



We Offer our tribute to
Rabindranath Tagore on the occasion of his
150th Birth Anniversary year 2010-11.



Rabindranath Tagore and
Jagadish Chandra Bose
were soul mates in their entire lives

ANNUAL REPORT

2009-2010

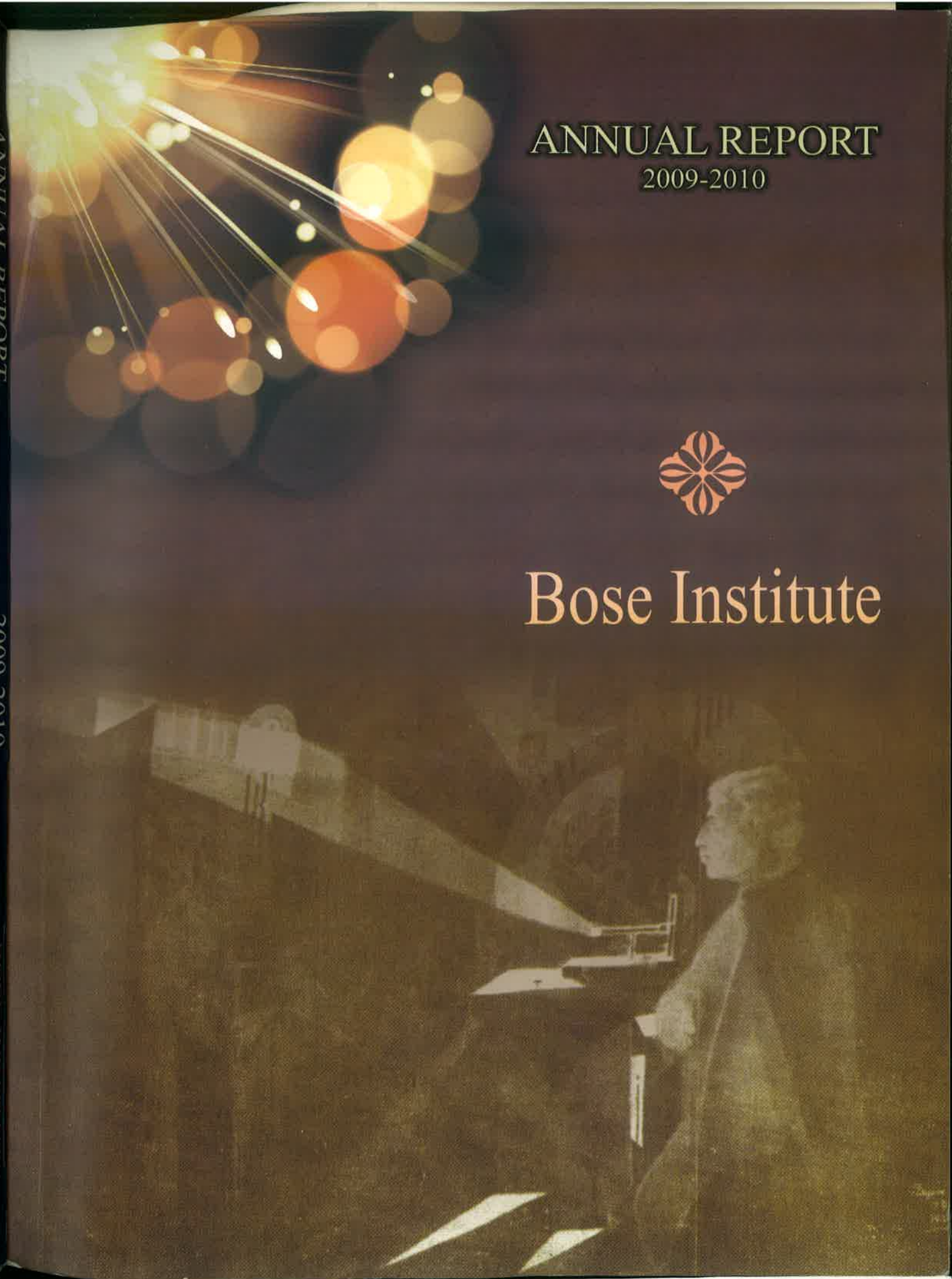
BOSE INSTITUTE

ANNUAL REPORT

2009-2010



Bose Institute



Compiled and edited by the Publication and Annual Report Committee
consisting of the following members :

Prof. Dipankar Home – *Chairman*
Prof. Gautam Basu – *Convener*
Dr. Pradip Parrack – *Member*
Dr. Debabrata Basu – *Member*

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Cover Picture :
THE REVEALER : The invisible waxing and waning of the life revealed by the moving
trail of light by the courtesy of the artist, Ganendranath Tagore.

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Silaidaha Group : (Seating from left) Jagadis Chandra, Lokendranath Palit, Rabindranath
(Standing from left) Rathindranath, Mahimchandra, Surendranath

From the Director's Desk



It gives me great pleasure to present, to all the readers, the annual report of Bose Institute for the year 2009-2010. For an institute supported by public funds, this is an important document testifying our accountability to the nation.

The report has been prepared by the publication committee of Bose Institute, chaired by Prof. Dipankar Home, with Prof. Gautam Basu, Dr. Pradeep Parrack, Dr. Debabrata Basu and Shri Tarun K. Maji as members. All members of the faculty and other staff members of Bose Institute have helped them generously; my gratitude to all of them. The philosophy adopted in preparing this volume has been to present a readable bird's-eye view of the activities of Bose Institute. Technical details, which may be of interest to expert peers, have not been stressed upon; interested readers are invited to look at the scientific/technical reports available online at the institute's website.

We are greatly indebted to the members of our Governing Council, the Governing Body of the Bose Institute Society, the members of the Finance Committee and other statutory committees for their help and guidance. A special word of our appreciation for the members of our Scientific Advisory Committee and Research Area Panels is in order for their great interest and expert advice/suggestions and encouragement; without their help, we would not be able to achieve whatever we have.

Lastly, I would like to put on record our gratitude to the Department of Science & Technology, Government of India for their substantial support to the Institute.


Sibaji Raha
Director

A HOMAGE TO RABINDRANATH TAGORE

“It is more than a third of a century that the poet Tagore and I have been drawn together in closest bonds of sympathy. His friendship has been unailing through years of my ceaseless efforts during which I gained step by step a wider and more sympathetic view of continuity of life and its diverse manifestations. It was in following this quest that I succeeded in making the dumb plant the most eloquent chronicler of its inner life and experiences by making it write down its own history. The self-made records, thus made, prove that there is no life-reaction in even the highest animal which has not been foreshadowed in the life of the plant. The barrier which seemed to separate kindred phenomena was found to have vanished, the plant and the animal appearing as a multi form unity in a single ocean of being. In this vision of truth the final mystery of thing will by no means be lessened, but greatly deepened. It is no less a miracle that man, circumscribed on all sides by the imperfection of his senses, should yet build himself a raft of thought to make daring adventures in uncharted seas. And in his voyage of discovery he catches an occasional glimpse of the ineffable wonder that was hidden from his view. That vision crushes out of him all self-sufficiency, all that kept him unconscious of the great pulse that beats through the universe.”

Acharya J C Bose



Introduction

THE BOSE INSTITUTE

Established: 30th November, 1917

The Bose Institute was founded by Acharya Sir Jagadis Chandra Bose in 1917 for the advancement of science and dissemination of knowledge. The Institute has served the nation for the past 93 years through its pursuit of advancement of knowledge in science and technology and by developing highly competent and able scientific manpower for the country. The Institute has on its staff highly qualified and experienced scientists devoted to original and path breaking research in the fields of Plant Sciences, Structural Biology, Molecular Biology, Biomedical Sciences, Biotechnology, Quantum Mechanics, Astrophysics and Condensed Matter Physics. Bose Institute started with three original departments, Botany, Chemistry and Physics. With time more departments were added the Animal Physiology Section (1930), Department of Microbiology (1942), Department of Biochemistry (1974), the Plant Tissue Culture Section (1976, subsequently renamed Plant Molecular & Cellular Genetics Section in 1989), Department of Biophysics (1985), the Environmental Science Section (1992) and the Immunotechnology Section (1992). Very recently, a division of Molecular Medicine has been established, absorbing the sections of Animal Physiology and Immunotechnology, along with the induction of a few scientists from the Departments of Chemistry and Microbiology. The Department of Botany and the plant Molecular & Cellular Genetics Section have been merged into a Division of Plant Biology. In addition, the Institute hosts support and service centres like the Central



Instruments Facility (CIF), the Distributed Information Centre (DIC), Library, Workshop, J.C. Bose Centre (comprising the Museum and the Publication sections). The wide-ranging and comprehensive base of available scientific infrastructure at Bose Institute also comprises the Acharya J.C. Bose High Altitude Research Centre at Darjeeling and the experimental field stations at Falta, Madhyamgram and Shyamnagar. Recent augmentations include the establishment of a National Facility on Proteomics and Genomics, a National Facility on Astroparticle Physics and Space Sciences, a Centre of Excellence in Bioinformatics, a Rural Biotechnology Training Centre at Falta and the J.C. Bose Biotechnology Innovation Centre based at the Madhyamgram campus. The facilities available in the institute for scientific enquiry and its applications also regularly cater to the scientists from several universities and research centres in the country. Special efforts have been undertaken to upgrade and modernize the library of Bose Institute during the recent years.

The eminence of Bose Institute scientific research spanning a wide range of disciplines is evident from the large number of research publications in the most competitive peer reviewed international and national journals, the recognition received by the scientists in the form of S.S. Bhatnagar Prize, INSA young scientist award, fellowship of the National Science Academies, fellowship of the Third World Academy of Science, Nehru Fellowship, K.S. Krishnan Fellowship, Rockefeller Foundation fellowship and Homi Bhabha fellowship. The institute has over the years provided yeoman service in manpower development, having trained a large number of Ph.D. students many of whom are now reputed experts in their fields in India and abroad; on an average, 30-40 scholars are awarded Ph.D. degree every year. Over the past decade, scientists of Bose Institute have maintained an enviable record of publication in peer reviewed journals. A number of its scientists and research scholars participate every year in numerous academic activities (seminars, conferences, workshops) in India and abroad as invited speakers, chairpersons and resource persons.

A large number of extramural research projects, with support from various government agencies as well as international funding agencies, are carried out at Bose Institute.

Research Activities

At the time of founding Bose Institute, the illustrious founder, Sir J. C. Bose had unequivocally declared that the objective of Bose Institute would be to practice seamless science, without compartmentalisation on the basis of specialisation. Bose Institute strives to achieve this ideal, encouraging inter-disciplinary research to the fullest. Broadly, the current research activities of our scientists cover the following areas:

Institutional 11th Plan (2007 - 2012)

I. Improvement of Plants: Biotechnological, Genomic and Proteomic Approaches:

Focus of this Institutional programme is to identify the components responsible for desirable phenotypes and to characterize them extensively through cellular, molecular, genomic and proteomic approaches for their further expression in target plants for quality improvement.

II. Protein Structure, Function and Engineering :

Resolution of Protein structure is the key criterion to determine the functional organization of a protein. Study on the structure-function relation coupled with expression analyses have been undertaken to design therapeutically and other economically important protein molecules.

