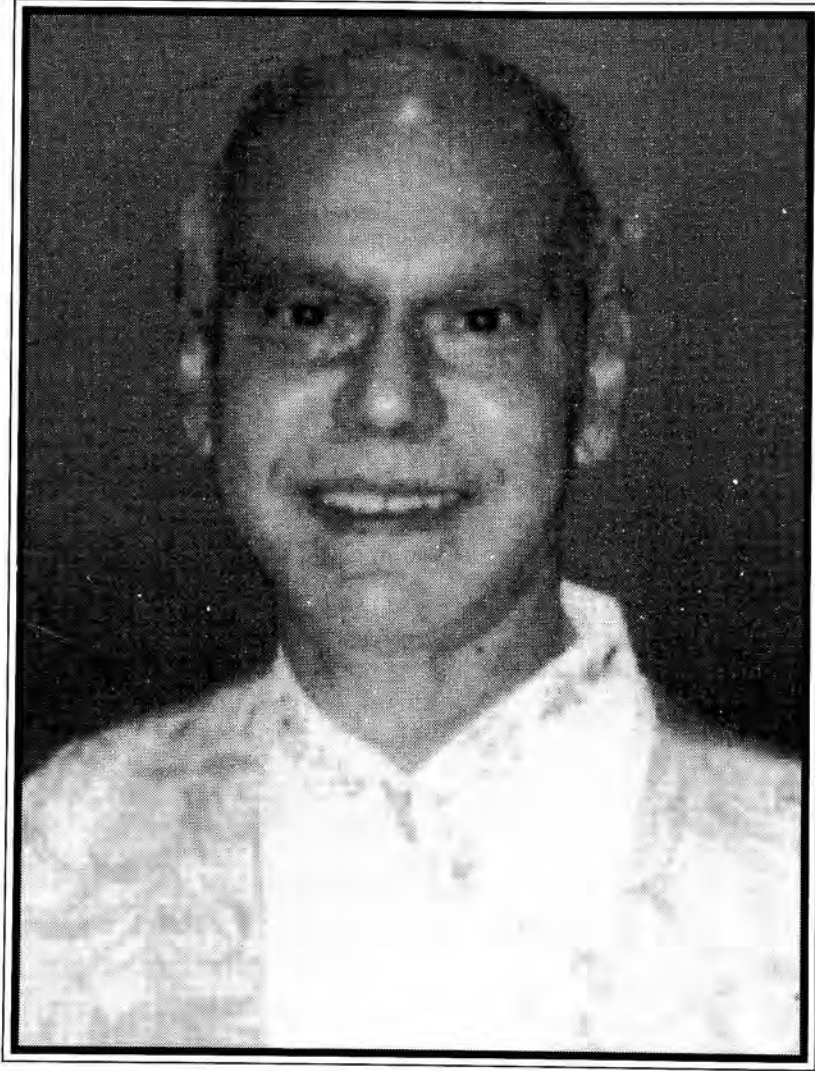


# ARDHENDU SEKHAR MUKHERJEE

(01 October 1935 - 15 November 2004)

*Biog. Mem. Fell. INSA, New Delhi* **34** 125-140 (2008)





*A. S. Mukherjee*



# ARDHENDU SEKHAR MUKHERJEE

(1935-2004)

(Elected Fellow 1983)

## FAMILY BACKGROUND AND EDUCATION

**A**RDHENDU SEKHAR MUKHERJEE was born on October 1, 1935 in Patadanga, in Birbhum district, West Bengal. His father's name was Shiva Shanker Mukherjee and mother's name was Smt. Nirupama Mukherjee. His father was a Headmaster in a high school in Bihar. Ardhendu Sekhar Mukherjee was the third child of his parents. As his father was a Head master of a school in Bihar, he had his schooling in a village of Bihar. After his preparatory school, he went to Nabinagar High School in Bihar. He passed matriculation examination in 1951, from Patna University. Thereafter, he completed his intermediate studies in TNJ College, Bhagalpur, from Bihar University in 1953. He was then admitted to Presidency college Kolkata, for his graduation. Ardhendu Sekhar Mukherjee was fortunate to enroll himself in B.Sc. (Zoology Hons.) at the Presidency college and had the opportunity of being taught by Prof. Sivotosh Mookerjee, a great teacher with great personality. He was also fortunate in learning comparative anatomy of vertebrates from another great teacher of the time, Prof. Jitendra Nath Rudra, to whom Prof. Ardhendu Sekhar Mukherjee had deep regard. Both Professor Rudra and Professor Sivotosh Mookerjee was glamorous and romantic with clear conceptuality and comprehension on the subjects he taught, while Prof. Rudra was highly provocative to impermeate thought and imagination into students, was also comprehensive and had a great command on the subjects he taught. In fact, Ardhundu Sekhar Mukherjee was influenced by his teachers in Presidency Colleges at that time so much that his basic training in swimming through love for science *vis-à-vis* Zoology was completed in Presidency College and that was mainly due to Professor Sivotosh Mookerjee. In 1955, he graduated from University of Calcutta, securing first position in first class. He completed his M.Sc. degree in Zoology from the same University in 1957 and stood first class first. During the period, he had also the opportunity to come close to some very renowned scientist like Prof. JBS Haldane and Prof. SP Raychaudhuri. Dr. Mukherjee was thus under the influence of a great tradition and of teachers who were both intellectually and experimentally creative scholars.

In 1959, he got married to Sati who had been the virtuous and strong life companion of a scientist. Mukherjees had two sons. Elder one is Dibyendu who is a computer engineer in USA and the younger one Subhendu is also a computer engineer and settled in USA.



