personalized (re)views of the recent developments.

If one goes through the various volumes of *ARPC* over the years, one gets a sense of how different areas have emerged, attained eminence and fell by the wayside. *ARPC* 1997 is a clear indicator of 'What is hot and what is not' in physical chemistry. It covers structure as well as dynamics. It covers research in gas, liquid and solid phases, surfaces and interfaces. It clearly indicates how the field is going: towards materials and biology. This does not mean that traditional topics have lost their relevance. The ubiquitous hydrogen bonding, for example, is enjoying renewed attention. It seems to occur everywhere – weaker in some places and stronger in some others (when compared to the 5 kcal/mol that Pauling gave it). The subject is being reviewed in this journal after a span of 25 years, with special emphasis on the 'strong' ones by Perrin and Nielson. It becomes clear from their article that the hydrogen bond remains an enigma – far from being understood.

There are 25 chapters in the 1997 volume of *ARPC*. The first one, as always, is a scientific autobiography by a senior physical chemist of repute. This time, by Sydney Leach of France. He brings out the difference between the physicists and chemists by recalling what Lagarrigue said to him, 'Well, when you have done hydrogen there is nothing else to be done'. That probably explains why there is more unemployment among physicists than among chemists. While reading the account of Leach's inability to reproduce the absorption spectrum of lead tetraethyl published in the *Journal of Chemical Society* in 1934 by H. W. Thompson, and learning from the author that it was due to benzene impurity in his (Thompson's) lead tetraethyl, one is reminded of the efforts of Raman and his students in removing the non-existent impurities in benzene before announcing to the world the discovery of Raman effect. It is gratifying to note Leach recording his appreciation of R. K. Asundi (an unsung hero in this country) and his original research in spectroscopy and combustion.

The rest of the chapters take us from the down-to-earth topic of physical and chemical properties of ultrathin oxide films (S.C. Street, C. Xu and D. W. Goodman) to the microphysics and heterogeneous chemistry of polar stratospheric clouds (T. Peter). The ones devoted to theory cover a range of topics, from *ab initio* quantum chemistry to protein folding. They are: theoretical studies of chemical dynamics (H. Nakamura), *ab initio* dynamics of surface chemistry (M. R. Radeke and E. A. Carter), molecular structure and dynamics at liquid–liquid interfaces (I. Benjamin) and the theory of protein folding (J. N. Onuchic, Z. Luthey-Schulten and P. G. Wolynes). Theory is complemented by experiment (or is it the other way around?). Loomis and Lester review the current status on OH–H_2 entrance channel complexes, while Gutman and Nachliel report on the recent findings on time-resolved dynamics of proton transfer in proteinous systems. State-to-state chemistry *per se* may not be fashionable any longer. But the fact that state-resolved collision-induced electronic transitions, femtosecond dynamics of electrons on surfaces and at interfaces, subfemtosecond processes in strong intense laser fields and active control of the dynamics of atoms and molecules are being vigorously pursued becomes evident from the reviews of Dagdigian, Harris *et al.*, Corkum *et al.* and Gordon and Rice.

How to do single-molecule spectroscopy without isolating a single molecule is the subject of the review by Plakhotnik *et al.* Spectroscopy in its umpteen different versions is the staple diet of modern day physical chemists. This becomes evident from the reviews on spectroscopy of metal ion complexes (M. A. Duncan), Stark spectroscopy (G. U. Bublitz and S. G. Boxer), two-photon-induced fluorescence (P. R.Callis), infrared and Raman vibrational optical activity (L. A. Nafie), fast natural and magnetic circular dichroism spectroscopy (R. A. Goldbeck *et al.*) and structural information from methyl internal rotation spectroscopy (L. H. Spangler). The review on molecules in high Rydberg states by Merkt covers the recent developments in the investigation of these exotic states and illustrates how in turn they are leading to chemical applications.

The reviews on kinetics in solids by Vyazovkin and Wight and new EPR methods for investigating photoprocesses with paramagnetic intermediates by Stehlik and Möbius are reminders to the point that the traditional physical chemistry tools can be put to modern use. One is also reminded of the lesson that developments in physics can have their offshoots in chemistry by reading the review on dissociative recombination with ion storage rings (M. Larsson).

There is an old belief in this country. Nothing is perfect on earth and anything that is, doesn't belong in here. The excellent reviews do contain some typographical and some grammatical errors. This is understandable, considering the size of the volume (822 pages in small print) and the time constraints with which they are produced. But what is surprising is that Sydney is spelled wrong and fullerenes are referred to as the largest of simple *compounds* in the preface.

For any practitioner of physical chemistry, a look through *ARPC* 1997 is a must. Because of the budget constraints, many libraries are deleting *ARPC* from their list of standing orders. This is a pity. What complicates matters is the difficulty in acquiring it in India. To those who do not get it in their library, my advice is the age old one: beg, borrow or steal (temporarily)!

