोलीय संस्थान काल की सापेक्षता से सूर्य की प्रधानता से उदित होते हैं। यदि खगोलीय पिण्डों के संचरण न होते तो कोई परिवर्त्तन न होता। भूमध्य दृश्य क्रान्तिवृत्तीय नक्षत्रपुञ्जों के क्षितिजवृत्तीय

आभासिक संयोग को लग्न कहते हैं। त्रिप्रश्नप्रपञ्च में इनका सम्यक् विधान प्राप्त होता है।[71]

संहितास्कन्ध में समस्त त्रिगोलीयसंस्थान के सम्बन्ध में प्राकृतिक संरचना एवं परस्पर संयोग वियोग संचार एवं लक्षणों के आधार पर सम्पूर्ण भूगोलीय प्रभाव का योगज एवं स्वतन्त्र प्रभाव आकलित करने के वैज्ञानिक प्रकार आज भी गोलीय + गणितीय + खगोलीयप्रेक्षण तथा अष्टविधनिमित्तों के संकेतरूप में प्राप्त होते हैं। मुहूर्त्त में कालखण्ड का लघुखण्डग्रहण किया जाता है। कालविशेष में जिस प्रकृति के पिण्ड का सत्व रज तथा तमभेद तथा भूतसम्बन्ध भेद से जो प्रभाव हो, तदनुरूप कार्य का प्रारम्भ अनुकूल एवं विपरीत प्रकृति के कार्य का प्रारम्भ प्रतिकूल होता है।[72]

मुहूर्त्त में काल, कार्य एवं कर्त्ता की प्रकृति में साम्य एवं वैषम्य मुख्यरूप से विचारित होते है। कर्त्ता की क्षमता एवं प्रकृति के अनुरूप किसी संकल्प विकल्प का सिद्ध या असिद्ध होना तीनों तथ्यों पर निर्भर करता है।

प्रभावशास्त्र का भौतिकादि आयाम

होराज्यौतिष का सम्बन्ध मानवीय व्यष्टिगत प्रभाव से है। एक अहोरात्र का लघुकालखण्ड सम्बन्धित जातक इसका मुख्य प्रयोज्य है। संहितोक्त वास्तु एवं स्थापत्य भी मानव का धर्मार्थकाम मोक्षादि इनसे सम्बद्ध हैं।

भूगोलीय, ग्रहगोलीय, नक्षत्रमण्डलीय एवं केतु सम्बद्ध प्रभाव तभी आकलित किये जा सकते हैं, जब आज के परिप्रेक्ष्य में इनके प्रकृति का निर्धारण तथा भूगोलीयसंयोग से होनेवाले विभिन्न परिवर्त्तन एवं प्रभावान्तर का सूक्ष्म आकलन करने की सर्वाभिप्रायिक व्यवस्था हो। प्राचीन सिद्ध निष्कर्षों के आलोक में इनका विवेचन किया जा सके, परन्तु ऐसा तभी पूर्णतः संभव होगा, जब हम पाञ्चभौतिक सिद्धान्त, रसायनिकसिद्धान्त, जीवविज्ञान, वनस्पतिविज्ञान तथा कालविज्ञान एवं यन्त्रात्मक शिल्प से युक्त योगमहाविज्ञान एवं तन्त्रागम सापेक्ष विस्तृत प्रयोगशाला का निर्माण संस्कृत संकायों में करा पायें । भौतिक, भूभौतिक, खगोलभौतिक, रसायनिक--कार्बनिक एवं अकार्बनिक आदि की सहायता से पिण्ड एवं ब्रह्माण्ड का सत्याापन की दृष्टि से सम्यक परीक्षण हो सके,। एतदर्थ उच्चस्तरीय गणितीय ज्ञान एवं सूक्ष्मतम यन्त्रों के निर्माण निर्माण पद्धति एवं संचालन की प्रक्रिया में सक्षम होना भी आवश्यक है। यद्यपि भारत में भी इस प्रकार का प्रयोग जाग्रण काल में शुरू हो गया था, परन्तु संस्कृतशिक्षण को अभी तक इस समन्वय से अलग रखा गया है। यह कैसी विड़म्बना है? इस पर विशेषज्ञ ध्यान दें।[73]

भौतिक परम्परा का निगमागम पक्ष

कालविधान शास्त्र के सम्बद्धता से पाञ्चभौतिक तथा यान्त्रिकविद्याओं का अस्तित्व वैदिक काल में भी था। रामायण तथा महाभारतकाल विकसितकाल था। तत्पश्चात् भी दिव्य विद्याओं का अस्तित्व रहा। किसी भी पिण्ड की संरचना के भौतिक एवं रसायनिकतत्त्व का ज्ञान भौतिक एवं रसायन विज्ञान का विषय है। सांख्यदर्शन तथा वैशेषिक दर्शन तथा भारतीयतन्त्रागम में भौतिक एवं रसायन के साथ अध्यात्म का समन्वय होने पर भी आज तक विभिन्न कारणों से प्रयोग बाह्य हैं। कारण अनेक हैं। भौतिक एवं रसायनिक तत्वों के जैविक एवं वनस्पतिगत प्रभाव के स्थूल एवं सूक्ष्म दोनों प्रभेदों का समन्वय होने पर ही त्रिगोलीयसंस्थान के योगज एवं इकाई गत स्वतन्त्र प्रभाव का आकलन आज फिर से विधिवत् संभव हो पायेगा।[74]

सैद्धान्तिक निष्कर्ष

पिण्ड, अण्ड़ एवं ब्रह्माण्ड के बाह्य एवं आन्तरिक संरचना के स्थूल, सूक्ष्म भेद एवं कारण का अन्वेषण प्राचीन प्रक्रिया के अन्तर्गत योग, ज्यौतिष, तन्त्रागम एवं कल्पात्मक शिल्प के समवेत समन्वय से संभव था। आयुर्वेद में प्रयुक्त रसायनादि विज्ञान का विस्तृत प्रयोगात्मकविधान आज भी आश्चर्योत्पादक है। हजारों वर्षों के पतन की प्रक्रिया एवं पराधीनता से पूर्व परम्परा विखण्डित होने से पूर्व प्रक्रियाओं का आज संकेत मात्र मिलता है, परन्तु बीजरूप मूल तथ्य आज भी जीवन के सभी क्षेत्रों में विद्यमान हैं।[75]