## PROFESSIONAL CAREER

After passing his M.Sc., Dr. Mukherjee spent two significant years as a research fellow under Prof. SP Raychaudhuri at the Department of Zoology, University of Calcutta, and became a practicing *Drosophila* geneticist. When he was selected for the 'State Fellowship' for his higher studies in abroad, he decided to go to USA. He selected Prof. Curt Stern's (renowned *Drosophila* geneticist) laboratory, for his predoctoral studies. Accordingly, he went to University of California, Berkley, USA, for his higher studies and completed his Ph.D. degree in Development Genetics. During the time he was also trained in human genetics. In 1964, he was also appointed as a course lecturer in human genetics, in the Department of Genetics University of California, Berkley, USA.

After receiving his doctoral degree from the University of California, Berkley, USA, he spent a year in Germany as a post-doctoral fellow in the laboratory of Wolfgang Beermann. During the time Beermann's laboratory was using what at the time was a state of the art molecular technique: transcription autoradiography. Using the technique, Mukherjee and Beermann first showed that the difference in morphology of the polytene X in the two sexes reflects a difference in level of activity. In 1965, he published his much acclaimed and popular theory of dosage compensation in *Drosophila* in Nature. His pioneering work on the hyperactive theory of dosage compensation in *Drosophila* induced other scientists to examine genetic control of all aspects of dosage compensation. This line of scientific investigation led Prof. Mukherjee to formulate a theoretical framework for the genetic regulation in higher eukaryotes.

On his return to India, in 1965, he joined as a Lecturer in the Department of Zoology, University of Calcutta, Kolkata. At the young age, he was very popular and friendly with all his colleagues, other teachers of Zoology and other faculties and officers including his subordinate staff. He was instrumental in creating a friendly atmosphere and a friendly relation among students and teachers. It was largely because of the initiatives and dedicated efforts of Prof. Mukherjee who established a strong school of *Drosophila* geneticist, the Department of Zoology, University of Calcutta, obtained the first UGC supported special assistance in 1976 in the area of genetics. He was also awarded UNDP programme besides a large number of projects from other national bodies. He remained in the Department of Zoology, University of Calcutta until his retirement in 2000. He held appointments at the Zoology Department, University of Calcutta, as Lecturer (1965-1974), Reader (1974-1978), and ultimately as a Professor (1978-2000). He was also the Head of the Department during 1983-1984. His farsightedness and imperative attitude led him to create an atmosphere of excellence among his colleagues. He could foresee the development of science much ahead of time. He visited many times USA and Germany. For example, in 1971, Dr. Mukherjee, went to the University of Nebraska, Lincoln, USA



visiting scientist and worked on mammalian oncology. He also visited several times in Prof. Finendegen's laboratory as a visiting scientist and worked on exogenous DNA incorporation, phosphopeptide, protein function etc. in human cell culture. In addition he visited many places in Europe and USA to present his results at conferences and seminars as well as a visiting professor.

Prof. Mukherjee was an outstanding keen observer, a very thorough and skilful geneticist and cytologist, a man who investigated a probable to the last detail. At the same time, he was able to recognize the essence of a phenomenon and common principles among a wealth of details. His work on dosage compensation and control of DNA replication has placed Mukherjee's group on an international platform. All his works have gained repute and have been confirmed by scientists abroad and cited in nearly 100 reviews and at least half a dozen books (e.g. in the three text books by Herskowitz, King and Levine, in Genetic mosaic and other essays by C Stern, in Animal Cytology and evolution MJD White, Cell differentiation by W Beermann, in Biology of *Drosophila* by Ashburner and Novitski and in Biology of *Drosophila*, edited by Wright and Ashburner). His theory on the male X hyperactivity as the mechanism of dosage compensation has been accepted as Mukherjee's theory of dosage compensation. According to this theory, the single X chromosome of *Drosophila* male compensates the gene products of the diplo X female by hyperactive transcription and faster rate of DNA replication.

Mukherjee's studies on the role of repair system in the fixation of mutations and hormone and cancer research have opened up new vistas in molecular biology and genetics; the latter work has been cited by Dr. Robert Holley (Nobel Laureate). He was also a master of formal genetics, a competence not found too often among cytologists. He described his results convincingly and could get others to recognize their general importance. He did not hesitate to draw far reaching conclusions those could be experimentally tested and were later proven to be correct. For example, he realized that the dosage compensation in *Drosophila* offered a model for the gene regulation in eukaryotes. Although he came up with the right results at the right time, part of his early success in winning the attention of the scientific community was the result.

Here I would simply like to recollect some of the qualities of the remarkable man. My first impression was of his brilliance. He was quick in his thought process and his eyes seemed to light up as the solution to a problem sprang into his mind. Most of his life time was spent for working mostly in genetics of *Drosophila*. In this context, it may be noted here that the first *Drosophila* laboratory in India was started by Prof. SP Raychaudhuri, a student of Prof. HJ Muller, Nobel Laureate, with the help of Prof. JBS Haldane. Prof. AS Mukherjee, played a very important role in spreading *Drosophila* research in India. He always kept his vision on new area of research where transformation of the common fruit fly *Drosophila* to 'queen



genetics' took place in the last few decades in the earlier century. He had rightly chosen his research material *Drosophila* which is now one of the most studied organisms in genetics and development biology. Prof. Mukherjee always tried to teach us that a researcher can derive satisfaction from the daily performance of his task, that the most important attributes of a scientific career are curiosity that lead to the planning of experiments and ability to perform these experiments. He was worried about two serious threats to the fundamental nature of scientific research and the role that it played and would continue to play in our culture and civilization: a goal-oriented approach coupled with the pressure for immediate relevance. He believed that research, like other serious human endeavors, should be approached thoughtfully and conducted ethically.

