

Ardhendu Sekhar Mukherjee (1935–2005)

Ardhendu Sekhar Mukherjee died, after a period of illness, on 15 November 2004 at the age of 69. He was a teacher *par excellence*, who trained generations of students in the country in the field of genetics and excited them with its fast developments.

Mukherjee was born in Patadanga, West Bengal on 1 October 1935. He completed his I Sc from TNV College, Bhagalpur (Bihar) and having developed interest in biological sciences, joined B Sc (Zoology Honours) at the Presidency College, Kolkata, and subsequently obtained his M Sc degree in Zoology and Comparative Anatomy from Calcutta University. He was a topper at both the examinations. Initially he joined S. P. Ray-Chaudhuri at Calcutta for Ph D, but on being awarded a State Scholarship by the Government of West Bengal, he left for USA for Ph D under the leading geneticist Curt Stern at University of California, Berkeley. Following the excellent training in formal genetics and developmental genetics in Stern's laboratory, Mukherjee spent one year as a postdoctoral fellow in the well-known laboratory of Wolfgang Beerman at Max-Planck Institute, Germany. He was appointed, at the young age of 30, as lecturer in the Department of Zoology, University of Calcutta in 1965, from where he retired as professor after a long service of 35 years in 2000.

His doctoral research in Stern's laboratory related to the role of the sexcombless gene in patterning the bristles on the legs of *Drosophila*. His postdoctoral research in Germany resulted in a seminal paper in *Nature*, which laid the foundation for the concept of hyperactivity of the single X-chromosome in male *Drosophila melanogaster* as the basis for the phenomenon of dosage compensation for X-linked genes in males and females. It is remarkable that Mukherjee was trained by Stern and Beermann in two rather different systems in *Drosophila*, viz. (i) the traditional mutational and gene interaction approach to understand the mechanism of pattern formation during development, and (ii) the cytogenetic approach using polytene chromosomes for a direct qualitative and quantitative assessment of specific gene expression. Stern's and Beermann's laboratories were the best to learn the intricacies of hard-core genetics and polytene chromosomes respectively, and Mukherjee learnt these well. He integrated these di-

verse approaches successfully in his own research. I have been fortunate in being trained by him in both these approaches.

After joining the Department of Zoology at University of Calcutta, Mukherjee revitalized the *Drosophila* laboratory, set up in the early 1950s at the initiative of J. B. S. Haldane, as the 'Genetics Research Unit' and initiated active research programmes on pattern formation, meiotic drive and dosage compensation in *Drosophila*. In a short period of time, this



unit became well known at the national as well as international level. The most notable contributions from his laboratory related to chromosomal basis of dosage compensation and the organization of replicating units in polytene chromosomes of *Drosophila*. In the late 1960s, cellular autoradiography was a rather novel approach to a variety of cell biological and cytogenetic studies, and his laboratory was one of the first in India to extensively use cellular autoradiography technique to characterize the basic framework of the mechanism of dosage compensation in *Drosophila*. Pioneering work in his laboratory during the late 1960s and early 1970s helped establish that (i) the hyperactivity of the single X-chromosome in male flies was not dependent upon the sex-physiology of the individual, rather it was a cell-autonomous property dependent on the hemizyosity for the X-chromosome; (ii) unlike the 'spreading-effect' seen during inactivation of one X-chromosome in somatic cells of female mammals, the hyperactivity of the different

regions of the male X-chromosome in flies was autonomously regulated and did not spread to inserted autosomal regions, and (iii) the X-chromosome in male polytene cells was not only hyperactive in transcription, but also completed a replication cycle faster than autosomes in the nucleus. It was my privilege that I worked in Mukherjee's laboratory during that period of time and contributed in some ways to the findings. Subsequent studies in his laboratory established, using *in situ* chromatin transcription assay, that the organization of chromatin in the male X-chromosome was different from the autosomes or the X-chromosomes in female nuclei. His laboratory also contributed to our understanding of evolution of dosage compensation in different species of *Drosophila* in relation to the evolution of neo-sex chromosomes. Much of the subsequent work on the mechanism of sex determination and dosage compensation in *Drosophila* in different laboratories around the world was stimulated by the seminal work carried out by Mukherjee's group at Calcutta.

Mukherjee visited the University of Nebraska as a Visiting Scientist in 1971 and worked in the field of mammalian oncology and published papers in reputed journals.

Besides being an active researcher, Mukherjee was an energetic and inspiring teacher. I was a student of final year M Sc in Zoology in 1965, when he joined as a young lecturer bubbling with the excitement of discoveries relating to gene expression, gene regulation and cracking of the genetic code. I would like to narrate some of my personal experiences with Mukherjee, which had a lasting impact on my own academic development.

After joining the Department of Zoology, he initiated the practice of laboratory seminars (journal club) in the *Drosophila* laboratory, which at that time had 3–4 research scholars. As a final year M Sc student, I was permitted to attend these seminars. His intense participation in these seminars prompted me to seek his permission to present a seminar on the then exciting developments relating to correlations between structural entities in mitochondria with its functions. He encouraged me to give the talk and I still vividly remember his spontaneous and encouraging pat and hug after I finished

PERSONAL NEWS

my maiden 'scientific presentation'. His inspiring and infective enthusiasm for the rapid developments in genetics and molecular biology in the early 1960s was responsible for my changing from parasitology to genetics. During M Sc dissertation work on a protozoan parasite, as part of the special paper in parasitology, I found significant amounts of extranuclear DNA, which made me approach Mukherjee to guide me as a Ph D student, so that I could understand the significance of this extranuclear DNA in the protozoan parasite. He candidly replied that he was not competent to guide me in the field of protozoan genetics, but he would be happy to train me in *Drosophila* genetics, and after having learnt that, I could switch over to the question in my mind. He not only introduced me to the finer nuances of *Drosophila* genetics and cytogenetics, but his training was so fascinating that I have not been able to go back to my original question yet! During the period that I worked as a Ph D student in his laboratory (August 1967 to mid-1970), I had full freedom to plan my experiments, to write and communicate research papers,

to differ with him and yet receive his fond affection and guidance. An example of this encouraging freedom was that I had a single author paper even before I submitted my Ph D thesis. It was indeed a great experience to have been his student. Much of the credit for whatever I have been able to achieve in my own academic career goes to the training that I received during my most formative years in Mukherjee's Genetics Research Unit. Besides teaching us how to plan our strategies and carry out the actual laboratory work, he also made us aware of basic 'ethics' of practising science. He would always remind us of doing our science honestly and that when we assess someone else's work as peers, we are only peers, neither relations nor teachers nor students. No words can describe the significance of this teaching and training.

Mukherjee guided 41 Ph D students and 4 M Phil students. He published a large number of original research papers besides contributing chapters in books and presentations at many national and international conferences. He published in several leading journals.

Mukherjee was elected fellow of the Indian National Science Academy, New Delhi and Indian Academy of Sciences, Bangalore. He received the J.C. Bose Award of the University Grants Commission, New Delhi. He served the Zoological Society of India at Kolkata as Editor of its journal and also as its President. He was President of the Zoology, Entomology and Fisheries Section of the Indian Science Congress Association in 1986–87 and later (1998–2001) he served the Indian Science Congress Association as General Secretary.

He is survived by his wife, two sons and their families and of course, by generations of students, who cherish his inspiring and enthusiastic teaching of genetics and his contributions as a committed and uncompromising researcher.

SUBHASH C. LAKHOTIA

*Cytogenetics Laboratory,
Department of Zoology,
Banarasi Hindu University,
Varanasi 221 005, India
e-mail: lakhotia@bhu.ac.in*