अतः सम्यक् परीक्षण किये वगैर किसी प्राचीन सिद्धनिष्कर्ष को रद्दी की टोकरी में डालने की प्रक्रिया से निश्चित प्रतिफलन तक पहुँचना असंभव है।

सत्तात्मकविश्व में से पूर्व प्रक्रियाओं के लुप्त तथ्य भी गम्य है। जहाँ प्राचीन भारतीय वाङ्मय का योगमहाविज्ञान, तन्त्रागम एवं वेदादि अष्टादशविद्याएँ सर्वज्ञान विज्ञानात्मक हैं, वहाँ आधुनिक भौतिक, रसायन एवं यन्त्रात्मकशिल्प का इनसे योग हो जाने पर मन्त्रात्मक विज्ञानों को छोडकर अन्य समस्त अमन्त्रात्मक भैतिकादि विज्ञान के क्षेत्र में अद्भुत निष्कर्ष क्रम से पाये जा सकते हैं।

कुछ तथाकथित शिक्षित ज्यौतिषशास्त्र के त्रिगोलीय-संस्थानाभिज्ञान तथा त्रिगोलीय प्रभावज्ञापक सिद्धान्तों को जाने बिना भौतिक आधिदैविक एवं अध्यात्मिकविज्ञानों में सक्षमता प्राप्त किये बिना आधुनिकता के स्वांग में हर प्राचीन अन्वेषण को अन्धविश्वास का मूल मानकर भ्रमोत्पादकचक्रों का संचालन कर देश के चतुर्विध विकास के रास्ते में अब तक रोड़ा अटकाने का काम करते रहे हैं। इससे सर्वोदय एवं सर्वांङ्गीण विकास तथा आत्मनिर्भर बनने की प्रक्रिया बाधित हुई है।

शारीरिक, मानसिक, बौधिक एवं अध्यात्मिक विकास के समन्वयात्मकपक्ष को विकसित करने हेतु व्यापकविश्लेषण की आवश्यकता है, जो सर्वाभिप्रायिक उच्चस्तरीय विशेषज्ञ समिति के गठन तथा उपर्युक्त संकेतित विधानों के प्रयोग से ही संभव है। आज की गठित अधिकांश समितियाँ एकाङ्गि है तथा प्राचीन निष्कर्षों के लिए बिना कुछ किये या तो बेकार सिद्ध करने का प्रयास करती

हैं या तो उन्हें असंभव मानकर छोड़ने की बात करती हैं।

ज्योतिर्विज्ञान कालविधायक सार्वकालिक तथा सार्वदेशिकशास्त्र है, अतः इसमें सम्यक् प्रवेशार्थ व्यक्तगणित अव्यक्तगणित, खगोलविज्ञान, ध्वनिविज्ञान, प्रकाशशास्त्र, भौतिकविज्ञान, रसायनविज्ञान, योग, तन्त्रागम, यन्त्रविज्ञान तथा जीवविज्ञान एवं वनस्पतिविज्ञान का वर्गीकृत सम्यक्ज्ञान होने पर ही त्रिस्कन्धज्यौतिष का समग्र ज्ञान संभव है। सभी शाखाएँ व्यक्तिगम्य नहीं अतः वर्गीकृत संघीय उद्यम ही इस युग में अपेक्षित है। कोई भी गणिताश्रितशास्त्र जिसमें प्रयोग तथा सदिश-साधार तर्क हो, उसे अन्धविश्वास की संज्ञा देने के भ्रम को छोड़कर आज भारतीयज्यौतिष तथा प्राच्यविद्या के क्षेत्र में यथार्थ दृष्टि अपना कर प्रयोग पक्ष को प्रथम प्रमाण मानना होगा।

आज भौतिक विद्याओं का तेजी से विकास हो रहा है, अतः आज प्राच्य विद्या के प्रयोगसिद्ध एवं तर्क सिद्ध पक्ष पर ध्यान देकर पूर्वापर सम्बद्धातानुरोध से प्राचीन-नवीन समन्वयानुरोध से संगठित करने की प्राथमिक आवश्यकता है। सामान्य लोग को कौन कहे विशेषज्ञ भी एक दो से अधिक ज्ञान विज्ञान वा कला के क्षेत्र में पूर्णसीमा प्राप्त करने में आज अक्षम है। अपवाद स्वरूप कोई-कोई आज भी प्रकृति के मूल संस्थानात्मक स्वरूप एवं संरचना का समवेत प्रत्यक्षीकरण कर अविष्कारक हो पाता है, यह अलग अपवाद स्थिति है।

आवश्यकता आविष्कार की जननी है, यह कथन त्रिविध सापेक्षता से भी व्यवहारसिद्ध गम्य तथ्य है। कोई भी गणिताश्रितशास्त्र जिसमें सतर्क सयुक्तिक प्रमाण एवं प्रत्यक्ष प्रयोग अङ्गीकृत हो तथा प्रत्यक्ष प्रयोग की परम्परा हो, उसे नकारना तथा भ्रमात्मकज्ञान के आलोक में किसी प्रयोगसिद्ध तथ्यों तथा निष्कर्षों को परखे बिना, अन्धविश्वास कहकर उपेक्षित करने से भारत की बहुत बड़ी क्षति B.C. 800 से B.C.100 तक तथा A.D.1200 से A.D.1906 तक तथा स्वतन्त्रता से अब तक होती रही है। त्रिस्कन्धात्मकज्यौतिष का पञ्चस्कन्धात्मक पक्ष ब्रह्माण्डीय तथा त्रिगोलीय संस्थान मान संचार तथा सापेक्षिक कालचक्र के पर्ययात्मक चक्रों से सम्बद्ध है। अण्ड पिण्ड ब्रह्माण्ड वा ब्रह्माण्ड पिण्ड एवं पात्र गत निष्पत्ति से हर पहलू दिग्देशकाल एवं पिण्ड के चतुर्विध आयाम से सम्बद्ध हैं। कालचक्र एवं स्वप्रकाश, परप्रकाश एवं अप्रकाशपिण्डों की निष्पति से ब्रह्माण्डीय सृष्टि-स्थिति एवं संहार की प्रक्रिया लघुकालखण्ड से प्रारम्भ कर अनन्ताकाश एवं अनन्त महाकाल में अनन्त चक्रात्मक रूप से घटित होते हैं।