III. Bioinformatics and Computational Biology :

The Bioinformatics Centre was started in 1988 as one of the nine nodal centres under the programme, Biotechnology Information System (BTIS) of the Department of Biotechnology, Government of India, with genetic engineering and molecular modelling as the two major thrust areas. Since then the centre is functioning as a repertoire of information related to bioinformatics and its dissemination in Eastern India. It provides computational facilities to carry out research in genome analysis, molecular modelling, plant genomics and proteomics, biomolecular structure determination (through NMR and X-ray crystallography), protein structure analysis, protein-protein interaction, docking and molecular recognition, protein folding and threading etc. The Bioinformatics Centre has the distinction of being designated as Centre of Excellence of the Department of Biotechnology, Government of India.

IV. Molecular Medicine :

Participants have taken initiatives in identifying and characterizing the active principles of biomolecules useful in pathophysiology. Development of novel peptides/ bio-molecules is also another target.

V. Microbial Genomics and Infection Biology :

Genomic approaches have been taken to study the basic biology of microbes leading to useful insights into the mechanisms of their growth, proliferation and cell-cycle regulation. Molecular mechanisms underlying the processes by which some of these microbes cause infectious diseases are being elucidated. Identification of microorganisms with a potential for bioremediation is also under study.

VI. Development of Systems Biology :

Scientists have taken system level approaches combining mathematical modelling with cell biological experiments to dissect the functional organization of various genes, proteins and transcription factors in relation to development of cancer, tuberculosis and other diseases; and the biology of pathogens.

VII. Basic and Applied Problems in Physical and Environmental Sciences :

The Department of Physics contributes both to fundamental knowledge as well as applications relevant to industry and society in general. The Department's current research activities are in the areas of Radiation Physics; Statistical Mechanics; Foundations of Quantum Mechanics and Quantum Entanglement; Astrophysics of Strongly Interacting Matter;

Characterization of Detector Materials for Heavy Ions; Preparation and Characterization of Dielectric Materials, Condensed Matter Physics, Nuclear and High Energy Physics, Astroparticle Physics and Cosmology. Recently, intense activities have also been initiated in Millimeter Wave and Microwaves as well as atmospheric sciences.

In other experimental stations attempts are being put forward to translate the knowledge acquired at plant molecular biological laboratories to the field.

Manpower Development, Academic

Bose Institute has recently started a new chapter in the realm of manpower development. In collaboration with the University of Calcutta, an integrated M.Sc.-Ph.D. course in Plant Molecular Biology & Biotechnology has been initiated in September 2007. Also in September 2007, a four semester M.Sc. course in Physics, with specialisation in Astrophysics & Space Sciences has been started in collaboration with St. Xavier's College, Kolkata.

Science and Society

In addition, a Rural Biotechnology Centre has been developed to provide the knowhow of basic biotechnology to the rural people to improve the socioeconomic status. Although the beginning is modest, the response of the local people, the primary beneficiaries of the project, has been one of tremendous enthusiasm and efforts are now on not only to sustain it but also to substantially expand its scope.

Management of the Institute

The Bose Institute is a grant-in-aid autonomous institution under the Department of Science and Technology (DST), Ministry of Science & Technology, Government of India. It has a Governing Body consisting of twelve members including the Director. The management of the Institute is vested in the Bose Institute Council. The Institute also has a Finance Committee responsible for the financial policies and management.

Members of the Governing Body

1. Prof. Debi Chakravarti
2. Prof. S.N. Chatterjee
3. Shri Somnath Sanyal
4. Prof. D. Banerjee
5. Dr. Anutosh Chatterjee
6. Dr. Manish Sekhar Chakraborty
7. Mr. D. Mandal
8. Shri Dilip Bhattacharyya
9. Prof. Parul Chakrabarti
10. Prof. Bikash Sinha
11. Vacant (*vice* Shri Debabrata Bose expired on 23-08-2007)
12. Director, Bose Institute – Secretary

Members of the Council

1. Secretary, Department of Science & Technology, Government of India or his nominee
2. Director General, C.S.I.R. or his nominee (upto 09-11-2009)
3. Joint Secretary and Financial Adviser, Department of Science and Technology, Govt. of India or his nominee
4. A Representative of the Lok Sabha
5. Principal Accountant General (A & E), West Bengal
6. Secretary, Higher Education, Nominee of the Govt. of West Bengal
7. Municipal Commissioner, Representative of the Calcutta Municipal Corporation
8. Director, Bose Institute – Ex-officio
9. Prof. S. S. Hasan, DTS nominated Scientist from outside West Bengal
10. Prof. M. Udaykumar, DTS nominated Scientist from outside West Bengal
11. Dr. Manish Sekhar Chakraborty (upto 09-11-2009) Nominee of the Governing Body
12. Shri D. Mandal (upto 09-11-2009), Nominee of the Governing Body
13. Prof. (Mrs.) Debi Chakravarti (upto 09-11-2009), Nominee of the Governing Body
14. Shri Somnath Sanyal (upto 09-11-2009), Nominee of the Governing Body



Bose Institute :
Darjeeling campus

15. Shri Dilip Bhattacharyya (upto 09-11-2009), *Nominee of the Governing Body*
16. Prof. S.N. Chatterjee, *Nominee of the Governing Body*
17. Prof. Bikash Sinha, *Nominee of the Governing Body*
18. Registrar, Bose Institute – Secretary

Members of the Finance Committee

1. Principal Secretary, Higher Education Department, Govt. of W.B.
2. Shri D. Mandal, Representative of the Governing Body (upto 09-11-2009)
3. Shri Somnath Sanyal, Representative of the Governing Body (w.e.f 09-11-2009)
4. Financial Adviser to the Department of Science and Technology, Govt. of India or his nominee
5. Principal Accountant General (A & E), West Bengal
5. Director, Bose Institute
7. Registrar, Bose Institute – Secretary.

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Bose Institute
Centenary Campus

Institutional Projects for the 11th Five-year Plan (2007-2012)

I. Improvement of Plants: Biotechnological, Genomic and Proteomic Approaches:

Dr. S. Das [(PMCG) Coordinator],
Dr. Sabita Bhattacharya (Botany),
Dr. Gaurab Gangopadhyay (Botany),
Dr. S. Gupta Bhattacharya (Botany),
Dr. Amita Pal (PMCG),
Dr. P. K. Saha (Botany),
Dr. D. N. Sengupta (Botany),

Dr. D. Basu (Botany),
Dr. S. Chaudhuri (PMCG),
Dr. T. K. Ghose (Botany),
Dr. P. Kundu (PMCG),
Dr. A. N. Lahiri Majumder (PMCG),
Dr. S. Sen-Mandi (Botany),
Dr. S. R. Sikdar (PMCG).

II. Protein Structure, Function and Engineering :

Dr. K. P. Das [Chemistry (Coordinator)],
Dr. J. Basu (Chemistry),
Dr. P. Chakrabarti (Biochemistry),
Dr. M. Kundu (Chemistry),
Dr. P. Parrack (Biochemistry),
Dr. P. C. Sen (Molecular Medicine),

Dr. G. Basu (Biophysics),
Dr. B. Bhattacharyya (Biochemistry),
Dr. R. Chattopadhyay (Biochemistry),
Dr. J. Mukhopadhyay (Chemistry),
Dr. S. Sau (Biochemistry),
Dr. P. C. Sil (Molecular Medicine).

III. Bioinformatics and Computational Biology :

Dr. P. Chakrabarti [Biochemistry (Coordinator)],
Dr. R. Chattopadhyay (Biochemistry),
Dr. T. C. Ghosh (Bioinformatics Centre),

Dr. G. Basu (Biophysics),
Dr. Tapan K. Dutta (Microbiology),
Dr. Debjani Roy (Bioinformatics Centre).

IV. Molecular Medicine :

Dr. P. C. Sen [Molecular Medicine (Coordinator)],
Dr. S. Majumder (Microbiology),
Dr. A. K. Ray (Molecular Medicine),
Dr. P. C. Sil (Molecular Medicine).

Dr. Tanya Das (Molecular Medicine),
Dr. N. N. Mandal (Molecular Medicine),
Dr. Gaurisankar Sa (Molecular Medicine),

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V. Microbial Genomics and Infection Biology :

Dr. P. Sinha [Biochemistry (Coordinator)],
Dr. Tanya Das (Molecular Medicine),
Dr. Sujoy Das Gupta (Microbiology),
Dr. M. Kundu (Chemistry),
Dr. P. Parrack (Biochemistry),
Dr. S. Sau (Biochemistry).

Dr. J. Basu (Chemistry),
Dr. Wriddhiman Ghosh (Microbiology),
Dr. Tapan Dutta (Microbiology),
Dr. A. Lohia (Biochemistry),
Dr. Subrata Majumder (Microbiology),

VI. Development of Systems Biology :

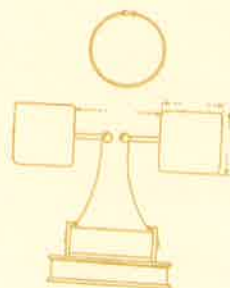
Dr. J. Basu [Chemistry (Coordinator)],
Dr. Indrani Bose (Physics),
Dr. Tanya Das (Molecular Medicine),
Dr. M. Kundu (Chemistry),
Dr. J. Mukhopadhyay (Chemistry),
Dr. Gaurisankar Sa (Molecular Medicine),

Dr. S. Banik (Chemistry),
Dr. B. K. Chatterjee (Physics),
Dr. T. K. Ghose (Botany),
Dr. A. Lohia (Biochemistry),
Dr. A. K. Ray (Molecular Medicine),
Dr. Pratima Sinha (Biochemistry).

VII. Basic and Applied Problems in Physical and Environmental Sciences :

Dr. D. Home [Physics & CAPSS (Coordinator)],
Dr. Manas Chakrabarty (Chemistry),
Dr. B. K. Chatterjee (Physics),
Dr. Sanjay K. Ghosh (Physics & CAPSS),
Dr. Amitabha Mitra (Physics & CAPSS),
Dr. Rajarshi Ray (Physics & CAPSS),
Dr. A. Singha (Physics),

Dr. Indrani Bose (Physics),
Dr. S. S. Bandopadhyay (Physics & CAPSS),
Dr. Pradip Das (Chemistry),
Dr. Dhruba Gupta (Physics & CAPSS),
Dr. S. Raha (Physics & CAPSS),
Dr. S. K. Saha (Physics & CAPSS),
Dr. T. P. Sinha (Physics).



Scientific Reports

Improvement of Plants: Biotechnological, Genomic and Proteomic Approaches :

Validation and functional characterization of *Sinapis alba* genes induced by *Alternaria brassicicola* : Dr. Debabrata Basu

The validation of the *Sinapis alba* (resistant) genes induced on infection with *Alternaria brassicicola* has been already achieved through Reverse Northern analysis and Real time PCR. Additionally, differential screening of *A. brassicicola* infected cDNA library was done not only for the revalidation of the genes identified earlier by cDNA AFLP but this also provided us with the full length gene information on a number of promising genes which have homology to known as well as not fully characterized *Arabidopsis* homologues.

Functional analyses of one promising gene, Auxin responsive protein were carried out by overexpression study in *B. juncea* background. Interestingly, the transgenic plants show altered phenotype as well as expression pattern of not only the transgenes but other defense related genes.