### IMPORTANT RESEARCH CONTRIBUTIONS

Here, I would highlight highlights of a brilliantly successful scientific career of Prof. Mukherjee. He published about 200 research papers including four chapters in books on developmental biology and genetics. He supervised forty one Ph.D. and four M. Phil students. Towards his students, Mukherjee showed much tolerance and understanding. He wanted them to work and think independently, and some time he would be reluctant to put his name on a publication to which he had not contributed with personal work. He thus continued a tradition from which he had himself benefited as a student. Out of his associates, I mention two scholars whose research grew directly out of his own. In 1969, Subhas Chandra Lakhota had shown cellular autonomy of dosage compensation in *Drosophila*. He also showed that faster rate of replication of the male X chromosome might be sufficient to sustain a hyper-activation of the male X chromosome. At the same time, RK Dutta had studied the pattern formation in *Drosophila* comb gap region. He had also pioneered on the prepattern concept of *Drosophila* development. In brief, he was a recognized authority in his field of sex determination and dosage compensation research. In addition, some contributions have been made by Mukherjee in the fields are: (a) recombination in male, (b) fractional mutations and repair, (c) developmental genetics and biological patterns, (d) hormones role in replication and maintenance, (e) exogenous DNA incorporation etc.

Mukherjee's laboratory was unique in the field in India as evidenced by the incredible number of visitors from the United States and other countries including numerous eminent scholars, who stayed for days, weeks and months and who were instrumental in bringing about the singular atmosphere that lived forever in the memory of Mukherjee's Ph.D. and post doctoral fellows. One such visitor was Prof. JC Lucchesi, University of North Carolina, Chapel Hill USA, who transferred to the young generation the spirit of a scientific tradition of the department.



In this context, it may be noted here that recently, Prof. JC Lucchesi, William G Kelly and Barbara Panning of the Department of Biology, Emory University Atlanta, Georgia 30222, USA have dedicated *Drosophila* portion of their review entitled "Chromatin Remodelling in Dosage Compensation" that appeared in *Annu Rev Genet* 2005 615-651 in the name of Prof. AS Mukherjee.

Prof. Mukherjee was also fortunate that he could perceive his position in the history of our science through the many honours and awards which were bestowed upon him during his career. Amongst the many awards and honours which were bestowed on Professor Mukherjee as recognition of his academic works, the following may be mentioned:

- Gold Medalist from Calcutta University for being 1<sup>st</sup> class First in M.Sc., 1957.
- Oversea State Scholar, Govt. of West Bengal, 1959.
- Platinum Jubilee distinguished Service Award of Indian Science Congress Association.
- Dr. Har Swarup Memorial Lecture Award of INSA.
- Jaykrishna Chakravorty Oration Lecture Award, in 1999 of N.R.S. Medical College.

### National Recognition

- UNDP grants to selected laboratories: Endocrinology and Genetics, in 1980.
- He was honoured by UGC by awarding him Sir JC Bose National Award for research in Life Science in the year 1986.
- Indo-Royal Society Exchange Fellowship program by INSA in 1986.
- He was elected as the Sectional President (Zoology, Entomology and Fisheries) of Indian Science Congress Association for the year, 1985-1986.
- 1986-1987 Prof. Mukherjee was invited by the UGC to deliver lectures at a number of Universities under the national lecture programme.
- 1990-91 Prof. Mukherjee was nominated as a member of the Zoology review committee of the UGC.
- He served as the President, Zoological Society, Kolkata for 1998-2000.
- He was General Secretary (Hqrs) of the Indian Science Congress Association for the year, 1998-2000.
- He was a member of Scientific Panel of University Grants Commission, Indian National Science Academy and panel Referee for Research Projects submitted to Council of Scientific and Industrial Research (CSIR), Department of Science and Technology (DST), and Ph.D. examiner of several Universities. He was also member of several scientific societies/academies.
- Prof. Mukherjee was a Fellow of two Academies of Science in the country. In 1983, he was elected a Fellow of the Indian National Science Academy and in 1985, he was offered the Fellowship of the Academy of Science, Bangalore.



## International Recognition

- Membership of National Sigma Xi Society, 1962.
- Abraham Rosenberg Merit Scholar, USA, 1963.
- Post doctoral Fellow, Max-Planck Institute, Germany from 1964-1965.
- In 1971, he spent three months as a visiting scientist in the Nuclear Research Center, Julich, Germany and conducted research on exogenous DNA incorporation.
- In 1972-1973, he had worked as a post doctoral fellow in the University of Nebraska, Lincoln, USA and worked on mouse mammary gland and hormonal action and gene expression.
- In 1978, he worked as a Visiting Scientist in the Nuclear Research Centre, Julich, Germany and worked on role of phosphopeptides in gene regulation. In this year he was also invited to the 13<sup>th</sup> International Congress of Genetics held at Moscow to present his results.
- In 1980, he spent three months in the University of Texas, Houston USA and worked on cell fusion studies.
- In 1982, he spent two months in the University of North Carolina Chapel Hill, USA and worked on DNA fibre autoradiography and gene expression.

He was also invited to present an account of his researches at cell biology genetic conference at various centres in USA, UK and Germany in 1986, 1990, 1995, 1996, 1998.