*** ज्यौतिषशास्त्र का प्रथमाधार गणित** के दोनों मुख्य प्रभेद अंकगणित, एवं बीजगणित में सर्वविध गणितीय आयाम समाहित हो जाते हैं। गणित की सहायता से कालचक्र सापेक्ष पिण्डाण्डों के संस्थानमानचार प्रभृति ज्ञापक विज्ञान खगोल विज्ञान के रूप में सिद्धान्तज्यौतिष एवं यन्त्रवेध के रूप में विकसित हुए। जहाँ वैदिक मूल सार्वकालिक है। इन खगोलीय पिण्डों की संरचना एवं संचार के विभिन्न प्रभाव विश्लेषक शाखा के रूप में समस्त भूगोलीयप्रभाव विश्लेषक संहिता स्कन्ध अस्तित्व में आया। अतः इन दोनों में गणितीय प्रयोग एवं यान्त्रिकविधान का निवेश किये बिना इनके वैशिष्ट्य का ज्ञान नहीं हो सकता। संहितास्कन्ध के पूर्ण प्रयोगात्मकज्ञान एवं युक्ति तथा प्रयोग के आयाम खोलने हेतु जहाँ योग तन्त्रागम एवं शिल्प के क्षेत्र में विकास आवश्यक है, कहीं भौतिक, खगोलभौतिक, भूभौतिक, रसायन जीवविज्ञान तथा वनस्पतिविज्ञान का उच्चस्तरीय सप्रयोगज्ञान भी वर्गीकरणानुरोध से आवश्यक है। होरास्कन्ध में भी भौतिक प्रभाव विज्ञान, रसायनविज्ञान तथा जीवविज्ञान का ज्ञान अपेक्षित है। शुभ-शकुन में प्राकृतिक लक्षणविज्ञान की भूमिका आवश्यक है। केरलतन्त्र में भी शब्द एवं ध्वनिशास्त्र, लक्षणविज्ञान तथा सकाल वातावरणविज्ञान का ज्ञान अपेक्षित है। स्वरविद्या में ज्यौतिष, योग एवं तन्त्र का समन्वय भी प्रत्यक्ष है। इसका युद्धक शास्त्र में प्रयोग के प्राचीन प्रमाण भी मिलते हैं।

*** सामुद्रिकविज्ञान** में आकृतिविज्ञान, लक्षणविज्ञान, मनोविज्ञान, अंगविद्या तथा प्रत्येक पदार्थ का सामान्य लक्षणज्ञान अपेक्षित है।

मुहूर्त्तविद्या में लघुकाल खण्ड विभाग पर विभिन्न रूपक प्रभाव स्वरूप कालखण्ड के चयन में कार्य काल एवं व्यक्ति की प्रकृति का साम्य अन्वेषित करने के प्रयोगात्मक प्रकार प्राप्त होते हैं। इस प्रकार आज भी भारतीयज्यौतिष सभी दृष्टि से पूर्णवैज्ञानिक पद्धति है।

लुप्त प्रयोग परम्परा को समर्पित सर्वाङ्गीण विकसित विशेषज्ञ ही संघीयोद्यम से प्रकट कर सकते हैं। अन्य एक का एक से अधिक धारा में विशेषता हासिल कर सकते हैं। सामान्य विकास तथा विशेष विकास की समवेत सर्वाङ्गीण विकास राष्ट्रीय शिक्षादि व्यवस्था को लागू किये बिना न तो Vedic maditetional का जाग्रण संभव है, न राष्ट्रीय विकास की गति को द्रुत गति करना । अतः उभय शास्त्र मर्मज्ञों से निवेदन हैं, जो उभयशास्त्र मर्मज्ञ होने के साथ मानवता के प्रति तथा आत्मविद्या के प्रति समर्पित विशेषज्ञों का राष्ट्रीय तथा अन्तर्राष्ट्रीय संगठन उपर्युक्त शोध निष्कर्षों पर विमर्श कर एक ऐसी राष्ट्रीय तथा विश्व व्यवस्था का दस्तावेज तैयार करें, जो सर्वोदय तथा सर्वाङ्गीण विकासान्तर्गत मानवीय जीवन मूल्य के आधारों को पुष्ट कर विषतत्व का शामक हो सके।

*** प्रयुक्तग्रन्थ एवं सन्दर्भ**

संहितास्कन्ध का संक्षिप्त इतिहास एवं समालोचना प्रकाशनाधीन है। भारतीय ज्योतिष नक्षत्रविद्या नामक ग्रन्थ में नक्षत्रविद्या के भारतीयस्वरूप पर तथा संहिता स्कन्ध के विभिन्न वैज्ञानिक सन्दर्भों पर विस्तृत समीक्षण द्रष्टव्य।

1. बृहत्संहिता – दिव्यप्रभाव –अ.3तः13पर्यन्त –वराह
2. सूर्यसिद्धान्त –भग्रहयुत्याधिकार –मयासुर-प.कपिलेश्वरशास्त्री