Micropropagation of transformed *Plumbago indica* and optimization of plumbagin production from transformed roots : Dr. Sabita Bhattacharya

Transformed *Plumbago indica* (rolB of *Agrobacterium rhizogenes* ATCC 15834) clone (Tf clone) was micropropagated in hormone-free MS medium at high frequency. Root mass obtained from Tf P.indica is significantly higher in comparison to that produced by non-transformed clones.

Plumbagin content of P. indica hairy roots increases while culturing in vitro (without growth hormone) in presence of elicitors. Effect of Methyl Jasmonate was best in this regard. MJ also caused leaching of the compound in culture medium (identified visibly by the compound's characteristic yellow colour) which was confirmed by HPLC.

Epigenetic regulations during plants response to different environmental or developmental stimuli : Dr. Shubho Chaudhuri

Plants constantly modify their physiological processes in response to developmental and environmental cues. The reprogramming of cell differentiation in response to stimuli requires alteration of gene expressions, post-transcriptional and/or translational modifications of factors. In eukaryotes, accessibility of DNA to transcription machinery is affected by the degree of

DNA packaging into chromatin structure. The central question therefore is to understand how gene expression is precisely regulated to give rise to the correct response during a process. The focus of the lab is to understand the change in chromatin dynamics in plant in response to different environmental or developmental cues.

Identification and expression of insect/pathogen resistant genes in plants : Dr. Sampa Das

Antibiotic resistant marker gene free insect resistant transgenic rice lines were successfully established using Cre-lox mediated recombination strategy through the expression of *Allium sativum* leaf lectin.

A series of mutants of Cry1Ac were generated and their interactions with the previously identified membrane bound alkaline phosphatase receptor of *Helicoverpa armigera* are being investigated to unravel the toxin-receptor binding specificity at molecular level.

Functional genomic analysis for understanding defense mechanism of chickpea against wilt causing *Fusarium oxysporum* detected significant differences in early sensing of pathogen, delayed pathogen establishment, lower HR intensity and compensation for the pathogen-induced damage through generation of host primary metabolic signals in incompatible resistant hosts compared to susceptible chickpea lines.

Improvement of cultivated sesame varieties : Dr. Gaurab Gangopadhyay

Since sesame (*Sesamum indicum* L.) breeding techniques vary greatly and have evolved from simple plant selection to hybrid cultivar development, revitalization of sesame-breeding methods assisted by Marker Assisted Selection (MAS) could be of great value in breeding superior varieties. As a pre requisite of MAS, characterization of the available sesame genotypes based on qualitative and quantitative traits following descriptor lists of Sesame by IBPGR / IPGRI are underway. Statistical analysis has already provided lead to understand the association between certain traits, which in the long run will assist in tagging of genes/QTL for traits through marker-trait association.

Genetic Diversity Analysis of Rice Landraces of West Bengal : Dr. T. K. Ghose

Over 250 varieties of rice landraces were collected from various parts of West Bengal and a few North Eastern States of India, and abroad. They were raised in the field as an effort of conservation. Out of those 250, 125 genotypes were selected for detailed analysis. Their grain and kernel morphological traits were estimated along with aroma, cooked kernel elongation, alkali spreading value (ASV) and amylose content. DNA fingerprinting of the 125 genotypes using 23 SSR primers and 3 pairs of RGA primers have already been done. Statistical analysis of the available morphological and biochemical data are complete. Dendrograms showing genetic relationship amongst the genotypes have been obtained from the similarity matrix of the SSR DNA fingerprints. 34 pairs of primers were designed from publicly available

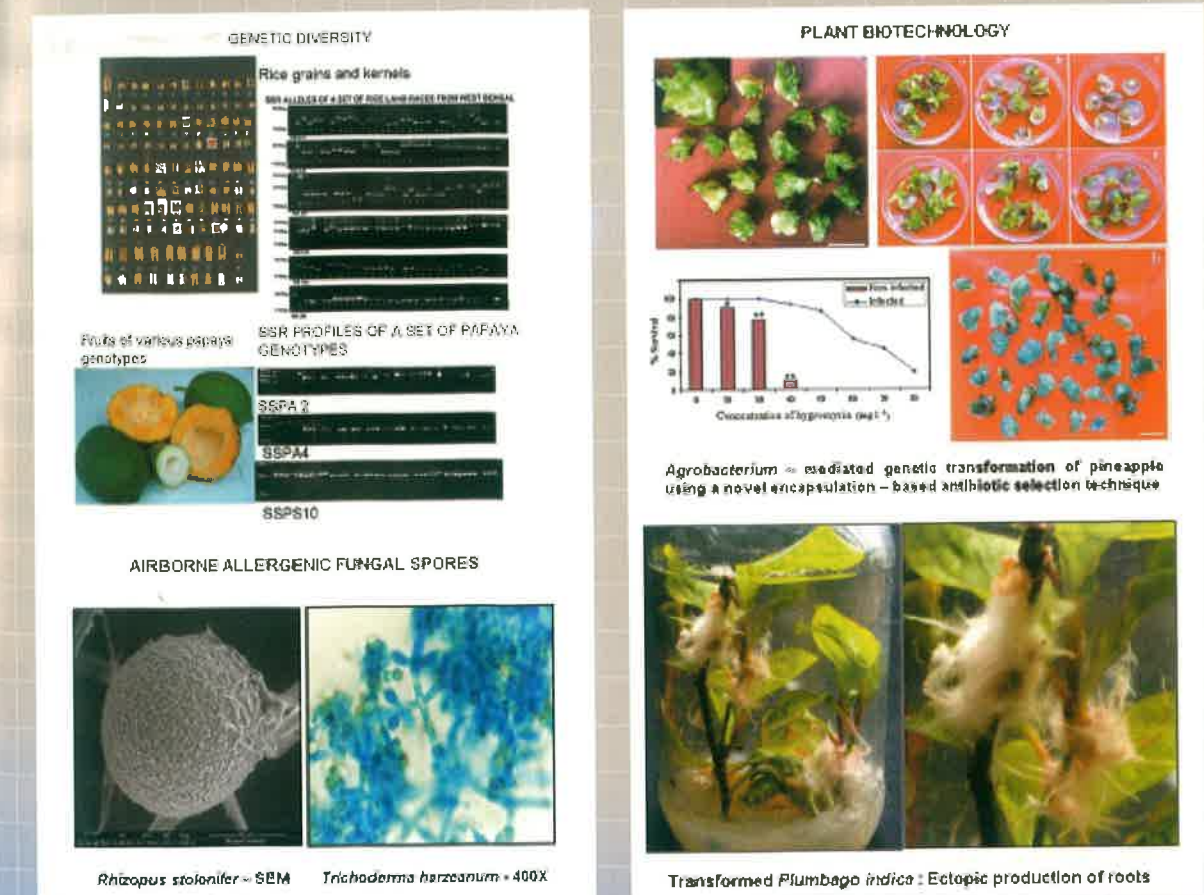
sequences of rice bacterial blight resistance genes using the software BatchPrimer3. Screening of the collection using those designed primers is in progress and sequencing of polymorphic bands is soon to follow.

Genetic Diversity Analysis of *Carica papaya* : Dr. T. K. Ghose in collaboration with Dr. P. Acharya, CU

In collaboration with University of Calcutta studies on genetic diversity of papaya have been initiated. Forty different varieties of papaya were collected from India and abroad. They were raised in poly bags, transplanted to the Madhyamgram farm as an effort of conservation. Appropriate field data have been recorded. Twenty papaya microsatellite primers have been used as a primary screen towards DNA fingerprinting of the papaya genotypes and the DNA profiles are being analysed. PCR profiles have also been generated using three resistance gene analogue primer pairs. This will be followed by sequencing of polymorphic bands.

DNA Fingerprinting of *Curcuma longa* : Dr. T. K. Ghose

Forty one different genotypes of *Curcuma longa* were collected from BCKV. A total of 12539 EST sequences of *Curcuma longa* were downloaded from publicly available database and analyzed using web-based bioinformatics tools including Blastn, ClustalW, GeneSplicer



and EGassembler. These were then processed and assembled into 3039 contigs using an online bioinformatics service. The contigs were mined for simple sequence repeats (SSR). A total of 50 primer pairs for DNA sequences containing simple sequence repeats were designed from these contigs using web-based primer design program BatchPrimer3. From these 10 microsatellite markers are being used to analyse genetic diversity of the curcuma collection.

Studies on airborne allergenic pollen grains and spores: Biochemical, clinical and molecular approach : Dr. Swati Gupta Bhattacharya

Total viable and non viable airborne fungal spore types in the air of a suburban agricultural field and central Kolkata have been monitored throughout the year. Detail studies performed with *Rhizopus stolonifer* and *Trichoderma herzeanum*, which are dominant types of fungal spores in the studied area are found to be highly allergenic too. IgE specific Immunoblotting of *R. stolonifer* showed one allergenic protein band of 45.5kDa. Impact of aeroallergens on general people and hospitalization of respiratory allergic patients in Kolkata has been studied in detail. Purification and characterization of the allergenic proteins from *R. stolonifer* is in progress.

Transcriptional and post transcriptional regulation of gene expression during plant and pathogen interaction : Dr. Pallob Kundu

During biotic and/or abiotic stress in plants a series of signaling cascade, including different hormone signalling pathways are activated. These pathways must converge to different transcription factors that can regulate expression of defense related genes. Using molecular biological and transcriptome analysis tools the role of these transcription factors in signalling crosstalk during biotic and abiotic stress responses will be studied. Reprogramming of gene expression cascade adds robustness and specificity towards the stress response. Accumulating evidences revealed that microRNA (miRNA)-mediated posttranscriptional regulation plays a crucial role in this process. However, very little is known about how the stress signal is transmitted for the functioning of the regulator (miRNA). Investigations on the mechanism of induction of miRNA gene expression after pathogen (fungal and viral) infection are in progress.

Inositol metabolism in relation to plant abiotic stress : Dr. A. N. Lahiri Majumder

An extension of inositol metabolism towards galactinol synthesis through the Galactinol synthase (GOLS) following abiotic stress has been probed in the wild rice, *Porteresia coarctata*. Two GOLS genes corresponding to the *Oryza* homologues have been cloned and characterized in *Porteresia*. Similar extension to methylated inositol (e.g. pinitol) has been completely worked out in this system. Abnormalities in the cell division induced by salt stress in *Allium cepa* root tip cells have been found to be ameliorated by pretreatment by inositol suggesting a definite role of the cyclitol in regulation of cell division cycle during stress.

Identification of MYMIV-resistance genes/proteins in *Vigna mungo* : Dr. Amita Pal in collaboration with Dr. K. P. Das, Chemistry

Two MYMIV-resistance loci were introgressed in a high yielding susceptible *V. mungo* cultivar through marker assisted breeding; recombinant inbred lines (RILs) were selected, agro-morphological traits were analyzed and marker based genotyping of these RILs have been performed.

A forward subtracted cDNA library was constructed using SSH, differentially expressed ESTs were isolated, sequenced and annotated in MYMIV- tolerant VM1 line after challenging with the virus. Differentially expressed leaf proteins between control and MYMIV-challenged plants of *V. mungo* were identified through 2-D gel electrophoresis followed by MALDI-TOF-based mass analysis. Four functional categories of differential ESTs/proteins were identified, viz. energy/metabolism, stress/defense, signal transduction and photosynthesis related.