## POPULARIZATION OF SCIENCE AND EDITORIAL ACTIVITIES

He along with his collaborator published a book "*Biswabhara Pran*" (The Universe full of life) in Bengali. He also delivered several public lectures in All India Radio, and Doordarshan, Calcutta on Genetic diseases. He also published a "Bengali" book "Aki Paraga a thui ful" (Human cloning).

He has been the Honorary Editor of the Journal Proceedings of the *Zoological Society, Calcutta* for 1988-1997. He was served as a member of Editorial Board of the *Science and Culture, Indian Journal of Experimental Biology* and others for several years.

## CONCLUDING REMARKS

Professor Ardhendu Sekhar Mukherjee, died on November 15, 2004 at his home, Kolkata. He was 69 years old. In his passing away, the community of Zoologists, Geneticists in particular, from both India and abroad have lost a brilliant academician, an outstanding scientist and an excellent teacher.

He is survived by his wife Mrs. Sati Mukherjee, his two sons, Dibyendu and Shubhendu, daughters-in-law, Anindita and Sumana and his grand children





Nishant, Maya, Rianna and Ryone. Those of us who knew him personally were fortunate enough to be directly influenced by him and will continue to honour him for years to come. He lives in the memory of his numerous colleagues friends and former students. The best tribute we could offer to Prof. Mukherjee is by adhering to his principles: continue basic research in genetics using *Drosophila* as a model system. Thus, when every time we push a fly, use a balancer stock or deficiency line, or studying *Drosophila* polytene chromosomes, we remember our teacher, Prof. AS Mukherjee.

### ACKNOWLEDGEMENTS

The help received from Mrs. Sati Mukherjee, Professor IB Chatterjee, Dept. of Biochemistry of the Calcutta University and Dr. Ramesh C Basu, Vice President, Zoological Society, Kolkata in the preparation of this memoir is gratefully acknowledged.

RN CHATTERJEE  
Taraknath Palit Siksha Prangan  
35, Ballygunge Circular Road  
Kolkata - 700 019 (WB)  
Phones: 033-24614959/5445/5277  
Fax: 033-24614849

### BIBLIOGRAPHY

- 1959 Mutagenic effect of quinhydrone on *Drosophila melanogaster* and *D. ananassae* *Dros Inf Serv* **33** 155-156.
- 1961 Effect of selection on crossing over in male of *Drosophila ananassae* *Amer Nat* **95** 57-59.
- 1962 (With STROHMAN A) A preliminary study on the chromatographic behaviour of the heterozygous and homozygous conditions of a mutant and that of wild type *D melanogaster* *Dros Inf Serv* **36** 13.
- Mutations in *Drosophila ananassaue* and their linkage map *Proc First Ind Cong Zool* **1** 1-11.
- 1963 Developmental genetics of the gene "sexcombless" in *Drosophila melanogaster* *Proc XIth Inter Cong Genet The Netherlands* **1** pp 1 Pergamon Press Lond.
- Some cytological information on the mutant sexcombless in *Drosophila melanogaster* *Dros Inf Serv* **38** 62.
- 1964 (With STERN C) Aspects of developmental genetics of the legs of *Drosophila* *Proc Ind Natl Acad Sci* **B34** 19-26.
- 1965 Cytological localization of the white locus in *D hydei* *Dros Inf Serv* **40** 70.
- (With BEERMANN W) Synthesis of ribonucleic acid by the X chromosomes of *Drosophila melanogaster* and the problem of dosage compensation *Nature* **207** 785-786.
- The effects of sexcombless on the forelegs of *Drosophila melanogaster* *Genetics* **51** 285-304.
- 1965 (With STERN C) The effect of sex combless in genetic mosaics in *Drosophila melanogaster* *Vererbungsl* **96** 36-48.



- 1966 Dosage compensation in *Drosophila*: An autoradiographic study *The Nucleus* (Calcutta) **9** 83-96.
- An analysis and interpretation of the prepatter concept and genetic control of differentiation *The Nucleus* (Calcutta) **9** 212-213.
  - The role of heterochromatin in the control of gene activity *Dros Inf Serv* **41** 160-161.
- 1967 (With MITRA N) Effect of the mutant *sexcomless* on the posterior legs of *Drosophila melanogaster* *J Cytol Genet* **2** 103-1113.
- (With DUTTA RK and MITRA N) Genetic control of morphogenetic variation in the sexcombs of *Drosophila melanogaster* *Genetica* **38** 340-354.
  - Influence of *y+* and *scute* alleles in supression of yellow colour in the sex comb of *Drosophila melanogaster* *Dros Inf Serv* **42** 62.
- 1968 Effect of Dicyaniamide on puffing activity and morphology of salivary gland chromosomes of *Drosophila melanogaster* *Ind J Exptl Biol* **6** 49-51.
- (With LAKHOTIA SC and CHATTERJEE SN) On the molecular and chromosomal basis of dosage compensation in *Drosophila* *The Nucleus* (Calcutta) (Suppl) 161-173.
  - New description of the mutant "sexcombless" *Bibliography and Genetics of Drosophila* Oakridge Tenn Eds Lindely and Grell pp 1-2.
- 1969 (With RAI CHAUDHURI A) Certain aspects of genetic physiology of the mutant "fat" in *Drosophila melanogaster*: A preliminary report *The Nucleus* (Calcutta) **12** 75-80.
- (With LAKHOTIA SC) Charomosomal basis of dosage compensation in *Drosophila* I Cellular autonomy of hyperactivity of male X chromosome in salivary glands and sex differentiation *Genet Res* (Camb) **15** 301-307.
- 1970 (With GANGULY R) Effect of larval age and heterologous inversions on induced crossing over in *Drosophila melanogaster* *Indian Biol* **2** 41-49.
- (With DUTTAGUPTA AK, LAKHOTIA SC and CHATTERJEE S) Replication patterns in *Drosophila* polytene chromosomes and molecular basis of dosage compensation In "*Proc Macromolecules in storage and transfer of Biological Information*" Bombay 199-209.
  - (With LAKHOTIA SC) Chromosomal basis of dosage compensation in *Drosophila* III Early completion of replication by the polytene X chromosome in male: Further evidence and its implications *J Cell Biol* **47** 18-33.
  - (With LAKHOTIA SC) Activation of a specific puff by benzamide in *D melanogaster* *Dros Inf Serv* **45** 62.
  - Segregation distortion and crossing over in males of *Drosophila ananassae* *Dros Inf Serv* **45** 108.
  - Developmental changes in puffing pattern in the mutant *ft* in *Drosophila melanogaster* *Dros Inf Ser* **45** 116.
  - Effect of split dose X irradiation on fractional mutational mosaicism in *Drosophila melanogaster* *Dros Inf Serv* **45** 61.
- 1971 (With DUTTA RK) Chaetotaxy of legs and external genitalia in normal and intersexual forms of *Drosophila bipectinata* and *D melanogaster* *Proc Zool Soc* (Calcutta) **24** 81-98.
- (With HILDRETH PE) Interaction of the mutants *sx tra* and *dsx* in *Drosophila melanogaster* chaetotaxy of the basitarsus of the forelegs in males and females *Genetica* **42** 338-352.