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Annual Review of Cell and Developmental Biology 1997, (J. A. Spudich, ed.). Annual Reviews Inc., 4139 El Camino Way, Palo Alto, California 94303-0139, USA. Price: Individuals $ 69, Institutions $ 139.

E. B. Wilson's 1925 *magnum opus* '*Cell in Development and Heredity*' was a path-breaking attempt to bring together the then available knowledge in disciplines that, in our current terminology, we may identify as 'cell biology' and 'developmental biology'. Unfortunately, however, as each of these areas grew in information content, their developments were 'autonomous', often bordering on some kind of 'contempt' for the other area. Fortunately, however, we seem to have covered the circle fully and come round to the position where 'cell biology' and 'developmental biology' are no more antago-

nistic but truly complementary. The 13th volume of *Annual Review of Cell and Developmental Biology* reflects the ever-increasing number of issues in biology that are beneficiary of the truly integrated approach possible due to concerted developments in molecular genetics, molecular cell biology, developmental biology, instrumentation, bio-informatics and other related areas.

Although the different chapters in this volume are not arranged around a common theme, the 22 articles can be considered in system/broad area-related sub-groups representing some of the current trends of research. Several articles deal with different aspects of cytoskeletal components and cell surface molecules; several others deal with kinases and ATPases. Of the eight chapters that deal with aspects of development, five relate to animal models and three to plants. The other areas of considerable contemporary excitement that are included in this volume concern translocation of proteins in mitochondria, assembly of nucleus in eukaryotes, and transcriptional regulation in yeast. With such a wide canvas, this volume would offer something to everyone with interest in cell differentiation and function.

Microtubules are very dynamic and are known to be associated with a wide variety of cellular activities. Desai and Mitchison have discussed the dynamics of microtubule polymerization *in vitro* as well as *in vivo* and examined the microtubules from the evolutionay point of view, since bacteria also carry a related FtsZ protein. The tubulin-like FtsZ cytoskeletal protein has a vital role in bacterial cell division. As discussed by Bramhill, while the bacterial cell division as described in our elementary biology teaching appears very simple and straight forward, the actual process brings forth intricate questions whose answers have great bearing not only from the point of view of cell biology but also from an evolutionary perspective.

The ovaries and oogenesis in *Drosophila* provide a very exciting system to study the role of cytoskeletal components not only in cell morphogenesis but also in vectorial transport of molecules. Robinson and Cooley have reviewed the genetic and cell biological studies dealing with assembly of actin cytoskeleton in ovarian cells therefore, and its functions in morphogenesis of *Drosophila* egg.

Besides the molecules, major structural components of the cell or even whole cells also need to move and they need force-generating motors that can convert the ATP-derived chemical energy into mechanical energy for movement. The kinesin family of microtubule-based proteins are of considerable diversity, and in view of the immense significance of such micromotors, they have attracted considerable attention from the viewpoint of their structure and molecular interactions. Vale and Fretrterick have discussed the design plan of kinesin motors.

Keeping the multitude of cells together in a spatially organized structurally and functionally communicating system in a multicellular organism is a task in which the cell adhesion molecules have very important roles. While Leahy discusses the implications of atomic-resolution structures for cell adhesion, Yap *et al.* have reviewed the cadherin-based adherens junctions. The guided growth of axons and establishment of new synaptic junctions is a very important but intriguing process. Walsh and Doherty discuss the role of immunoglobulin superfamily neural cell adhesion molecules in axonal growth guidance, synaptic plasticity and in signalling.

The nucleus and mitochondria have several things in common: besides both containing DNA, they are also covered by double-layered membrane/envelope. However, while the nuclear envelope has elaborate nuclear pores for import and export of various macromolecules, the mitochondrial membrane does not have any such specialized structure. The import of the majority of mitochondrial proteins from the surrounding cytoplasm is a fascinating process and its study has contributed a great deal to the development of the concept of molecular chaperones. Pfanner, Craig and Hönlinger have discussed the mechanistic aspects of translocation of pre-proteins in mitochondria. Unlike mitochondria, the nuclear envelope undergoes a cyclic reassembly during mitosis. The roles played by a variety of lamins, lamin-associated proteins, their receptors, and their interactions with other proteins in the act of nuclear reassembly are discussed by Gant and Wilson.