Resource survey analysis of gene pool with reference to seeds : Dr. Prabir Kumar Saha

Sesame (*Sesamum* sp.) of the family Pedaliaceae is an important oil crop in tropical and subtropical areas. To clarify genetic relationships among 71 sesame accessions (63 Indian Accessions of *Sesamum indicum* L. along with three accessions of *Sesamum mulayanum* L., collected from the Germplasm Bank of NBPGR, New Delhi and five local cultivars from West Bengal, India). The degrees of phenotypic diversity present among them were assessed. Micro (by scanning electron microscopy) and macro morphological characteristics of those germplasms revealed in terms of the parameters considered e.g. - testa colour, testa thickness, surface ornamentations, mean value of seed weight, length and breadth. Preliminary screening based on the similarity coefficient using cluster analysis method, accessions showed five major groups. When agro-morphological characters were considered, three major groups were observed. Combination of both the characters (seed and agro-morphological) when subjected to cluster analysis resulted in four major groups. The accessions were further separated in sub-clusters which showed distinct diversity among them.

Regulation of Gene Expression in Rice Cultivars as affected by Salinity stress and During Fruit Ripening in Tomato, Banana, and Mango : Dr. D. N. Sengupta

Expression of genes like HKT-1, SOS3, Nhx-1, SAPK5, SAPK7, Nac1, Rab16A, OSBZ8, etc, in leaves (lamina) of rice plants (salt sensitive and salt tolerant) treated with salinity stress was compared and found to be more or less same. The upstream of OSBZ8 and SamDC gene were cloned and sequenced. Different cis-acting elements like light box, ABRE, dehydration responsive elements etc were detected. We are trying to find out the role of OSBZ8, a transcription factor that binds to ABRE, on the regulation of expression of SamDC gene in rice cultivars. Since salinity stress with high concentration e.g above 300mM for longer time causes chromosomal breakage, we have studied the expression of genes like DNA Pol λ , RAD-50, XRCC-1 and PCNA which are known to be involved in DNA repair. Salinity stress inducible gene expression was detected. Salinity stress was found to enhance the activity of DNA Pol λ (ddNTP sensitive but aphidicoline resistant).

In fruit ripening projects, the upstream region of RIN (MADS-box transcription factor, that regulates developmental programme essential for fruit ripening) gene showed many cis-acting elements e.g. LRE responsive to light, circadian rhythm and anaerobic condition. The expression of the RIN, GBF4, GBF12 and TAGL11 were found to be more in diffuse light treated tomato fruits than bright light treated fruits. The binding of the RIN factor on the upstream of the gene for sucrose phosphate synthase in banana and on a similar cis-acting element on expansin gene in tomato were identified by South western blot analysis. Anaerobic condition was found to inhibit fruit ripening in tomato and expression of RIN gene was found to be inhibited. In addition the activity of many enzymes like polygalacturonase, beta-galactosidase and lycopene pigment formation was found to be totally inhibited.

Molecular Documentation and Bioprospecting of Plant Diversity in Eastern and North Eastern India : Dr Swati Sen Mandi

Zingiber sp :

Species specific AFLP markers have been developed for *Zingiber officinale*, *Zingiber montanum* and *Zingiber zerumbet*. The AFLP pattern based dendrogram revealed distinct clustering of the landraces under each of these species. *Zingiber montanum* and *Zingiber zerumbet* appeared phylogenetically closer to each other than to *Zingiber officinale*.

Sequence analysis of cloned Chalcone Synthase gene (a key enzyme of the Phenyl Propanoid pathway for biosynthesis of antioxidants) from high and low antioxidant containing landraces of *Zingiber officinale* revealed 7 SNPs. Conversion of nucleotide sequences into amino acid sequence showed amino acid variations at 2 positions correlating with 2 SNPs out of the 7. The remaining 5 SNPs did not show any change in amino acid due to degeneracy of codon.

Xanthoxylum acanthopodium :

Xanthoxylum acanthopodium collected from different areas in and around Manipur have provided identical AFLP patterns thereby confirming the classical taxonomic positioning of these plants.

Digitalis purpurea :

AFLP analysis of six collections of *Digitalis purpurea* from different areas of Sikkim showed genomic polymorphism that appears correlated with flower colour viz. purple and white. Such DNA analysis will help to determine precise taxonomic position of these plant populations that have been variously reported in classical taxonomy as *Digitalis purpurea* L 'albiflora' *Digitalis purpurea* L.alba (Shrank) K.Werner.

Acorus calamus :

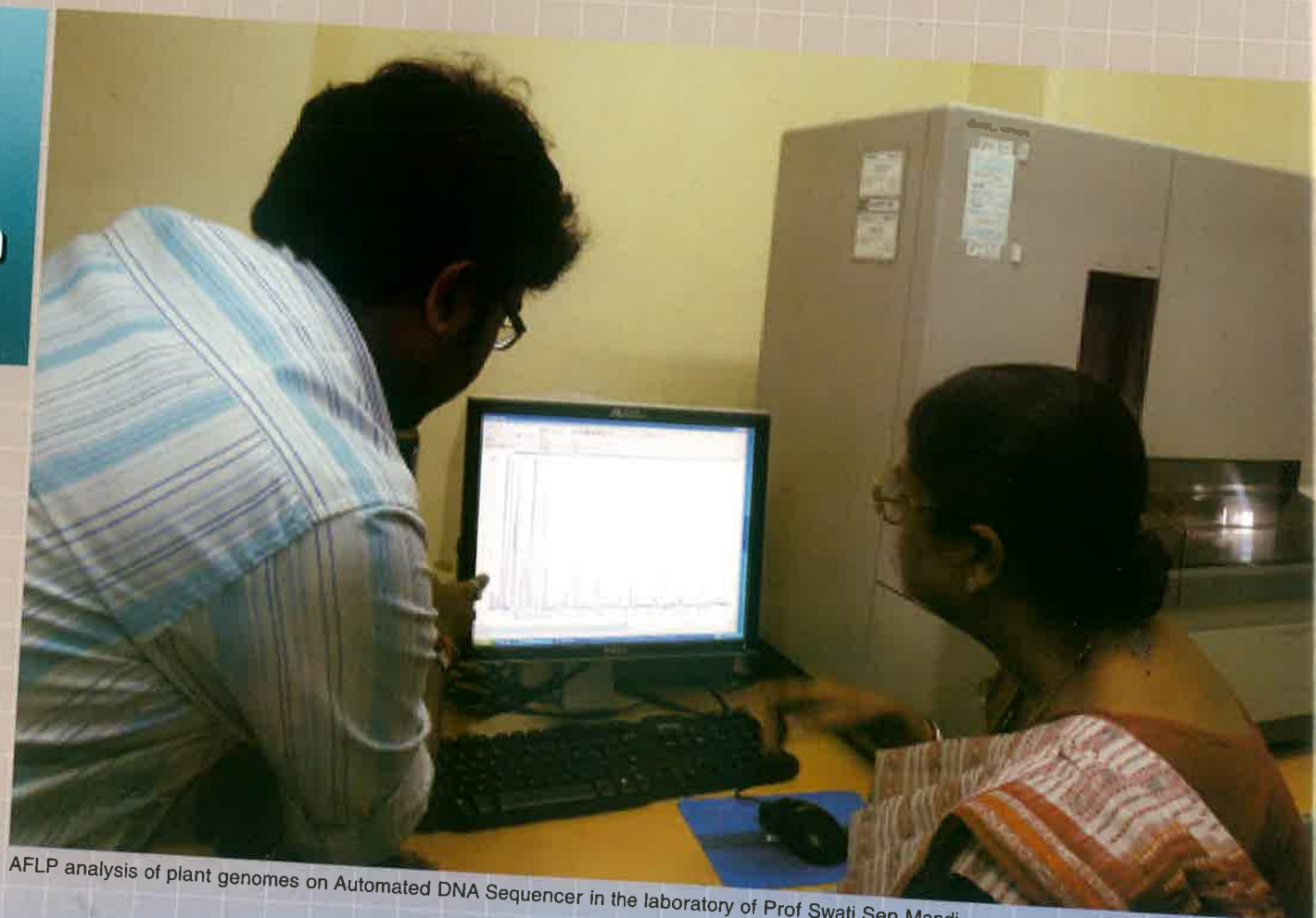
Collections of *Acorus calamus*, from areas near and remote (viz-pachay) from Gangtok showed genomic polymorphism in AFLP analysis. Significance of the polymorphism vis-à-vis phylogenetic relationship is being studied through dendrogram analysis.

Bamboo sp:

For documentation of wild genotypes of the North Eastern region (as per an MOU between BI and IBSD, Manipur) different species of bamboo from in and around Manipur are being studied through AFLP analysis.



Zingiber and *Curcuma* plants of the North East region growing in Glass House at main campus, Bose institute (under Prof Swati Sen Mandi's ICMR Programme)



AFLP analysis of plant genomes on Automated DNA Sequencer in the laboratory of Prof Swati Sen Mandi

Identification of candidate gene(s) for aphid tolerance in cruciferae : Dr. Samir R. Sikdar

Hundred sixteen transcript derived fragments, including both up and down regulated ones, were obtained from *Rorippa indica*, an aphid tolerant wild crucifer unchallenged and challenged with the mustard aphid *Lipaphis erysimi* through cDNA AFLP using 40 selective primers. Sequence analysis and confirmation of the expressed transcript fragments are in progress. Detailed profiling will help to understand the interaction taking place between apparently resistant plant type, *R. indica* and *L. erysimi* during aphid infection and finally to identify the candidate aphid tolerance/resistance gene(s).

Production of hybrid mushroom strains : Dr. Samir R. Sikdar

A total of 9 and 12 hybrid mushroom strains were produced between *Pleurotus florida* + *Lentinula edodes* and *P. florida* + *Lentinus squarrosulus*, respectively, through somatic protoplast fusion. Fruit body could be produced from 6 out of 9 hybrid strains from the first programme.

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ACHARYA J.C. BOSE
BIOTECHNOLOGY INNOVATION CENTER

Bose Institute :
Madhyamgram Campus

II. Protein Structure, Function and Engineering :

The biological role of colchicines binding site in tubulin : Dr. Gautam Basu, Dr. Pratima Sinha, Dr. Sujay Dasgupta and Dr. B. Bhattacharyya

A large number of mutants at two potential colchicine-binding sites in β -tubulin of *Saccharomyces cerevisiae* have been generated and the viability of the mutants have been studied, along with growth defects. The aim of this work is to produce a colchicine-sensitive yeast and also to decipher the biological role of the colchicine-binding site.

Analysis and design of peptides with cis peptide bonds: Pro-Pro-Xaa sequence motifs : Dr. Gautam Basu

From an analysis of NMR spectra of a large number of designed synthetic peptides we confirmed that cis Pro-Pro peptide bonds are stabilized by the Pro-Pro-Aro motif where Aro is an aromatic amino acid. More such motifs are being investigated using NMR and bioinformatics tools.

Deciphering the mechanism of anti-mutagenic activity by Caffeine : Dr. Gautam Basu, Dr. Samir K. Pal, SNBNCBS

The mechanism of anti-mutagenic activity of caffeine molecule was studied by NMR spectroscopy using ethidium bromide (EtBr) as a model mutagen. The association constant of caffeine-EtBr complex and a model of the complex were determined. This, along with in vivo data and time resolved fluorescence experiments allowed us to show that caffeine acts by complexation with EtBr rather than by interacting with the DNA.