- 1971 (With CHATTERJEE SN) Chromosomal basis of dosage compensation in *Drosophila* V Puffwise analysis of gene activity of the X-chromosome of male and female of *D hydei* *Chromosoma* (Berl) **36** 46-59.
- (With DAS AK) Segregation distortion and crossing over in males of *Drosophila ananassae* I Preliminary genetic analysis *Genetics* **67** 521-532.
  - (With DATTA RK) Studies on the effects of the mutant combgap on the legs of *Drosophila melanogaster* *Genetics* **68** 269-286.
- 1972 (With LAKHOTIA SC) Chromosomal basis of dosage compensation in *Drosophila* IV Hyperactivity of the polytene X chromosome in male *Drosophila kikkawai* and *D bipectinata* *Proc Zool Soc (Calcutta)* **25** 1-9.
- (With LAKHOTIA SC) Chromosomal basis of dosage compensation in *Drosophila* VI Transcription and replication in male X chromosome of *D melanogaster* after X-irradiation *The Nucleus* (Calcutta) **15** 189-200.
- 1973 (With DUTTAGUPTA AK and MITRA N) Salivary gland chromosomes of *Drosophila ananassae* I Banding pattern and intercalary heterochromatin *The Nucleus* (Calcutta) **16** 130-146.
- Differential replication of DNA in polytene chromosomes and its relationship to genetic regulation and differentiation *J Sci and Ind Res* **32** 394-398.
  - (With MITRA N) <sup>3</sup>H thymidine labelling patterns in the polytene chromosomes of mitomycin treated *Drosophila melanogaster*: Evidence to continuous type labelling as the beginning of replication *Exptl Cell Res* **76** 47-54.
  - (With CHATTERJEE SN) Chromosomal basis of dosage compensation in *Drosophila* VII DNA replication patterns of the puffs in the male and female larval polytene chromosome *Cell Differentiation* **2** 1-19.
  - (With BANERJEE MR and LOUDON MR) Reverse transcriptase in lactating preneoplastic and neoplastic tissues of mammary-tumor virus (muMTV)-free mouse mammary gland Proc VIII meeting of mammary cancer in Experimental animals and man 73.
  - (With WOOD BG and BANERJEE MR) Reverse transcriptase in muMTV-free mammary tumors and differential normal mammary gland of BALB/c mice *Genetics* **74** ps 187.
  - (With WASHNUR LL and BANERJEE MR) Role of Insulin as a "permissive" hormone in mammary gland development *Nature* **246** 159-160.
- 1974 (With BANERJEE MR) RNA dependent DNA polymerase in preneoplastic nodules and tumors and of the mammary gland of BALB/c mice *J Natl Cancer Inst* **53** 817-824.
- (With MANDAL S, RAHMAN R and NAG A) Effect of X-ray dose rate fractionation and mitomycin treatment on whole body and fractional mutations in the X chromosome of *Drosophila melanogaster* *Dros Infor Serv* **51** 123.
  - A modified super-operon model of regulation in eukaryotes and its implications on regulation of dosage compensation *The Nucleus* (Calcutta) **17** 183-189.
  - (With SHARMA T) Studies on animal chromosome and gene physiology *Annu Rev Zoology* **1** 1-24.
- 1974 (With CHATTERJEE SN and DUTTAGUPTA AK) Lack of differential transcriptional activity in the left and right arms of the X chromosome of *D pseudoobscura* *Dros Inf Serv* **51** 84.