3. अर्वाचीनज्योतिर्विज्ञान–रमानाथसहाय तथा ज्योतिर्विज्ञान – अर्कसोमयाजि
4. बृहत्संहिता –अ.14नक्षत्रकूर्मविभागाध्याय-वराह
5. बृहत्संहिता-अ.2 - सांबत्सराध्याय - पञ्चमहाभूतानि योनिरिति पाराशर वराह तथा बल्लालसेनादि
6. बृहत्संहिता-अ.16.ग्रहभक्तियोगाध्याय
7. नरपतिजयचर्याआदि नरपति तथा 6विध प्रश्नतन्त्र (प्रश्नमार्गादि)
8. बृहत्संहिता-अ.18 शशिग्रहसमागमाध्याय
9. बृहत्संहिता-अ.19 ग्रहवर्षफलाध्याय तथा अ.20. ग्रहशृंगाटकाध्याय
10. बृहत्संहिता-अ.21तः38 वृष्टिविज्ञान -वराह तथा अद्भुतसागर बल्लालसेन, कादम्बिनी मेघमाला –वि.वि.मधुसूदल ओझा आदि
11. बृहत्संहिता-अ.29तथा30
12. बृहत्संहिता-अ.18तः40 द्रष्टव्य
13. द्रष्टव्य प्रज्ञा –अंक 59-2 में वृष्टिविज्ञान एवं प्राकृतिक उत्पात निर्धारण 2013 प्रकाशित है
14. बृहत्संहिता-अ.3, 32 विशेषतः तथा अ.3तः39 पूरकरुप में द्रष्टव्य
15. बृहत्संहिता-अ.19तः39नाभसप्रभावज्ञापकविधान द्रष्टव्य
16. बृहत्संहिता-अ.51तः58 संहितोक्तवास्तुविज्ञान द्रष्टव्य
17. बृहत्संहिता-अ.60तः75 तथा शकुनबसन्तराज-बसन्तराज
18 बृहत्संहिता-अ.76 तः उत्तरार्ध एवं पाराशरादि होराशास्त्रद्रष्टव्य
19. दैवज्ञकामधेनु –अनवमदर्शी
20. बृहद्दैवज्ञरञ्जन –पं.रामदीन –काशीराज –वाराणसी
21. बृहद्दैवज्ञरञ्जन –पं.रामदीन –उत्तरार्ध
22. मुहूर्त्तचिन्तामणि –रामाचार्य --पीयुषधारा-गोविन्द
23. नरपतिजयचर्या-नरपति -,शिवस्वरोदय-एवं आगमविधान –
24. भारतीय ज्योतिष नक्षत्र विद्या भाग-2
25. भारतीयज्योतिष नक्षत्र विद्या, अयनांशविमर्श, भास्करीय-गोलाध्यायस्य समीक्षणम्, प्रज्ञा - वैदिकअन्तरिक्षविज्ञानं पर्यावरणं च, प्रभृति द्रष्टव्य
26. विश्वेश्वरानन्द वैदिक शोधसंस्थान—विश्व संस्कृतम् होशीयरपुर, पंजाब से संक्षिप्त रूप में 'भारतीय ज्योतिषस्य साम्प्रतिकत्व्
27. पातंजलयोगप्रदीप –महामुनि पतंजलि, नरपतिजयचर्या स्वरोदय – नरपति प्रभृति
28. अष्टांग आयुर्वेद तथा त्रिस्कन्धज्योतिष के समवेत अध्ययन तथा अन्वेषण से गम्य
29. मन्त्रमहार्णवादि द्रष्टव्य
30. मेरुतन्त्र एवं योगिनीतन्त्रादि द्रष्टव्य
31. प्राचीनविज्ञानेषु यानविद्या –संस्कृतविमर्श -1995, रा.सं.सं., नईदिल्ली तथा भारद्वाजप्रणीत यन्त्रसर्वस्वादि द्रष्टव्य
32. सांख्यकारिका, वैशेषिकदर्शन तथा नवीनभौतिकादि विज्ञान का विकाश अनुशीलनीय
33. 'यत्पिण्डे तद् ब्रह्माण्डे' –पातंजलयोगप्रदीप - महामुनि पतंजलि
34. भारतीयज्योतिषस्य साम्प्रतिकत्वेन निर्धारम् –प्रज्ञा –अंक 50.
35. वेदोऽखिलोधर्ममूलम् –मनुस्मृति –अ.2
36. पंचांगकमिटी की रिपोर्ट -प.दीनानाथशास्त्री चुलैट –
37. संहितास्कन्ध का इतिहास –वाराणसी
38. A rivission in long darkness - Dr. V.S. Agraval वैदिकविज्ञान एवं भारतीयसंस्कृति –म.म.गिरिधरलालशर्मा चतुर्वेदी
39. मूकपंचदशी –शंकराचार्य का कालनिर्णय –डॉ विष्णुकान्त झा
40. पंचांगकमिटी की रिपोर्ट -प.दीनानाथशास्त्री चुलैट एवं प्राचीनविज्ञानेषु यानविद्या– संस्कृतविमर्श 1995, रा.सं.सं., नईदिल्ली तथा भारद्वाजप्रणीत यन्त्रसर्वस्वादि द्रष्टव्य
41. पंचांगकमिटी की रिपोर्ट -प.दीनानाथशास्त्री चुलैट
42. बृहत्संहिता अ.2 सांवत्सराध्याय तथा सूर्यसिद्धान्त अ. 2 श्लोक 1तः21
43. वैदिकविज्ञान एवं भारतीयसंस्कृति –म.म.गिरिधरलालशर्मा चतुर्वेदी
44. चरकसंहिता –महर्षिचरक, वीरसिंहावलोक-वीरसिंह तोमर प्रभृति
45. संस्कृतवाड.मय के इतिहास के अनुशीलन से गम्य तथ्य
46. भारतीय ज्योतिष नक्षत्र विद्या भाग-1
47. वैदिकविज्ञान एवं भारतीयसंस्कृति –म.म.गिरिधरलालशर्मा चतुर्वेदी
48. मनुस्मृति –अ.2 द्रष्टव्य ,.संघेशक्तिःकलौयुगे
49. भारतीय ज्योतिष नक्षत्र विद्या भूमिका
50. संस्कृतवाड.मय का संक्षिप्त इतिहास –वाचस्पति गोरेला
51. बृहत्संहिता –वराह
52. शंकरबालकृष्ण दीक्षित - भारतीयज्यौतिष
53. भारतीयज्यौतिष –डॉ नेमिचन्द शास्त्री
54. गणकतरंगिनी –म.म.सुधाकरद्विवेदी
55. डॉ. रामरत्न ओझा –फलितविकास
56. गणकतरंगिनी –म.म.सुधाकरद्विवेदी तथा गणित का इतिहास –
57. बृहत्संहिता एवं अद्भुतसागर द्रष्टव्य
58. बृहत्संहिता एवं अद्भुतसागर द्रष्टव्य
58. श्रीमद्भग्वद्गीता –श्री कृष्ण
59. ज्योतिर्पिण्डों के स्वप्रकाश, परप्रकाश एवं अप्रकाशभेद, अत्युच्चताप से अतिशीतगर्भ तक पिण्डाण्डों का ब्रह्माण्डीय प्रभेद, प्रत्येक पिण्ड तथा पिण्डान्तर्गत अण्डों का कालांश एवं क्षेत्रांश गत सम्बन्ध सार्वकालिक वैज्ञानिक पद्धति को प्रकट करते हैं। कालशास्त्र विधायक ज्योतिर्विज्ञान में अनेक प्रयोगात्मक शाखा प्रशाखा विभाग कालाश्रित, गणिताश्रित एवं पञ्चमहाभूताश्रित होने के साथ परस्पर पूरक सम्बन्ध को भी प्रकट करते हैं।
60. त्रिस्कन्ध ज्योतिष के अध्ययन तथा अनुशीलन से गम्य तथ्य
61. बृहत्संहिता –वराह तथा अद्भुतसागर –बल्लालसेन द्रष्टव्य
62. भारतीयज्योतिष –नक्षत्रविद्या –संहिता स्कन्ध का वैज्ञानिकत्व
63. भारतीयज्योतिष –नक्षत्रविद्या –भूमिका
64. बृहत्संहिता –वराह –अ.1
65. बृहत्संहिता –वराह –अ.3तः21
66. भारतीयज्योतिषस्य साम्प्रतिकत्वेन निर्धारम् –प्रज्ञा –अंक 50
67. कादम्बिनी –भूमिका-ओझा जी
68. नवीन भौतिक विज्ञान A Brief Histori of Time_ stephen Hawking & The Universe in a Nutshell_ stephen Hawking
69. मुहूर्त्तचिन्तामणिः-रामाचार्य
70. द्रष्टव्य अयनांश विमर्श तथा पञ्चाङ्ग निर्माण की दृष्टि से सूर्य सिद्धान्त की समीक्षा प्रभृति
71. सूर्यसिद्धान्त –त्रिप्रश्न
72. मुहूर्त्तचिन्तामणिः –अ.1. शुभाशुभप्रकरण रामाचार्य