The mechanism of interaction between SGR and H24 : Dr. Gautam Basu and Dr. Dipak Dasgupta, SINP

Guanine-rich telomeric sequences fold into G-quadruplex conformation and are known to bind a variety of ligands including potential drug candidates. We demonstrated that the drug sanguinarine (SGR) exhibits two distinct interactions with human telomere d[(TTAGGG)₄] (H24) in presence of K⁺. Up to about 1:2 molar ratio of H24:SGR (10 μ M H24), two molecules of SGR bind H24. Beyond this molar ratio, SGR induces a conformational transition in H24 from the K⁺-form to the basket-form, typically observed in presence of Na⁺. This is the first demonstration of drug-induced conformational transition in a G-quadruplex formed by a human telomeric sequence and may provide new insights into drug-DNA interaction exhibited by quadruplex DNA structures.

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Conformational studies on the plug domain of protein translocon channel SecYEG (Dr. Gautam Basu)

We have synthesized the isolated plug SecY plug domain in SecYEG protein translocation channel, along with a disulphide variant. Extensive CD studies on these peptides in a number of solvents have shown that the isolated peptides are structured that undergoes a beta to alpha transition with changing solvent polarity. This results complements and supports the existing model for protein translocation.

Mechanistic study of the binding of TN16 to tubulin : Dr. B. Bhattacharyya

3-(l-anilinoethylidene)-5-benzylpyrrolidine-2, 4-dione (TN16), a synthetic compound, has been reported to have potent antiproliferative effect on diverse mammalian cell lines and to inhibit microtubule assembly in vitro. However, the effects of TN16 on cellular microtubules are not clear and a little is known about the interaction of TN16 with tubulin. In this study, it has been shown that TN16 inhibited HeLa cell proliferation with a half-maximal inhibitory concentration of $48 \pm 2 \mu\text{M}$ and the inhibition of cell proliferation found to occur in association with the inhibition of mitosis. TN 16 depolymerized microtubules of both interphase and mitotic HeLa cells and exerted stronger depolymerizing effects on the microtubules of mitotic cells compared to that of the interphase cells. To understand above mentioned observation, binding of TN16 with purified tubulin using several biophysical techniques have been characterized. TN16 recognizes the colchicine site on tubulin, and the binding properties are more like 2-methoxy-5-(2',3',4'-trimethoxyphenyl) tropone (AC) in terms of reversibility, high on-rate, low activation energy and pH independency. However, thermodynamic parameters like enthalpy and entropy show significant similarity with colchicine-tubulin interaction. Nevertheless, the ΔC_p value of TN16-tubulin interaction is close to AC-tubulin interaction. Based on these data, it is concluded that TN16 inhibited HeLa cell proliferation at mitosis by depolymerizing spindle microtubules and its interaction with tubulin bears partial similarity with both colchicine as well as AC.

Cloning, expression, purification and structural studies on proteins from *Vibrio cholerae* : Dr. P. Chakrabarti

Vibrio cholerae is the causative agent of the diarrheal disease cholera, which is usually acquired by oral ingestion of the bacterium with contaminated water or food. The bacterium expresses virulence factors that allow it to colonize the human intestine and cause the disease. Regulation of virulence genes can involve the ToxR, Fur, or HlyU regulatory system. We have cloned, expressed, purified HlyU, ToxR and HlyT and carried out biophysical studies. The DNA sequence that HlyU recognizes is being worked out by EMSA studies. HlyU structure has been modeled and its terminal helices are being deleted to study its effect on the oligomeric structure of the molecule and DNA binding properties.

Protein-nanoparticle interaction : Dr. P. Chakrabarti

We have initiated a new project to understand the interaction of some model, as well as recombinant proteins with ZnO nanoparticles, synthesized and characterized in the lab of Dr. Vinay Gupta, Department of Physics and Astrophysics, University of Delhi. It is found that these have antibacterial properties, and are effective even in dark. These interact at the active site of lysozyme without much perturbation of the enzyme activity, but with a slight increase in helicity on binding.

Selection and purification of some lectins : Dr. Rajagopal Chattopadhyaya

We have identified and purified lectins from some four plants for biophysical and crystallographic studies. Though some similar crystal structures have been solved, there is variation among plants regarding agglutination and anti-insecticidal properties and we are hoping these could be explained on the basis of biophysical studies and more crystal structures.

Stabilization of quaternary structure of α -crystallin by Zn^{+2} : Dr. K. P. Das

Urea denaturation profiles for α -crystallin showed that the stability of α -crystallin increased from about 22 kJ/mol in absence of Zn^{+2} to about 60 kJ/mol in presence of 1 mM Zn^{+2} . Dynamic light scattering data indicates that in absence of Zn^{+2} , the oligomer breaks down above 3M urea concentration. In presence of 0.5 mM Zn^{+2} DLS data showed that even at 6 M urea the oligomer remains intact indicating intersubunit bridge formation by Zn^{+2} .

Identification of histidine residues involved in Zn^{+2} binding : Dr. K. P. Das

Histidine residues are common among Zn^{+2} binding sites in protein. We mutated several histidine residues to see if the Zn^{+2} binding properties of α -crystallin changed. We found that point mutation of histidine residues did not prevent Zn^{+2} binding completely, but mutation of His18 and His101 significantly reduced Zn^{+2} binding and also showed negative enhancement in chaperone function and surface hydrophobicity of α B-crystallin. The results indicated that His18 and His101 of α B-crystallin are involved in Zn^{+2} binding. Attempts to identify additional histidine residues involved in Zn^{+2} binding by DEPC modification and MALDI mass spectrometry are underway.

Role of alternative sigma factors in *M. tuberculosis* gene regulation : Dr. Jayanta Mukhopadhyay

Transcription is the first step in gene expression and is the step at which most regulation of gene expression occurs. RNA polymerase (RNAP) is the enzyme responsible for transcription. Sigma factor binds to RNAP and directs it to specific promoters and thus orchestrates the

transcription initiation. *Mycobacterium tuberculosis* has 13 sigma factors. To identify promoter specificity of a sigma factor from *M. tuberculosis*, we plan to use a SELEX based method using recombinant *M. tuberculosis* (Mt) RNAP. To produce recombinant Mt RNAP, we have cloned each of four subunits of Mt RNAP into two different dual expression vectors and optimised RNAP expression in *E. coli* harbouring those plasmids. Currently we are assessing the activity and purity of the recombinant Mt RNAP. We have also purified several sigma factors of Mt RNAP.

Studies on the functional implications of the structure of lambda CII :
Dr. Pradeep Parrack

Lambda CII is a homotetrameric transcription activator that binds to DNA at the direct repeat sequence TTGCN₆TTGC, utilising two of its four helix-turn-helix motifs. Tetramerisation of CII is necessary for its function, and is mediated by a four-helix bundle involving the helix $\alpha 4$ from each all-helix subunit. We have shown that certain specific hydrophobic residues located at key positions in the $\alpha 4$ helix of CII are vital for the maintenance of the structure and function of the protein.

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Centre for Astroparticle Physics and Space Science

Bose Institute :
Salt Lake Campus

III. Bioinformatics and Computational Biology:

Electrostatic interactions in protein-protein complexes : Dr. Gautam Basu

In continuation of our earlier result that electrostatics plays a role in the rejection of wrong subunit orientations in protein-protein interactions, we are exploring if this can be effectively used in prediction of protein-protein complex orientations for subunits with unknown geometries when bound to each other.

Molecular Dynamics simulations of short peptides : Dr. Gautam Basu

We have generated and analyzed long MD trajectories of two peptides, the Hdm2 binding helix of p53 and another a mimetic of this peptide containing Aib, designed to interrupt p53-Hdm2 interaction, focusing on the intrinsic conformational preferences of the two peptides and its implication on designed mimics of the p53 peptide fragment.

Mechanism of substrate recognition and discrimination by glutamyl-tRNA synthetases : Dr. Gautam Basu, Dr. Siddhartha Roy

We have studied the structure/sequence/activity relationships of *E. coli* GluRS and several of the mutants, in relation with tRNA^{Gln}-discrimination. With this model system and complementary bioinformatics analysis we have established idiosyncrasies of tRNA^{Gln}-discrimination by GluRS in the bacterial world.

Physicochemical features involving protein-protein/RNA interfaces : Dr. P. Chakrabarti

Our on-going project to delineate features that characterize protein-protein interaction has been extended to protein/DNA and protein/RNA interfaces. The protein-nucleic acid interfaces have been characterized in terms of two types of segments – stretches of (nearly) contiguous residues along the polypeptide chain and those containing distinct secondary structural elements.

Analysis of cavities in protein structures, and the development of a scoring function to identify the native structure from a set of decoys based on packing consideration : Dr. P. Chakrabarti

Cavities in protein tertiary structures and protein-protein interfaces have been analyzed to find out the relationship between the size of the molecule (or interface) and the number of cavities, the nature of atoms and residues and their secondary structures lining the cavities, the degree of

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solvation, etc. In many computer simulation methods for the prediction protein structures a large number of possible models are generated from which one has to identify the correct (native) structure. We have developed a simple, scoring function which does this with remarkable efficiency.

Empirical estimation of the contribution of an interface residue to binding free energy : Dr. P. Chakrabarti

An empirical method has been developed to estimate the contribution of a residue to the binding free energy of a protein-protein interaction by considering its degree of burial and finding out if the residue is involved in any hydrogen bond across the interface and its location in the core or the rim of the interface. The method has been implemented in a server PRICE available at <http://www.boseinst.ernet.in/resources/bioinfo/stag.html>.

Model of malaria dihydrolipoamide dehydrogenase : Dr. Rajagopal Chattopadhyaya

In June 2006, a three dimensional model of *P. falciparum* apicoplast dihydrolipoamide dehydrogenase (PDB entry 2g7d) was deposited, in collaboration with Dr. Debjani Roy. This is a promising drug target for malaria as the said enzyme is crucial for the parasite's survival. The in silico drug discovery part of this study remains to be done and has been resumed recently.

Insight into the origin and functional evolution of bacterial dioxygenases : Dr. Tapan K. Dutta

To cope with the enormous diversity of aromatic compounds in the environment, bacterial aromatic ring-hydroxylating dioxygenases (ARHDs) enzyme family has evolved remarkably exhibiting broad substrate specificity. They are known to oxidize hundreds of substrates including toxic and/or carcinogenic compounds such as polychlorinated biphenyls and polycyclic aromatic hydrocarbons (PAHs) apart from several other linked and fused aromatics, aliphatic olefins, and substituted aromatics. The present study attempts in depicting a modified classification scheme for ARHDs on the basis of their evolutionary and functional aspects, correlating structural configuration of substrates vis-à-vis their oxygenation site(s). In addition, a novel approach to identify shared ancestry of ARHDs on the basis of similar structural and functional features, structural phylogenies have been derived, substantiated by comparison of solvent accessibilities, positions of residues lining the substrate cavities, as well as in silico side-chain substitutions. Finally, a model for evolution of bacterial ARHDs has been proposed, beginning from genesis of the terminal oxygenase components followed by recruitment of constituent ET components, finally evolving into various 'extant' ARHD types.

Evolutionary Bioinformatics : Dr. Tapash C. Ghosh

Our major goal is to identify and understand the different evolutionary forces by analyzing the genomic and functional data of various organisms and to incorporate such information in bioinformatics tools to achieve thorough and multi-dimensional understanding of living organisms. Very briefly, the major results of the last one year (2009-10) are as follows:

1. Our work on evolutionary system biology established the role protein disorder ness and three dimensional structural contexts on the evolution of protein-protein interaction network;
2. Comparative genome analysis of human and mouse established that the variation of evolutionary rate between housekeeping and tissue specific protein-protein interaction network is mainly guided by the protein multifunctionality over protein connectivity, expression level and interacting protein length.