- 1975 (With PRASAD J and DUTTAGUPTA AK) Studies on the puffing activity pattern of the X chromosome of *Drosophila ananassae* with reference to their sexual dimorphism *Proc Dunn Dob Symp Genet* pp 15-20.
- (With CHATTERJEE RN, CHATTERJEE SN, MANDAL SN, NAG A and MAJUMDAR D) A rapid autoradiographic technique for chromosomal squash preparation *Ind J Expt Biol* **13** 261-263.
- (With CHATTERJEE SN) DNA replication in polytene chromosomes of *D pseudoobscura*: New facts and their implication *Ind J Expt Biol* **13** 452-459.
- (With WOOD W, BONNIE G, WASHBURN LINDA L and BANERJEE MR) Hormonal regulation of lobulo-alveolar growth functional differentiation and regression of whole mouse mammary gland in organ culture *J Endocri* **65** 1-6.
- (With CHATTERJEE SN and MUKHERJEE AS) Chromosomal basis of dosage compensation in *Drosophila* VIII Faster replication and hyperactivity of both arms of *Drosophila pseudoobscura* *Chromosoma* (Berl) **53** 91-106.
- (With MAJUMDAR D and CHATTERJEE RN) Effect of  $\alpha$ -amanitin and cordycepin on the RNA synthesis in the polytene chromosomes of *Drosophila melanogaster* *J Cytol Genet Cong Suppl* **Vol** 128-132.
- 1976 (With CHATTERJEE SN) Hyperactivity and faster replicating property of the two arms of the male X of *Drosophila pseudoobscura* *J Microscopy* **106** 199-208.
- (With CHATTERJEE SN and MANDAL SN) Interchromosomal asynchrony of DNA replication in polytene chromosomes of *D pseudoobscura* *Chromosoma* (Berl) **54** 117-125.
- Gene and its functional organization *Everyman's Science* **10** 175-182.
- 1977 (With MANDAL SK and RAHAMAN R) Characterization of fractional mutations in *Drosophila melanogaster*: Effect of fractionation of dose, dose rate of X-ray and Mitomycin C in post meiotic broods *Ind J Exptl Biol* **15** 8-12.
- (With CHATTERJEE SN, CHATTERJEE RN, MAJUMDAR D and NAG A) A replication cytology of *Drosophila* polytene chromosomes *The Nucleus* (Calcutta) **20** 171-177.
- (With CHATTERJEE RN) Chromosomal basis of dosage compensation in *Drosophila* IX Cellular autonomy of the faster replication of the X chromosome in haplo X cells of *D melanogaster* and synchronous initiation *J Cell Biol* **74** 168-180.
- (With CHATTERJEE RN) Inhibition of initiation of DNA replication in *Drosophila* by  $\alpha$ -amanitin and its possible significance *Ind J Exptl Biol* **15** 973-975.
- (With DAS A) Segregation distortion and crossing over in males of *Drosophila ananassae* II Effect of selection of segregation distortion and recombination *Ind Biol* **9** 9-19.
- (With GUPTA R) Characterization of crossing over in males induced by X-irradiation in the pupal stage of *Drosophila melanogaster* *Proc Zool Soc* (Calcutta) **30** 73-82.
- (With CHATTERJEE RN) Application and efficiency of scintillation autoradiography for *Drosophila* polytene chromosomes *Histochemistry* **52** 72-84.
- 1978 (With MANDAL SK) Characterization of fractional mutations in *Drosophila*: differential inhibition of complete and fractional mutations by inhibitors of repair synthesis *Genet Res* (Camb) **32** 19-24.



- 1978 (With CHATTERJEE SN, CHATTERJEE SN and CHATTERJEE C) Effect of puromycin on DNA synthesis in *Drosophila* polytene chromosomes: A probe into the control of replication *Ind J Exptl Biol* **16** 1027-1031.
- (With CHATTERJEE RN, CHATTERJEE C and MAJUMDAR D) Is termination of DNA replication of a chromosomal replication unit guided by its nearest neighbour? *Proc Inter Cong Genet Moscow* **C8** 194.
  - (With MAJUMDAR D) Extra hyperactivity of the X chromosome in spontaneously occurring mosaic salivary glands of *Drosophila* *Cell and Chromosome News letter* **1** 8.
  - (With CHATTERJEE SN) *In vivo* synchronization of DNA replication in salivary gland cells of *Drosophila* *Cell and chromosome News letter* **1** 12-14.
- 1979 (With MANDAL SK) Characterization of fractional mutations in *Drosophila*: Role of RNA, protein and repair synthesis *Ind J Exptl Biol* **17** 1374-1376.
- (With CHATTERJEE SN) *In vivo* synchronization of DNA replication in salivary gland cells of *Drosophila* *Cell and Chrom Newsletter* **2** 14-15.
- 1980 (With CHATTERJEE RN, DERKSEN J and PLOEG MVD) Role of non-histone chromosomal protein in the attainment of hyperactivity of the X chromosome of male *Drosophila*: A quantitative cytochemical study *Ind J Exptl Biol* **18** 574-576.
- (With MAJUMDAR D) Culture of *Drosophila* salivary glands *Dros Inf Serv* **55** 159.
  - (With MAJUMDAR D) Morphogenetic expression of a reversible Bar-inversion of *D. melanogaster* *Dros Inf Serv* **55** 89.
  - (With DUTTAGUPTA AK, CHATTERJEE SN, CHATTERJEE RN, MAJUMDAR D, CHATTERJEE C, GHOSH M, MOHAN ACHARYYA P, DEY A and BANERJEE I) Regulation of DNA replication in *Drosophila* In "*Development and Neurobiology of Drosophila* (Plenum Press NY) 57-83.
- 1981 (With ACHARYYA PMR, MAJUMDAR K and DUTTAGUPTA AK) Replication of DNA in larval salivary gland of *Drosophila* and *in vivo* synchronization *Chromosoma* (Berl) **82** 505-514.
- (With CHATTERJEE RN and DUBE DK) *In situ* transcription analysis of chromatin template activity of the X chromosome of *Drosophila* following high molar NaCl treatment *Chromosoma* (Berl) **82** 515-523.
  - (With CHATTERJEE RN) Chromosomal basis of dosage compensation in *Drosophila* X: Assessment of hyperactivity of the male X *in situ* *J Cell Sci* **47** 295-309.
  - (With PRASAD J and DUTTAGUPTA AK) Transcription in X chromosomal segmental aneuploids of *D melanogaster* and regulation of dosage compensation *Genet Res* (Camb) **38** 103-113.
  - (With CHATTERJEE RN) Effect of  $\alpha$ -amanitin on  $^3\text{H}$ -uridine incorporation of the *Drosophila melanogaster* salivary gland chromosome *Dros Infor Serv* **58** 33-37.
- 1982 (With BOSE D) Transcription pattern in X chromosomal Cis-Tandem duplication of *Drosophila melanogaster* and problem of X chromosomal hyperactivity *Ind J Exp Biol* **20** 623-625.
- Dosage compensation as a model system for genetic regulation in eukaryotes *Current Sci* **51** 205-212.