Kinases and phosphatases perform very important regulatory roles in cell function by phosphorylating or dephosphorylating proteins, etc. The cyclin-dependent protein kinases (Cdks), reviewed by Morgan, drive the cell cycle events and also clock them; in addition, they have roles in transcription and other processes. Genetic and molecular studies on Cdks have given exciting insights into the complex but very finely tuned process of cell division. One of the most important steps of cell division is the act of DNA replication. Although the process of DNA replication in theory appears very simple, its coordination in an eukaryotic cell with respect to temporal and spatial regulation is complex and necessitates the involvement of a very large number of proteins. Dutta and Bell have reviewed the initiation of DNA replication in eukaryotic cells, particularly with reference to their roles in formation and progression of the replication fork, and the role played by cell cycle machinery in regulating initiation of DNA synthesis.

Cell surface receptors and kinases are closely linked and critical for cell signalling. Since the multicellularity of eukaryotes makes cell signalling studies more difficult, bacteria provide a convenient model system to study such processes. The molecular mechanisms of signal transduction by receptors, kinases, and adaptive enzymes during bacterial chemotaxis are discussed by Falke *et al.* Simple chemotaxis by individual bacterium can generate remarkably complex (and beautiful!) patterns at population level and therefore provide a convenient model system for studies on eukaryotic patterning.

A very important class of kinases is the Src family of tyrosine kinases which are activated when a variety of cellular receptors bind their specific ligands, and this activation triggers specific signalling cascades. Thomas and Brugge have reviewed the very diverse area of cellular functions regulated by the Src kinases. Vacuolar-ATPases (V-ATPases) are special class of phosphatases that function to acidify different vacuolar compartment in cell. The review by Stevens and Forgac summarizes structure, function, and regulation of the V-ATPases.

Developmental biology in concert with molecular genetics and cell biology has become one of the most exciting and fertile areas for current research and for synthesis of basic biological concepts. Spemann's organizer not only provides 'instructions' to surrounding cells at the gastrula stage of Chordate embryos, it has been most instructive to generations

of students of developmental biology. Ever since the classical experiments of Hans Spemann and Hilde Mangold in the 1930s, the primary organizer has remained the most important paradigm for the phenomenon of induction in biological systems. The review by Harland and Gerhart provides the current status of formation and function of Spemann's organizer in relation to its role in inductive signalling and patterning. A less discussed phenomenon in developmental biology is the left-right asymmetry displayed by most 'bilaterally symmetrical' animals. The review by Wood highlights this intriguing aspect of development, and provides insights into the developmental pathways that help establish and maintain the left–right asymmetry.

The Notch mutation was identified in 1919 by Mohr as a dominant mutation which in heterozygous condition caused small incisions at tips of wings of adult female flies. This recessive lethal sex-linked mutation in *Drosophila* has been a subject matter of a very large number of genetic studies; recent molecular biological studies have revealed this gene to be a member of a highly conserved family of cell surface receptor involved in controlling numerous cell fate decisions during development. Kumble and Simpson have reviewed the Notch (*Drosophila*) and LIN-12/GLP-1 (nematodes) signalling pathways and their regulation during development.

While the central issue in developmental biology still concerns the genetic control of embryonic development, analyses of specific terminal differentiation pathways are also providing very useful insights. Hwang *et al* have discussed the differentiation of adipocytes, the cells that house the latent energy sources of our body and which through production of the leptin hormone play an important role in regulation of energy intake and expenditure. The 'obese' gene, encoding the leptin hormone has been in news recently as being responsible for obesity of some 'helpless' people.

With the availability of molecular and cell biological tools, studies on plant development have also made significant progress. Morphogenesis of plant cells is somewhat different from that of the animal cells due to their general immobility. The role of plasma membrane, cytoskeleton, and the targeted secretion of cell wall in the spatial regulation of cell morphogenesis in plants is discussed by Fowler and Quatrano. The non-motility of plants and their dependence on light for energy have required the plants to evolve special responses to light. As discussed by Fankhauser and Chory, light controls plant development in many ways: *Arabidopsis* has been the work-horse of plant developmental biologists, and combination of genetic, molecular and cell biological studies on this model system has provided substantial information on the light-induced signal transduction pathways.

Understanding of development and cell function is dependent upon elucidation of the mechanisms of gene expression and its regulation; interestingly, however, much of our comprehension of gene expression has been the result of studies on developmental phenomena, a typical example of 'complementation' between related fields of studies. The major regulation of gene activity takes place at the level of transcription by RNA polymerase II. Carlson shows that genetic studies, using the yeast as a model, on the diverse sets of transcriptional regulatory responses and the studies on the carboxy-terminal domain (CTD) of the RNA polymerase II have together unraveled the regulatory role of proteins, designated as the Srb or mediator proteins, associated with the CTD.

In summary, this volume of the *Annual Review of Cell and Developmental Biology* has in-depth reviews on a wide variety of contemporary topics. I think the heterogeneity of topics makes this collection of use to a much large number of readers, and anybody who refers to it for one topic may be expected to end up being richer by glances through the other topics. And, it is not unlikely that glances may sometimes provide the missing link!

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