73. संस्कृतसमिति का प्रतिवेदन –डॉ. सुनीत चटर्जी –तथा- भारतीयज्योतिषस्य साम्प्रतिकत्वेन निर्धारणम् –प्रज्ञा –अंक 50
74. भारतीयज्योतिष –नक्षत्रविद्या –भूमिका
75. विज्ञानविद्युत् –ओझ जी –वैदिक महाब्रह्माण्ड का असीमत्व
76. द्रष्टव्य भारतीय ज्योतिष इतिहास खण्ड....संहिता स्कन्ध का इतिहास एवं समालोचना डॉ. सच्चिदानन्द मिश्र।
वेदकाल निर्णय -दीनानाथ शास्त्री चुलैट।
(क) भास्करीय गोलाध्याय की समीक्षा-डॉ. सच्चिदानन्द मिश्र-दृष्टव्य ।
(ख) पञ्चाङ्ग कमेटी की रिपोर्ट-दीनानाथ शास्त्री चुलैट
(ग) अयनांश विमर्श–डॉ. सच्चिदानन्द मिश्र
(घ) भगण समीक्षा-प्रो. डॉ. दामोदर झा प्रभृति द्रष्टव्य
(च) केरल प्रश्न संग्रह-डॉ. सच्चिदानन्द मिश्र द्रष्टव्य।

काल + कालखण्ड + वातावरण + स्वर + शब्द + अंक-मानवीयचेष्टाँएँ +पंचांग विद्या का समनिवत रुप यह ग्रन्थ मानवमात्र के लिए बोधगम्य तथा सभी विद्याओं का परमोपकारी है।

(घ) समीक्षण तथा सायन निरयण पक्ष में समन्वय तथा वैदिक विज्ञान की श्रेष्ठता प्रतिपादक-अयनांश विमर्श अ.1 तः7 द्रष्टव्य ।

(ड़) संस्कृत वाङ्मय का विश्वेतिहास के अन्तर्गत संहिता स्कन्ध का इतिहास एवं समालोचना- द्रष्टव्य ।
द्रष्टव्य भारतीय ज्योतिष इतिहास खण्ड....संहिता स्कन्ध का इतिहास एवं समालोचना डॉ. सच्चिदानन्द मिश्र । वेदकाल निर्णय दीनानाथ शास्त्री चुलैट।

(क) भास्करीय गोलाध्याय की समीक्षा-डॉ. सच्चिदानन्द मिश्र-द्रष्टव्य।

(ख) पञ्चाङ्ग कमेटी की रिपोर्ट-दीनानाथ शास्त्री चुलैट अयनांश विमर्श–डॉ. सच्चिदानन्द मिश्र, भगण समीक्षा-प्रो. डॉ. दामोदर झा प्रभृति द्रष्टव्य

(ग) समीक्षण तथा सायन निरयण पक्ष में समन्वय तथा वैदिक विज्ञान का श्रेष्ठता प्रतिपादक - अयनांश विमर्श द्रष्टव्य।

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विज्ञान का मूल : जिज्ञासा और उद्यम