- 1982 (With GHOSH M and CHATTERJEE RN) Cytochemical characterization of the functional morphology and nucleic acid metabolism of the nucleolar chromatin of giant salivary gland cells of *Drosophila Ind J Exptl Biol* **20** 797-804.
- (With DAS M, MUTSUDDI D and DUTTAGUPTA AK) Segmental heterogeneity in replication and transcription of the X<sub>2</sub> chromosome of *Drosophila miranda* and conservativeness in the evolution of dosage compensation *Chromosoma* (Berl) **87** 373-388.
  - (With BANERJEE S and CHINYA PK) Effect of mytomycin C on polytene chromosome replication of *Drosophila Dros Inf Serv* **58** 19.
- 1983 (With GHOSH M) Regulation of dosage compensation in *Drosophila Proc XV Int Cong Genet Delhi* 104.
- (With GHOSH S) Fluorescence autoradiographic assay of transcriptive activity of benzamide induced puffs 93D in *Drosophila melanogaster Ind J Exptl Bio* **21** 49-53.
- 1984 (With MUTSUDDI M, MUTSUDDI D and DUTTAGUPTA AK) Conserved autonomy of replication of the X chromosome in hybrids of *Drosophila miranda* and *D persimilis Chromosoma* (Berl) **89** 55-62.
- (With BHAKTA RK) Genetics and epigenetics of some sex linked lethals in *Drosophila melanogaster Dros Inf Serv* **60** 60.
  - (With BANERJEE I) Activation of potential initiation sites of DNA replication by puromycin: evidence from fibre autoradiography *Dros Inf Serv* **60** 55.
  - (With GHOSH M) Evolutionary related species and their NCT structures *Dros Inf Serv* **60** 113.
  - (With CHAUDHURI GK) Effect of  $\alpha$ -Methyl-DL-Methionine on the replication of polytene chromosomes in *Drosophila melanogaster Dros Inf Serv* **60** 74.
  - (With UKIL M and CHATTERJEE K) Activation of potential initiation sites of DNA replication and induction of new initiation within *Drosophila* polytene chromosome *J Cell Sci* **65** 95-109.
  - (With UKIL M and CHATTERJEE K) Cytophotometric analysis of in situ binding of non-histone protein to the chromatin in *Drosophila melanogaster Dros Inf Serv* **60** 201.
- 1985 (With PRASAD J and DUTTAGUPTA AK) Cellular autonomy of hyperactivity in segmental X chromosomal aneuploids of *Drosophila* and dosage compensation *Genet Res* (Camb) **46** 19-29.
- (With GHOSH M) DNA replication in the X chromosome of In(1)BM2 (rv mosaic) of *Drosophila melanogaster Dros Infor Serv* **61** 82.
  - (With GHOSH M and BANERJEE S) Activity of the X chromosome of the reinverted mosaic mutant larva of *Drosophila melanogaster* in vitro culture *Dros Inf Serv* **61** 81-82.
- 1986 (With UKIL M, CHATTERJEE K, DEY A and GHOSH S) Affinity binding of non-histone chromatin proteins to the X chromosome of *Drosophila* by in situ chromatin reconstitution and its significance *J Cell Sci* **86** 35-45.
- (With CHATTERJEE C, DEY A, BANERJEE I and CHAUDHURI G) DNA replication in *Drosophila* polytene chromosomes In '*Perspectives in Cytology and Genet*' **5** 43-54.
  - (With GHOSH AK) Catalase activity in trisomy for the whole left arm of third chromosome in *Drosophila melanogaster Dros Inf Ser* **63** 58.
  - Genetics of dosage compensation: An old concept in new perspective Presidential Address Section Zoology Entomology and Fisheries 73<sup>rd</sup> Session Delhi *Proc Indian Sci Cong* 1-38.