Molecular dynamics simulations of biotechnologically important proteins : Dr. Debjani Roy

Molecular dynamics simulations of psychrophilic type III antifreeze protein and its corresponding mesophilic counterpart, the antifreeze-like domain of human sialic acid synthase have been carried out. Molecular dynamics simulations of human pollen allergen Betv1 complexed with their biologically significant ligands have also been performed. Analyses of dynamic trajectories have provided detailed structural information about these proteins. These studies may help in designing proteins with improved functions.

Codon usage and gene expression pattern of human parasites : Dr. Debjani Roy

Codon usage and gene expression pattern of human parasite *Stenotrophomonas maltophilia* strain R551-3 have been carried out. Our work provided insight into the unique gene structure and differential expression of replicating leading and lagging strand genes of this genome, essential for its survival and replication during human infection. We have also identified several multiple drug resistance genes, which could be used as potential drug target for this pathogen in order to control its infection.

Virtual library design and screening of potential drug like molecules of *P. falciparum* Ser/Thr protein phosphatase 5 : Dr. Debjani Roy in collaboration with Dr. Amit Roy, Visva Bharati University, Santiniketan.

A library containing 2,250 drug like molecules targeting Ser/Thr protein phosphatase 5 of *P. falciparum* (PfPP5) has been generated and subjected for virtual screening. Five structurally diverse compounds showing good binding energies have been selected for molecular dynamics simulation.



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Blood Gel Documentation System

IV. Molecular Medicine

Resistance-to-apoptosis switchover : A molecular approach towards cancer chemoprevention : Dr. Tanya Das

One of the main causes of failure in the treatment of cancer is the development of drug resistance by the cancer cells. This is a very serious problem that may lead to recurrence of disease or even death. While the contribution of specific tumor suppressor networks to cancer development has been the subject of considerable recent study, it remains unclear how alterations in these networks are integrated to influence the response of tumors to anti-cancer treatments. Here, we show that in resistant lung cancer cells, a cross-talk between ROS-PIASy-NEMO directs ATM to oscillate between NFkB pathway and JNK pathway to shift the cells from resistance to apoptosis. Whereas in drug-resistant medullary carcinoma of the thyroid, downregulation of the surface expression of RET decreases the interaction between both Ras and PI3K with RET thereby inhibiting PI3K/AKT/Bad/cytc/caspase-9 pathway in one hand and Ras/Raf/ERK/p38-MAPK/caspase-8 pathway on the other to induce apoptosis via activation of caspase-3. Since emergence of resistance to genotoxic drugs is still a major obstacle in the successful management of different cancers, which no doubt is the most fatal disease in both men and women worldwide, such profound investigation into the in-depth molecular mechanisms of drug resistance may hopefully translate into effective therapies that can flip the switch from drug resistance to susceptibility in cancer.

Amphotericin B regulates the host immune response in visceral leishmaniasis : reciprocal regulation of protein kinase C isoforms : Dr. Subrata Majumdar

Treatment of visceral leishmaniasis (VL) is marked by the failure of pentavalent antimonials which has brought amphotericin B (AmpB) to the forefront. In this study we have focused on signaling pathway regulating AmpB triggered effector response. AmpB triggered effector response in the form of free radicals and proinflammatory cytokines was determined by FACS, colorimetric estimation or Real-Time PCR (RT-PCR). Specific peptide inhibitors for classical and atypical protein kinase C (PKC) were used to investigate the role of PKC isoforms in the functioning of AmpB during VL. In vitro studies with THP1 cells showed that 2 µg/ml dose of AmpB could mediate effective parasite clearance due to strong induction of free radicals and proinflammatory cytokines. This induction of proinflammatory response paralleled with antagonistic regulation of classical and atypical PKC. Further confirmation was provided by RT-PCR of (peripheral blood mononuclear cells) PBMC isolated from VL patients undergoing AmpB treatment. Overall, our results suggest that classical and atypical PKC signaling pathways are involved in the modulation of proinflammatory response triggered by AmpB against *Leishmania donovani*. These observations may contribute to the understanding of the mechanism responsible for the initiation of protective response induced by AmpB during VL.

Effect of CXC chemokine, IP-10 on T cell subsets during visceral leishmaniasis : Dr. Subrata Majumdar

IP-10, a proinflammatory CXC chemokine, renders protection against both in vitro and in vivo model of Visceral Leishmaniasis (VL). The in vivo protective response was found to be mediated via the induction of IFN-γ secreting CD4⁺ T cells along with decrease in IL-10 secreting CD4⁺ T cells. Further analysis of splenic T cells showed significant decrease in CD25⁺ CTLA4⁺ OXP3⁺ CD4⁺ T cells in comparison to infected sets. These T regulatory cells isolated from IP-10 treated mice had low immunosuppressive functions as compared to infected sets which might promote the heightened Th1 responses in IP-10 treated sets.

An adjunct immuno-modulatory role of *Mycobacterium indicus pranii* re-establishes host-protective anti-leishmanial immune response : Dr. Subrata Majumdar

Leishmania donovani, a protozoan parasite, causes a strong immunosuppression in a susceptible host and inflicts the fatal disease visceral leishmaniasis. Relatively high toxicity, low therapeutic index and failure in reinstating host-protective anti-leishmanial immune responses have made anti-leishmanial drugs patient non-compliance and adjunct immuno-modulatory treatments a necessity. Herein, we have tested the anti-leishmanial efficacy of a combination of a novel immunomodulator, *Mycobacterium indicus pranii* (Mw), and an anti-leishmanial drug, amphotericin B (AmpB). We observed that Mw alone or with a suboptimal dose of AmpB offered significant protection against *L. donovani* infection by activating the macrophages. Our experiments examining the anti-leishmanial activity of Mw alone or with AmpB in IL-12 deficient macrophages indicate a pivotal role for IL-12 in the induction of p38MAPK and ERK-1/2 regulated pro-inflammatory responses. The Mw-AmpB combination induced nitric oxide production, restored Th1 response and significantly reduced *L. donovani* infection in susceptible BALB/c mice. Thus, we demonstrate a novel chemo-immunotherapeutic approach whereby Mw and AmpB crosstalk eliminating the parasite-induced immunosuppression and inducing collateral host-protective effects.

Ara-LAM triggers host-protective immunomodulatory changes during visceral leishmaniasis : Dr. Subrata Majumdar

Arabinosylated lipoarabinomannan (Ara-LAM) is a cell wall glycolipid isolated from the nonpathogenic mycobacterium species. This molecule up regulates the expression of TLR-2 and downstream signaling of TLR-2 in *L. donovani* infected murine macrophages. CCR-5, which acts as an entry point for *L. donovani*, was found to be down regulated upon Ara-LAM pretreatment in *L. donovani* infected macrophages in a TLR-2 mediated pathway. This down-regulation of CCR5 expression in *L. donovani* infected macrophages by Ara-LAM was found to be significantly reduce the intracellular parasitic burden. Ara-LAM, with its immunomodulatory properties, could restore the suppressed immune responses during *Leishmania* infection in in vivo murine model as was seen by significantly reduced liver and spleen parasitemia. In vitro and in vivo studies under TLR-2 silenced condition significantly abrogated the protective immune response generated by Ara-LAM.

Disease resistance in marine shrimp, *Penaeus monodon* : Dr. Nripendranath Mandal

Marine shrimp (*Penaeus monodon*) aquaculture is one of the most economically important industries all over the world, including India. White spot disease caused by white spot syndrome virus (WSSV) poses major problems that result in huge economic losses each year in shrimp aquaculture throughout the world. Despite serious efforts, it is a failure in most cases to control the disease caused by viruses and continue huge economic loss.

We have collected wild *Penaeus monodon* from four geographically distant locations on the east coast of India (Digha, West Bengal, Chilika, Orissa, Visakhapatnam, Andhra Pradesh and Chennai, Tamil Nadu). All shrimp samples (almost 30 mg gill tissue) were screened for WSSV prevalence. We observed that the percentages of WSSV prevalence are 10.86%, 0.00%, 0.82%, 56.25% among the natural populations from Digha, West Bengal; Chilika, Orissa; Visakhapatnam, Andhra Pradesh and Chennai, Tamil Nadu, respectively.

Two pleopod tissues (almost 100-150 mg tissue) were used for shrimp genomic DNA preparation by using phenol chloroform method and were subjected for screening of disease resistant shrimp using microsatellite DNA marker which we have developed earlier. We found that the percentage of disease resistant shrimps were 8.77%, 24%, 36.89% and 51.04% among the natural populations from Digha, West Bengal; Chilika, Orissa; Visakhapatnam, Andhra Pradesh and Chennai, Tamil Nadu, respectively.

We have also collected shrimp samples (almost 20 or more) were collected from 15 ponds highly affected by WSSV, around different locations in West Bengal during 2008-2009. Shrimp samples were 30-50 g in weight on average and mature adults which survived in the same disease affected ponds where most of the individuals died due to viral disease. All shrimp samples were screened for WSSV prevalence and disease resistance prevalence among these cultured populations. It was observed that WSSV prevalence was 86.27% and disease resistance prevalence was 13.07% among these samples.

This information will be very useful to develop disease resistant brood-stock for marker-assisted selection (MAS) of breeding program for shrimp hatcheries and disease resistant seeds will be supplied to the rural shrimp farmer. As a result, this will prevent the huge socio-economic damages due to viral diseases in shrimp aquaculture industries thereby causing rural development, socio-economic upliftment and improvement of both rural and urban population.

Development of biomarkers to predict coronary heart disease (CHD) : Dr. Nripendranath Mandal

Coronary heart disease (CHD) is leading to a large proportion of all deaths worldwide. The highest number of death in Indian population due to CHD has also increased drastically. It has been predicted that the cause of deaths from CHD in Indian population will be rank one by the year 2015. The high frequency to develop premature and accelerated CHD in

Asian Indian population is only partially explained by the presence of conventional risk factors, viz. insulin resistance and abdominal obesity. So, from a preventive point of view, it is very important to develop alternative biomarkers to predict CHD. As inflammation and thrombosis are knotted pathologies in the natural history of atherosclerosis, measurements of inflammatory markers can help in the prognosis of patients with acute myocardial infarction (AMI). The multivariate model generated from case control study of AMI by our laboratory suggested that the IL-10 to IL-6 ratio may be valuable indicator compared to IL-6 in AMI. We have predicted that reduced levels of anti to pro inflammatory cytokine ratios may favor atheromatous plaque instability and may be implicated in the development of AMI. We have also observed that the individuals in "AB" blood group decrease the risk of CHD in healthy controls due to the higher concentration of high density lipoprotein cholesterol (HDL-c) while the individuals in "O" blood group increase the risk of CHD due to lower HDL-c levels. Blood type needs to be considered together with other risk factors to understand the individual patient's risk.