*प्रो. गिरीश चन्द्र त्रिपाठी**

पृथ्वी का आविर्भाव होने के बाद हजारों साल पूर्व सृष्टि ने जब मनुष्य जाति का स्वरूप गढ़ा और मानव मात्र में विवेक का पुंसवन हुआ संभवतः उसी क्षण से मनुष्य में जिज्ञासा का भाव उत्पन्न हुआ। एक ओर पृथ्वी पर प्रकृति का क्रमिक विकास हुआ जिसे हम प्राकृतिक विकास कह सकते हैं, वहीं दूसरी ओर मनुष्य के द्वारा भौतिक विकास किया गया। यह भौतिकता आधुनिक विज्ञान से जुड़ी हुई है। विज्ञान या वैज्ञानिकता के विकास के मूल में जिज्ञासा ही है जिसने हमें इस आधुनिकता के दर्शन कराए हैं। वास्तव में प्राकृतिक विकास सुनिश्चित होता है। इसे स्वाभाविक विकास भी कहा जा सकता है। यह सृष्टि ही उसकी नियामक है किंतु मनुष्यकृत विकास का मूल कारक जिज्ञासा है। जिज्ञासा मनुष्य के मन में उत्पन्न होती है। जिज्ञासा के बाद कल्पना का स्थान आता है और कल्पना के बाद मनुष्य प्रयास करता है। प्रयास या उद्यम ही उसे सफलता के सोपान तक ले जाते हैं। यदि मनुष्य केवल जिज्ञासा ही करता रहे और उसे कल्पना या उद्यम तक न ले जाए तो न तो विकास का मार्ग प्रशस्त होगा और न ही विज्ञान की उन्नति होगी।

जिज्ञासा ही वह तत्व है जो मनुष्य को जड़ता से मुक्ति दिलाता है और उसी जिज्ञासा के पश्चात किये गए कार्य या उद्यम ने इस संपूर्ण संसार को आधुनिकता के चरम पर लाकर खड़ा कर दिया है। यह सर्वविदित है कि किसी भी कार्य की सिद्धि बिना परिश्रम के नहीं होती। संस्कृत का यह श्लोक द्रष्टव्य है :

''यथा ह्येकेन चक्रेण न रथस्य गतिर्भवेत
एवं पुरुषकारेण बिना दैव न सिध्यति''

जिस प्रकार कोई रथ एक ही पहिये पर नहीं चल सकता उसी प्रकार बिना श्रम के किसी प्रकार के फल की प्राप्ति नहीं हो सकती। यही श्रम व्यक्ति को उद्यमी बनाता है। उद्यम उसे ज्ञान की ओर ले जाता है और ज्ञान ही आगे जाकर विशिष्ट होता है और विज्ञान में परिणत हो जाता है इसीलिए ज्ञान का अलग ही महत्व है। यह ज्ञान जितना ही खर्च किया जाए उतना ही बढ़ता है। यही कारण है कि इसे विशेष प्रकार का धन कहा गया है :

''न चौरहार्यं न च राज्यहार्यं
न भ्रातृभाज्यं न च भारकारी
व्ययेकृते वर्धति एव नित्यं
विद्याधनं सर्वधनप्रधानम् ।''

इस विद्या का सीधा संबंध जिज्ञासा से है। जिज्ञासु मन ही ज्ञान प्राप्ति के लिए उद्यत होता है। यह जिज्ञासा ही है जिसने विश्व के सभी आविष्कारों को जन्म दिया है। कहा जाता है कि आवश्यकता आविष्कार की जननी है लेकिन आवश्यकता का अनुभव होने पर मनुष्य का जिज्ञासु मन उसकी प्रतिपूर्ति के लिए उद्यम करता है। रवींन्द्रनाथ टैगोर ने भी कहा है कि

''हमारा सारा ज्ञान और योग्यताएँ जिज्ञासा के बिना व्यर्थ हैं। जिज्ञासा होगी तभी हम किसी काम को सीख सकते हैं या लक्ष्य को हासिल कर सकते हैं।''

इस लक्ष्य को हासिल करने के लिए उद्यम तो करना ही होगा।

''यथा एकेन न हस्तेन तालिका संप्रपद्यते
तथा उद्यम परित्यक्तं कर्म न उत्पादयेत् फलम्''

जिस प्रकार एक हाथ से ताली नहीं बज सकती उसी प्रकार उद्यम के बिना फल की प्राप्ति नहीं हो सकती है। उद्यम या पुरुषार्थ के माध्यम से ही कार्य की सिद्धि होती है। यही पुरुषार्थ सतत् विकास की ओर ले जाता है। किंतु यह भी विचारणीय है कि आधुनिकता के चक्कर में कहीं हम अपनी मूल भावनाओं और परंपराओं से विश्रृंखलित तो नही हो रहे। भारतीय सत्ता त्यागमूलक है। वह अपरिग्रह में विश्वास करती है, संग्रह में नहीं। वह अपने लिए न सोच कर बहुजन हिताय बहुजन सुखाय की अवधारणा को स्वीकार करती है। विज्ञान का ध्येय भी यही होना चाहिए। यदि विकास का आधार संपोषणीय होगा तो ही यह धरती बचेगी और सतत् विकास का मार्ग प्रशस्त होगा। जिन वैज्ञानिक आविष्कारों का व्यवहार समाज के हित में किया जाता है वे ही श्रेयस्कर हैं और ग्राह्य भी। यदि उनका विवेकपूर्ण व्यवहार नहीं होगा तो वे मानव जाति पर ही वज्रपात करेंगी और इसका उदाहरण भी हमें मिल चुका है। इसीलिए विज्ञान को सकारात्मक होना चाहिए। यदि अपनी जिज्ञासाओं और कल्पनाओं को पंख लगाकर हम उद्यमिता की राह पर चलते हुए उनके समाधान खोजें तो वह दिन दूर नहीं होगा जब **सर्वे भवंतु सुखिनः, सर्वे संतु निरामया** की अवधारणा मूर्त होती हुयी दिखाई देगी।