- 1986 (With GHOSH M) A different level of X chromosomal transcription in an In (1) BM2 (reverted) strain and its hyperploid derivatives resolves an X coded regulatory activity for dosage compensation in *Drosophila Genet Res (Camb)* **48** 65-75.
- (With GHOSH S) Transcriptive and replicative activity of the X chromosome in an autosomal segmental hyperploid in *Drosophila* and its significance *J Cell Sci* **81** 267-281.
  - (With GHOSH AK) Replication behaviour of trisomy for 2L and 3L arm in *Drosophila melanogaster* *Dros Inf Serv* **63** 59.
  - (With KAR A) Role of cell density and Cell shape in polyethylene Glycol-induced Cell hybridization *Ind J Exptl Biol* **26** 551-554.
  - (With GHOSH M) Nucleolar chromatin thread (NCT) in different mutant strain of *Drosophila melanogaster* *Dros Inf Serv* **63** 63.
  - (With GHOSH M) Nucleolar chromatin thread (NCT) in different mutant strain of *Drosophila hydei* *Dros Inf Serv* **63** 62.
  - Genetic load and human evolution on "Man and his culture - A resurgence" (Eds: P Bellwood, A Dutta, PG Chatterjee and AK Sen) Publisher Books, New Delhi 1-9.
- 1987 (With BANERJEE and BANERJEE SK) Separation of two population of nascent replicons in polytene chromosomes in *Drosophila hydei* by agarose gel electrophoresis *Dros Inf Serv* **66** 17.
- (With GHOSH S) Transcriptional and enzymetic analysis of segmental aneuploids of *Drosophila melanogaster* involving the proximal region of X chromosome *Dros Inf Serv* **66** 64.
  - (With GHOSH AK) Effect of trisomy for 3L on the expression of 87A and 87C heat shock loci in heat shocked trisomy for 3L *Dros Inf Serv* **66** 62.
  - (With GHOSH AK) Lack of dosage compensation phenomenon in haplo -4 chromosome in *Drosophila melanogaster* *Dros Inf Serv* **66** 63.
  - (With GHOSH M) Effect of salivary gland extract on the X chromosome of salivary gland nuclei of *Drosophila melanogaster* under in vitro culture condition *Dros Inf Serv* **66** 63.
- 1988 (With GHOSH S) Benzamide induced activity patterns of 93D and other puff sites in *Drosophila melanogaster* with low and high salt *Ind J Exptl Biol* **26** 258-267.
- (With BANERJEE SK and BANERJEE S) Silver nitrate stained non-ribosomal cistrons in *Drosophila hydei* polytene chromosome *Dros Inf Serv* **67** 10.
- 1989 (With BANERJEE SK, BANERJEE I, CAHUDHURI G, BANERJEE S and GHOSH P) Replication of eukaryotic genome: Different levels of regulation of DNA replication in *Drosophila* *Proc Zool Soc (Calcutta)* **40** 1-11.
- (With GHOSH AK and GHOSH M) Autosomal dosage compensation in interspecific hybrids of *Drosophila*: transcriptional activity in diploid and triploid hybrids *Current Science* **58** 907-911.
  - (With GHOSH M) Protein mediated control of male X-hyperactivity and the modulator concept for dosage compensation in *Drosophila* *Proc Zool Soc (Calcutta)* **42** 13-19.
  - (With GHOSH M) Organization of the nucleolar chromatin I Relation to altered activity state under different conditions of chemical treatment in *Drosophila hydei* *Cell and Chromosome Res* **12** 77-92.



- 1990 (With WELSH RS, VYSKA, K DOHMEN W, MIELKE T and CHAKRAVORTY R) Functional aspect of a phosphopeptide derived from a calf thymus nuclei and DNA *Ind J Exptl Biol* **29** 301-307.
- (With GHOSH AK) Expression of 87A, 87C and 93D heat shock puffs in trisomic (2L and 3L) strains of *D melanogaster*: Evidence for a functional relation between 93D and 87C *Chromosoma (Berl)* **99** 71-75.
- 1991 (With MAL A) The pattern of protein synthesis in the presence of puromycin in *D melanogaster* *Dros Inf Serv* **70** 136.
- (With GHOSH M) Induction of hyperactivity in Oregon R<sup>+</sup> males X chromosome by haemolymph proteins from in (1) BM2 [rv] male *Dros Inf Serv* **70** 76.
- (With MUTSUDDI M) On the female determining factors on the X chromosome of *D melanogaster* *Dros Inf Serv* **70** 153.
- (With MUTSUDDI M) Specificity of the interruption of X chromosome in determining male or female level activity vis-à-vis level of compaction in *Drosophila* *Dros Inf Serv* **70** 156.
- 1992 (With GHOSH AK) Replicative activity of X chromosome and autosomes of *Drosophila melanogaster* in autosomal hyperploids and problem of dosage compensation *Ind J Exptl Biol* **30** 557-566.
- (With KUNDU JK, ROY GC, MUKHERJEE C, *nee* GHOSH S, SUSHMITA M and PAL TK) Comparison of HMG proteins in *Drosophila* silkworm and mammal under steady state and heat shock response and chromatin template activity *Pers Cytol Genet* **7** 227-239.
- (With KANDU JK) Evidence for the existence of HMG-like proteins in *Drosophila melanogaster* and functional implications through in situ transcription assay *Dros Inf Serv* **71** 217.
- 1995 (With GHOSH S and BASU S) Regulation of sex determination and dosage compensation in *Drosophila* operates through interaction of several genetic elements forming temporally separated cascades *Proc Zool Soc (Calcutta)* **47** 141-159.
- (With SUR R, BASU S and GHOSH S) Epigenetic interaction between *Scutoid (Sco)* and *Tufted (Tft)* of *Drosophila melanogaster* *Dros Inf Serv* **76** 152-153.
- 1996 (With GHOSH P) Induction of a new round of DNA replication in some major heat shock puffs in the 3R arm of polytene chromosomes of *Drosophila melanogaster* at 37° C *Dros Inf Serv* **77** 139-141.
- 1997 (With BASU S) Sex determination and dosage compensation in *Drosophila*: Essential components of the hierarchy *Ind J Exptl Biol* **35** 203-21.
- 1998 Dosage compensation in *Drosophila*: A pragmatic sequel of hierarchies of segmentation, neurogenesis and sex determination *PINSA* **B64** 101-124.