Development of alternative herbal medicines to combat cancer and other autoimmune diseases in human : Dr. Nripendranath Mandal

Many of the non-curable diseases are associated with oxidative stress caused by reactive oxygen species (ROS). ROS, generated in cells, are fundamental in modulating various physiological functions. But, sometimes, excessive generation of ROS, beyond the capacity of endogenous antioxidant defense system to control them, leads the development of many diseases such as cancer, diabetes, liver injury, atherosclerosis, neurodegenerative disorders etc. In treatment of these diseases, antioxidant compounds have gained an immense importance. Although some synthetic antioxidants have been developed in the past few years, their wide application has been restricted due to adverse effects. However, various plant products or metabolites are used to treat many diseases in the ancient systems of medicine such as Ayurveda. Thus, interest in natural antioxidants of plant origin has increased considerably.

In the course of the above mentioned aims, we have prepared different extracts of various medicinally important plants viz. *Spondias pinnata*, *Caesalpinia crista*, *Cajanus cajan*, *Hemidesmus indicus*, *Gymnema sylvestre*, *Dolichos biflorus*, *Acacia catechu*, *Terminalia chebula*, *Terminalia belerica* and *Emblica officinalis* in solvents like water, ethanol, water-methanol and hydroalcoholic mixture. The antioxidant and free radical scavenging, iron chelating and DNA protective activities of all the extracts were shown simultaneously. All the extracts are found to be nontoxic for normal cells, whereas some of them showed anticancer activity through apoptosis. These results signify that these plant extracts may be useful for remediation of many pathophysiological conditions.

Synthesis and bioevaluation of organic small molecules and microbial antigenic complex oligosaccharides : Dr. Anup Kumar Misra

Our goal is to synthesize medicinally relevant organic small molecules and their biological screening in different drug development program (e.g. cancer, enzyme inhibitors, antioxidant

etc.) in collaboration with biologists of Bose Institute. Our research group have also been engaged in developing concise chemical synthetic strategies for the synthesis of several complex oligosaccharides found in the cell-wall of pathogenic bacteria for their use in the preparation of glycoconjugate derivatives for their use in the preparation of antibacterial agents. In the current scenario, glycoconjugates have emerged as successful synthetic vaccine candidates to control microbial infections. In collaboration with biologists, screening of small molecules as drug leads and immunochemical studies are going on in the laboratory.

Thyroid hormone action in adult mammalian brain : Dr. Arun K. Ray

Imbalance in thyroid hormone concentrations has been linked with profound neurobehavioural alterations in the adult mammalian vertebrates. Peripheral hypothyroidism is associated with a phenomenon of 'central thyroid hormone homeostasis' in adult rat. This 'central homeostasis' mechanism could be maintained by adrenergic interplay due to close physiological association between sympathetic nervous system activity and thyroid hormones. The central homeostasis is characterised by increased cerebrocortical synaptosomal T3 content, deiodinase type II (DII) activity, and cAMP content. We injected specific α - and β -adrenergic receptor (AR) agonists and antagonists along with an antithyroid drug to find out any AR-mediated action on 'central homeostasis'. The β -AR agonist did not alter the onset of 'central homeostasis', but prolonged its duration. Similar prolongation was observed with α_2 -AR antagonist and β -AR agonist, but these compounds amplified the normal anti-thyroid drug-induced rise in cerebro-cortical T3 content on the day of onset of 'central homeostasis'. Injections of the β -AR antagonist did not cause any perturbations. All these observations have been supported by parallel changes in cerebrocortical DII activity, cAMP and $[Ca^{2+}]_i$ content.

There emerges a close correlation between cerebral T3 content, DII activity, cAMP and $[Ca^{2+}]_i$ content that are regulated by the AR system. Thus thyroid hormone homeostasis in the adult mammalian brain is maintained primarily by the β -adrenergic pathway along with an unexpected pharmacological involvement of the α -ARs.

Gain of cellular adaptation due to prolong p53 impairment leads to functional switch-over from p53 to p73 during DNA damage in acute myeloid leukemia cells : Dr. Gaurisankar Sa

Tumor-suppressor p53 plays the central role in regulating apoptosis in response to genotoxic stress. From an evolutionary perspective, the activity of p53 has to be backed up by other protein(s) in case of any functional impairment of this protein, in order to trigger DNA-damage-induced apoptosis in cancer cells. We adopted multiple experimental approaches to demonstrate that in p53-impaired cancer cells, DNA-damage caused accumulation of p53-paralogue p73 via Chk-1 that strongly impacted Bax expression and p53-independent apoptosis. On the contrary, when p53 function was restored by ectopic-expression, Chk-2 induced p53 accumulation that in turn overshadowed p73 activity suggesting an antagonistic interaction between p53 family members. To better understand such

interaction, p53-expressing cells were impaired differentially for p53 activity. In wild-type p53-expressing cancer cells that were silenced for p53 for several generations, p73 was activated, while no such trend was observed when p53 was transiently silenced. Prolong p53-interference, even in functional p53 settings, therefore, leads to the "gain of cellular adaptation" in a way that alters the cellular microenvironment in favor of p73 activation by altering p73-regulatory proteins, e.g., Chk1 activation and $\Delta Np73$ down-regulation. These findings not only unveil a hitherto unexplained mechanism underlying the functional switch-over from p53 to p73, but also validate p73 as a promising and potential target for cancer therapy in absence of functional p53.

Regulation of tyrosine kinase activity during capacitation in goat sperm : Dr. Parimal C. Sen

Protein tyrosine phosphorylation is a key event accompanying sperm capacitation. Although this signaling cascade generates an array of tyrosine-phosphorylated polypeptides, their molecular characterization is still limited. It is necessary to differentiate the localization of the tyrosine phosphorylated proteins in spermatozoa to understand the link between the different phosphorylated proteins and the corresponding regulated sperm function. cAMP plays a pivotal role in the regulation of tyrosine phosphorylation. The intracellular cAMP levels were raised in goat spermatozoa by the addition of the phosphodiesterase inhibitor, IBMX in conjugation with caffeine. Tyrosine phosphorylation was significantly up-regulated following treatment with these two reagents. Treatment of caudal spermatozoa with both IBMX and caffeine, time dependent up-regulated phosphorylation of the protein of molecular weights 50 and 200kDa was observed. Increased phosphorylation was observed with a combination of IBMX and caffeine treatment. Tyrosine phosphorylation in caput spermatozoa was not affected significantly under these conditions. The expression level of tyrosine kinase in sperm was examined with specific inhibitors and with anti-phosphotyrosine antibody. The indirect immunofluorescence staining was carried out on ethanol permeabilized sperm using anti-phosphotyrosine antibody. Western blot analysis was done using two separate PKA antibodies: anti-PKA catalytic and anti-PKA RI α . Almost no difference was found in the intracellular presence of the PKA RI α and RI β subunits in caput and caudal epididymal spermatozoa. However the catalytic subunit seemed to be present in higher amount in caudal spermatozoa. The results show that caprine sperm display an enhancement of phosphorylation in the tyrosine residues of specific proteins under in vitro capacitation conditions.

Characterization of arylsulphatase A in a 70 kDa protein isolated from goat spermatozoa having Na⁺, K⁺-ATPase inhibitory activity : Dr. Parimal C Sen

A protein having inhibitory effect on Na⁺, K⁺-ATPase as well as showing arylsulphatase A activity (ASA) was isolated from the cytosolic fraction of goat spermatozoa. The protein was characterized biochemically. The molecular mass of the protein was found to be 70 kDa on 10% SDS-PAGE after 35% ammonium sulphate precipitation, followed by hydroxyapatite column chromatographic separation. The ASA activity of the protein was studied with respect to its pH (5.5), temperature optima (37°C) and incubation time (30 min). The isoelectric point

(pI) of the protein was found to be 4.9. The protein and arylsulphatase from a commercial source were studied with respect to the sensitivity to different metal ions, vanadate, carbonyl compounds and ascorbate. Inhibition of AS activity in P70 by silver nitrate suggested that it was related to ASA. Comparable effects of different polyunsaturated fatty acids and purified anti P70-antibody on P70 and arylsulphatase from commercial source were observed. The findings suggested that protein is novel in nature having both regulatory and catalytic functions and showed similarities with the ASA reported from different sources.

Studies on the protective action of bio-active molecules in organ pathophysiology :
Dr. Parames C Sil

Research in our laboratory mainly focuses on the mechanism of the beneficial role of naturally occurring bio-active molecules in organ pathophysiology. Studies on the signal transduction mechanism suggest that some common pathways (both mitochondria dependent and independent) are shared by these molecules for their mode of action although chemical structures do not classify them under the same category. In addition to continuing research on these active principles, we are also investigating the mechanism of environmentally exposed nanostructure induced organ pathophysiology and its reversal by the nature derived active principle(s).



V. Microbial Genomics and Infection Biology :

DNA Trajectory in a Mycobacterial plasmid origin complex : Dr. Sujoy K. Das Gupta

The Mycobacterial plasmid pAL5000 represents a group of novel plasmids isolated from Actinomycetes bacteria about which very little is known. Plasmid pAL5000 is also considered important as it has been used extensively in the genetic engineering of Mycobacteria, and therefore it has always played an important role in Tuberculosis research. We have been using pAL5000 as a model system to study replication mechanisms in Mycobacteria. Previous investigations from this lab have revealed that a plasmid encoded replication protein RepB which is essential for replication, binds to the origin and bends it asymmetrically. We now demonstrate that this asymmetric DNA bend is necessary for replication and that it is caused by the presence of a rigid-flexible junction within a conserved A/T rich box located in the origin. Mutations within this region lead to alterations in the trajectory of the DNA in the origin complex and concomitant drop in replication efficiency. The results throw significant new light on the role of asymmetric DNA bending in DNA transaction processes.

Novel pathway(s) involved in the bacterial assimilation of PAHs :
Dr. Tapan K. Dutta

A versatile species belonging to genus *Sphingomonas* sp. (strain PNB) was isolated, which could utilize naphthalene, phenanthrene, anthracene and biphenyl individually as sole carbon sources and can co-metabolize number of high molecular weight PAHs. In the degradation of phenanthrene by strain PNB, both 2-hydroxy-1-naphthoic acid and 1-hydroxy-2-naphthoic acid were processed via a novel meta-cleavage pathway ultimately leading to TCA cycle intermediates. In the lower pathway, a differential expression of multiple catechol dioxygenase activities was determined by RT-PCR analysis and was found to be regulated by 1-hydroxy-2-naphthoic acid. Moreover, rational designing of primer sets allowed to amplify and sequence four distinct α -subunits of aromatic ring-hydroxylating dioxygenases from strain PNB. On the other hand, the novel enzyme, 1-hydroxy-2-naphthoic acid meta-cleavage dioxygenase was partially purified by a combination of chromatographic techniques and the enzyme was found to be of unique molecular size compared to other ring cleavage dioxygenases available in literature. Apart from that, numbers of bacterial isolate belonging to the genera *Pseudomonas*, *Burkholderia*, *Ochrobactum* were isolated and were found to utilize various aromatic pollutants via unique pathways providing new insights towards the novel metabolic enzymes in the management of hazardous aromatics in the environment.

Understanding the metabolic strategies of early Life on Earth : Dr. Wriddhiman Ghosh

It is widely believed that the earliest lifeforms on Earth were similar to the hyperthermophilic chemolithotrophs that inhabit present-day geothermal systems. I am exploring the metabolic range, ecological dynamics, and evolution of lithotrophic bacteria (particularly the sulfur-oxidizing ones) that hold the key to our understanding of the earliest metabolic strategies of Life on Earth. Since ecologically and taxonomically diverse photo- and chemotrophic prokaryotes use distinct enzyme and electron transport systems for the oxidation of sulfur substrates and conservation of energy my current objectives also include exploring the evolution and interactions of the different sulfur oxidation mechanisms with an aim to settle the issue of their ancestry.