संसार के आरंभिक आविष्कारों में सर्वप्रमुख है, चक्रीय आकार की वस्तु की खोज। पहले पहल जब मानव ने किसी गोलाकार वस्तु को तीव्र गति से लुढ़कता हुआ देखा होगा तभी उसके मन में यह जिज्ञासा उत्पन्न हुई होगी कि इस पदार्थ में जो गति है वह इसके गोलाकार होने के कारण उत्पन्न हुई होगी। यह गति हमें तेजी से आगे की ओर ले जा सकती है। उसके बाद मनुष्य ने पत्थर, काष्ठ और फिर लोहे को काट छाँट कर उसे गोलाकार

*कुलपति, काशी हिन्दू विश्वविद्यालय, वाराणसी

बनाया। इस आविष्कार ने मानव को एक ऐसा उपकरण दे दिया जिससे पूरे विश्व में क्रांतिकारी परिवर्तन आया। तबसे लेकर आज तक सभी यंत्रों में चक्रीय उपकरणों का प्रयोग बहुतायत से किया जाता है।

मानव मात्र की जिज्ञासा ने उसे अंतरिक्ष के अनसुलझे रहस्यों को जानने के लिए प्रेरित किया है। अंग्रेजी की एक लोकप्रिय कविता जो बचपन से ही बच्चों को अपनी ध्वन्यात्मकता के कारण प्रभावित करती है उसकी पंक्तियाँ है :

"Twinkle twinkle little star
How I wonder what you are
Up above the world so high
Like a diamond in the sky"

क्रिस्टीना रुजेटी की यह कविता यों तो बच्चों के लिए लिखी गई है लेकिन यह बालमन में अद्‌भुत जिज्ञासा उत्पन्न करती है। बच्चे के मन में एक बड़ी उत्सुकता है कि आकाश में चमकते हुए तारे जो वास्तव में अनोखे आश्चर्य की तरह हैं वे आखिर क्या हैं? इस सवाल का उत्तर खोजने में वैज्ञानिकों का बड़ा समूह लगा हुआ है। अंतरिक्ष और ब्रह्मांड के रहस्यों की तलाश वैज्ञानिकों के लिए रुचिकर विषय है। चंद्रमा पर मानव के चरण अनेक दशक पूर्व पड़ चुके हैं और अब मंगल ग्रह पर जीवन की खोज की जा रही है। इसी प्रकार अन्य रहस्यों को जानने का प्रयास भी मानव कर रहा है। विश्व में संचित समस्त ज्ञान जिज्ञासा की ही देन है।

जब हम भारतीय वांग्मय पर दृष्टि डालते हैं तो पाते हैं कि अनेक आविष्कारों के अंतःसूत्र वहाँ उपलब्ध हैं। भारतीय ग्रंथों में आधुनिक विज्ञान के तंतु व्यापक पैमाने पर मिलते हैं। सूचना क्रांति के इस युग में हम अपनी वाणी और अपनी तस्वीर भी विभिन्न उपकरणों के माध्यम से एक स्थान से दूसरे स्थान तक आसानी से पहुँचा रहे हैं। ऐसा लगता है कि यह एक अद्‌भुत खोज है किंतु महाभारत में संजय ने अपनी दिव्यदृष्टि से धृतराष्ट्र को कुरुक्षेत्र में हो रहे युद्ध का आँखों देखा हाल सुना रहे थे। क्या यह घटना उस समय के वैज्ञानिक विकास की देन नहीं है? इसी प्रकार शब्दभेदी बाण आज की मिसाइलों की पूर्वपीठिका हैं और वायुगामी पुष्पक विमान वर्तमान में सत्य रूप में हमारे सामने है। आज चरक और सुश्रुत की चिकित्सा पद्धतियाँ यथार्थ में व्यवहार में लाई जा रही हैं और आर्यभट्ट का ज्ञान एक नई दिशा दे रहा है। यह सब कुछ सैकड़ों साल पूर्व भारतीय ग्रंथों में उल्लिखित मिलता है। आवश्यकता उनके पुनर्पाठ की है। उनमें अंतर्निहित सूत्रों के संधान की आवश्यकता है। भारतीय परंपरा में जिज्ञासा का विशेष महत्व रहा है।

प्राचीन काल में गुरुकुलों में विद्यार्थी अपनी जिज्ञासा निरंतर अपने गुरुओं के सामने रखते थे जिनका समाधान ऋषिगण अपने ज्ञान के द्वारा किया करते थे। स्पष्ट है कि जिज्ञासा के शमन का कार्य अध्यापक का ही है। वह अपने ज्ञान को विद्यार्थियों के मध्य वितरित करता है। दरअसल वह वात्सल्य की निधि भी है और इसीलिये वह देव तुल्य हैं। इस आशय का एक श्लोक है:

''अधिगत्य गुरो ज्ञानं छात्रेभ्यो वितरंति ते
विद्या वात्सल्य निधयः शिक्षका मम दैवतम्''

जिज्ञासा का गवाक्ष जितना ही खुला रहेगा हमारी दुनिया उतनी ही सुंदर होगी। जिस प्रकार संगीत के श्रवण के बाद प्राप्त आनंद अनिर्वचनीय होता है उसी प्रकार जब कोई वैज्ञानिक अपनी जिज्ञासा का हल खोजता है तो उसे भी वही आनंद प्राप्त होता है जिसे हम अलौकिक कहते हैं। अतः हमें जिज्ञासा को उगने देना चाहिए, उसे उद्यम के रथ पर सवार होने देना चाहिए और विज्ञान की सहायता से विकास के सकारात्मक आयामों का स्पर्श करते हुए प्रगति के पथ पर अग्रसर होना चाहिए।

●

''प्रज्ञा'' : नियम एवं निर्देश

1. ''**प्रज्ञा**'', जहाँ तक संभव होगा, वर्ष में दो प्रकाशित होगीः प्रथम अंक सत्रारम्भ के अवसर पर और दूसरा अंक मालवीय जयंती के अवसर पर।

2. ''**प्रज्ञा**'' पत्रिका में प्रकाशनार्थ काशी हिन्दू विश्वविद्यालय के शोध छात्रों एवं अध्यापकों के लेख/शोध प्रपत्र सम्पादक ''**प्रज्ञा**'' के कार्यालय में प्रथम अंक के लिए 30 नवम्बर तथा द्वितीय अंक के लिए 30 अप्रैल तक पहुँच जाने चाहिए। शोध छात्रों के लेख/शोध प्रपत्र अपने निर्देशक एवं विभागाध्यक्ष से संस्तुत एवं अग्रसारित होने चाहिए।

3. ''**प्रज्ञा**'' जर्नल में प्रकाशित लेखों/शोध प्रपत्रों के लेखकों को ''**प्रज्ञा**'' की दो प्रतियाँ दी जायेगी : प्रथम लेखकीय प्रति और दूसरी प्रतिमुद्रण की 10 प्रतियों के बदले में।

4. सभी प्रकार का शुल्क, सम्पादक ''**प्रज्ञा**'' काशी हिन्दू विश्वविद्यालय पत्रिका, वाराणसी-221005 के नाम भेजें।

5. **शोध-प्रपत्र/लेख के पाण्डुलिपि निर्माण सम्बन्धी दिशा निर्देश :**

   (क) संगणक (कम्प्यूटर) पर टंकित शोध प्रपत्र/लेख की एक प्रति सी०डी० के साथ ''**प्रज्ञा**'' कार्यालय में जमा करना होगा।

   (ख) पाण्डुलिपि ए-4 आकार के बाण्ड पेपर पर डबल-स्पेस में टंकित होना चाहिए। लेख के चारों तरफ 2 से०मी० की हासिया छोड़ें।

   (ग) **हिन्दी एवं संस्कृत भाषा में टंकित लेखों के लिए दिशा निर्देश :**

   ए.पी.एस.-डी.वी.-प्रियंका रोमन फॉन्ट, शीर्षक– 17 प्वाइंट ब्लैक, लेखक का नाम – 13 प्वाइंट इटैलिक ब्लैक, टेक्स्ट – 13 प्वाइंट, फोलियो – 11 प्वाइंट और पाद टिप्पणी 9 प्वाइंट।

   (घ) **अंग्रेजी भाषा में टंकित लेखों/शोध प्रपत्रों के लिए दिशा निर्देश :**

   'टाइम्स न्यू रोमन' फॉन्ट, शीर्षक – 14 प्वाइंट आल कैप्स काला, लेखक का नाम – 11 प्वाइंट सभी कैप्स इटैलिक ब्लैक, टेक्स्ट – 11 प्वाइंट ऊपर नीचे की पाद टिप्पणी और फोलियो – 9 प्वाइंट।

   (ङ) **टंकित पृष्ठ संख्या : अधिकतम 10 पृष्ठ।**

6. **लेखक का घोषणा-पत्र :**

''**प्रज्ञा**'' जर्नल में प्रकाशनार्थ प्रेषित ''.....'' शीर्षक लेख/शोध प्रपत्र का लेखक मैं घोषणा करता हूँ कि—

(अ) मैं लेखक के रूप में इस लेख की सभी सामग्रियों की जिम्मेदारी लेता हूँ, क्योंकि मैंने स्वयं इसे लिखा है और अच्छी तरह से पढ़ा है, और साथ ही अपने लेख/शोध प्रपत्र को ''**प्रज्ञा**'' जर्नल में प्रकाशित होने की स्वीकृति देता हूँ।

(ब) यह लेख/शोध प्रपत्र मूल रूप से या इसका कोई अंश कहीं और नहीं छपा है और न ही कहीं मैंने इसे छापने के लिए भेजा है। यह मेरी मौलिक कृति है।

(स) मैं ''**प्रज्ञा**'' जर्नल के सम्पादक मण्डल को अपने लेख के संशोधन एवं सम्पादन की पूर्ण अनुमति देता हूँ। ''**प्रज्ञा**'' में लेख प्रकाशित होने पर इसके कापी राइट का अधिकार **सम्पादक** ''**प्रज्ञा**'' को देता हूँ।

लेखक का नाम एवं हस्ताक्षर .....

दिनांक एवं स्थान .....

मोबाइल/टेलिफोन नं० .....

INSTITUTE OF MEDICAL SCIENCES, BANARAS HINDU UNIVERSITY

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काशी हिन्दू विश्वविद्यालय

BANARAS HINDU UNIVERSITY

सर्वविद्या की राजधानी

विश्वविद्यालय के उद्देश्य

1. अखिल जगत् की सर्वसाधारण जनता के एवं मुख्यतः हिन्दूओं के लाभार्थ हिन्दू शास्त्र तथा संस्कृत साहित्य की शिक्षा का प्रसार करना, जिससे प्राचीन भारत की संस्कृति और उसके विचार-रत्नों की रक्षा हो सके, तथा प्राचीन भारत की सभ्यता में जो कुछ महान् तथा गौरवपूर्ण था, उसका निदर्शन हो।

2. साधारणतः कला तथा विज्ञान की समस्त शाखाओं में शिक्षा तथा अन्वेषण के कार्य की सर्वतोन्मुखी उन्नति करना।

3. भारतीय घरेलू धन्धों की उन्नति और भारत की द्रव्य-सम्पदा के विकास में सहायक आवश्यक व्यावहारिक ज्ञान से युक्त वैज्ञानिक, तकनीकी तथा व्यावसायिक शिल्प कलादि सम्बन्धी ज्ञान का प्रचार और प्रसार करना।

4. धर्म तथा नीति को शिक्षा का आवश्यक अंग मानकर नवयुवकों में सुन्दर चरित्र का गठन करना।

Objectives of the University

1. To promote the study of the Hindu Shastras and of Samskrit literature generally as a means of preserving and popularizing for the benefit of the Hindus in particular and of the world at large in general, the best thought and culture of the Hindus, and all that was good and great in the ancient civilization of India;

2. To promote learning and research generally in Arts and Sciences in all branches;

3. To advance and diffuse such scientific, technical and professional knowledge, combined with the necessary practical training as is best calculated to help in promoting indigenous industries and in developing the material resources of the country; and

4. To promote the building up of character in youth by religion and ethics as an integral part of education.