The mycobacterial protein FipA is phosphorylated by PknA and is required for cell division under oxidative stress : (Dr. Joyoti Basu in collaboration with : Dr. Manikuntala Kundu

The bacterial divisome is a multiprotein complex. Specific protein-protein interactions specify whether cell division occurs optimally, or whether division is arrested. Little is known about these protein-protein interactions and their regulation in mycobacteria. We have demonstrated that FipA, a product of the ORF Rv0019c of *Mycobacterium tuberculosis*, is phosphorylated by PknA, a mycobacterial serine/threonine kinase. Phosphorylation-dependent interactions between FipA and FtsZ are required for maintenance of cell shape under oxidative stress.

Penicillin-binding protein 1* (PBP1*) of *Mycobacterium tuberculosis* as a regulator of cellular morphology : Dr. Joyoti Basu in collaboration with Dr. Manikuntala Kundu

A PBP1* transposon mutant of *M. smegmatis* is defective in cell division. This mutant has been complemented with PBP1* of *M. tuberculosis* and cellular morphology has been found to be restored after complementation. Work is under way to characterize the interacting partners of PBP1* and to find out how these interactions influence cell division.

Regulation of immune response by the *Helicobacter pylori* secretory antigen, HP0175: Dr. Manikuntala Kundu

Colonization of the stomach by *H. pylori* is associated with infiltration of the mucosa by polymorphonuclear leukocytes, macrophages and lymphocytes. Cytokines produced by both immune and non-immune cells contribute to the immune response. Antigen-presenting cells release interleukin (IL)-12 and IL-23. In our continuing efforts to understand the role of HP0175 in regulating the immune response, we have observed that HP0175 induces the release of IL-12p35, IL-12p40 and IL-23p19 from macrophages. HP0175 is therefore a potent stimulator of the immune response. We are focusing on the mechanistic aspects of cytokine induction by HP0175.

The cell cycle of *Entamoeba histolytica* : Dr. Anuradha Lohia

Over the last few years our laboratory has established that uncoupling of cell cycle events and survival of daughter cells with unequal DNA contents leads to genetic heterogeneity in *E. histolytica*. Our recent study has focused and identified the role of epigenetic mechanisms that affect microtubular stability and consequently chromosome segregation in this organism. Sirtuins are deacetylases that target non-histone proteins and thus modify their function epigenetically. We have discovered four sirtuin genes in *E. histolytica*, two of which are similar to eukaryotic sirtuins and two to bacterial and archeal sirtuins. The eukaryotic sirtuin homolog, EhSir2a showed NAD⁺ dependent deacetylase activity and was sensitive to Class III HDAC inhibitors. Localization of EhSir2a at different cellular sites suggested that this deacetylase could have multiple targets. Indeed we identified several interacting proteins that bound to EhSir2a through a yeast two-hybrid genetic screen. These proteins included Eh α -tubulin, whose interaction with EhSir2a was validated in *E. histolytica*. We have shown that EhSir2a deacetylated tubulin and localised with microtubules in *E. histolytica*. Increased expression levels and therefore increased deacetylase activity of EhSir2a in stable transformants led to reduced number of microtubular assemblies in synchronised cells. This effect was abrogated by mutations in the deacetylase domain of EhSir2a, showing that EhSir2a deacetylase activity affected the stability and number of microtubular assemblies during the cell cycle of *E. histolytica*. Our results suggest that epigenetic modification of tubulin by EhSir2a is one of the mechanisms that regulated microtubular assembly in *E. histolytica*. In addition a novel translation initiation factor and a protein with actin-motifs were also substrates of EhSir2a suggesting a wide network of epigenetic regulation in the parasite.

Studies on proteins associated with the lysis/ lysogeny decision of bacteriophage lambda: Dr. Pradeep Parrack

The lysis/ lysogeny decision is an important event in the lifecycle of the temperate coliphage lambda. This decision is dependent on a crosstalk among several proteins, belonging both to the virus and the host bacterium (*E. coli*). One such host protein is HflD, which is thought to sequester CII and present it to the *E. coli* metalloprotease HflB. We have demonstrated that HflD also impairs transcription activation by CII by preventing the binding of CII to DNA.

Studies on the bacteria and bacteriophage-specific transcriptional regulators : Dr. Subrata Sau

Investigations on the primary sigma factor (σ^A) of *Staphylococcus aureus* revealed that it exists as a monomer in solution, possesses multiple domains, harbors primarily α -helix and efficiently binds to an *S. aureus* promoter DNA in the presence of core RNA polymerase. While ends of σ^A are flexible in nature, two Trp residues in its DNA binding region are buried. Proteolysis, thermal aggregation, and equilibrium unfolding studies suggest that σ^A is an unstable protein. Core RNA polymerase, however, stabilized σ^A appreciably.

Two repressor genes (namely, *ci* and *cro*) of *Staphylococcus aureus* phage $\phi 11$ are located in the divergent orientation. Promoter of *ci* was identified and mapped. Besides, promoter of *cro* was found to be repressed in the *S. aureus* cells expressing *CI* (the product of *ci*). Interestingly, $\phi 11$ CI showed thermosensitivity at 37°C and above.

Repressor of mycobacteriophage L1 unusually exhibited binding to the 13 bp asymmetric operator DNA. Several mutants of mycobacteriophage L1 repressor have been generated by site-directed mutagenesis. Physicochemical properties and the DNA binding capacity of these mutant repressor proteins are currently being investigated.

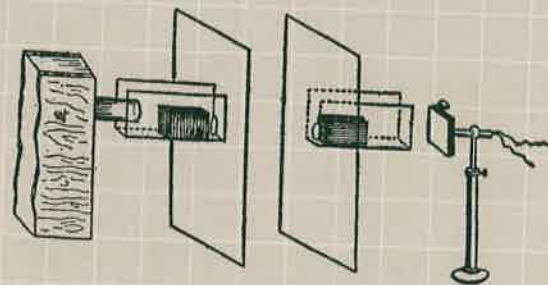
High fidelity chromosome segregation in the budding yeast :
Dr. Pratima Sinha

Sum1p, a transcriptional repressor, is a novel regulator of yeast cytoskeleton:

Work on the novel role of a transcriptional repressor of the yeast *Saccharomyces cerevisiae*, Sum1p, in controlling microtubule dynamics was continued. Further experiments show that Sum1p is also involved in actin cytoskeleton organization. A paper on the role of Sum1p in regulating microtubule stability has been accepted for publication in FEMS Yeast Research.

Spindle length maintenance in S-phase arrested cells requires sister chromatid cohesion :

We have also established sister chromatid cohesion (SCC) requirement in maintaining spindle length during S-phase arrest of cells. This is contrary to the current belief that SCC does not play a role in spindle length maintenance during early S-phase. A manuscript on this work has been communicated.



VI. Development of Systems Biology :

Differential gene expression in *Bordetella pertussis*: Dr. Suman K Banik

Bordetella pertussis, the causative agent for the disease whooping cough, expresses multiple genes when induced with different external signals. To understand the signal transduction pathway in this human pathogen we have adopted computational systems biology approach. The final goal of this project is to explain several experimental results and to make new testable predictions.

MicroRNAs (miRNAs) in *M. tuberculosis* infection : Dr. Joyoti Basu in collaboration with Dr. Manikuntala Kundu

miRNAs play an important role in the immune response including the development and differentiation of immune cells, antibody production, and innate immunity regulation. We have initiated efforts to understand the global regulation of miRNAs by *M. tuberculosis* infecting macrophages.

Interdisciplinary Physics/Systems Biology : Dr. Indrani Bose

Some recent experiments provide significant new knowledge on the molecular constituents and connectivity of the Jasmonate (JA) signaling pathway in plants. The pathway is activated as defense response to a number of stresses like attacks by pests or pathogens and wounding by animals. We have constructed a mathematical model to explain and characterize the transient nature of the JA activity. A number of testable predictions have also been made.

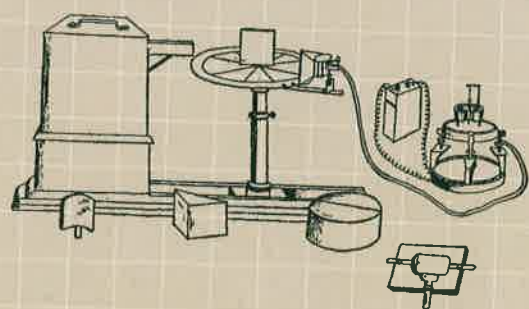
We (In collaboration with Dr. J. Basu and Dr. M. Kundu) have characterized quantitatively the single cell expression levels of all the three key genes, namely, *mprA*, *sigE* and *rel*, in the stringent response pathway of *M. smegmatis* with *gfp* as the reporter. In each case, the GFP distribution was found to be bimodal. We have shown that the distribution of GFP levels is a linear superposition of two distributions: one Gaussian and the other lognormal. We have further obtained evidence for a recently proposed mechanism of bistability based on positive feedback and cell growth retardation due to protein synthesis.

Regulation of the mycobacterial stress response : Dr. Manikuntala Kundu in collaboration with Dr. Indrani Bose, Dr. Joyoti Basu and Dr. Suman Banik

We are continuing efforts to use experimentation along with mathematical modeling to understand the stress response of mycobacteria, focusing on the stringent response regulator Rel, MprAB, a two-component system and the alternate sigma factor SigE. At present, mathematical modeling is being coupled with experimental results to understand the regulation of the sigE promoter under surface stress. In addition, a combination of flow cytometry with mathematical modeling has provided evidence of a mechanism of bistability in rel expression based on positive feedback and cell growth retardation due to protein synthesis.

Understanding the 'sigma-cycle' paradigm in prokaryote : Dr. Jayanta Mukhopadhyay

'Sigma cycle' is a process in which sigma associates with RNAP to orchestrate transcription initiation and then dissociates after the transition to a stable elongation complex. To describe 'sigma cycle' in *E. coli*, three models— no-sigma release model, sigma release model, and stochastic-sigma release model—have been proposed. To study 'sigma cycle' in detail, we plan to determine the model for sigma release in other bacterial systems, e.g. from *B. subtilis* and *M. tuberculosis*.



VII. Basic and Applied Problems in Physical and Environmental Sciences :

Local access of global quantum information : Dr. Somshubhro Bandyopadhyay

One of the principal goals of quantum information theory is to find efficient ways to extract global quantum information stored in orthogonal states of a many-body system by performing local quantum operations on the individual subsystems and communicating via classical channels. We are investigating discrimination of orthogonal quantum states of composite quantum systems under one-way and two-way LOCC protocols. We have shown that any set of orthogonal bipartite quantum states that can be perfectly distinguished by one-way LOCC can be written in a canonical form. We are now investigating local discrimination specific classes of orthogonal states that are local unitarily related with one another (in collaboration with Dr. G. Kar, ISI, Kolkata and Dr. S. Ghosh, IMSc, Chennai).

Entanglement cost of quantum operations : Dr. Somshubhro Bandyopadhyay

Quantum operations on composite systems may not always be implemented by operations on individual subsystems. The reason behind this is the tensor product structure of the Hilbert space of the composite systems and quantum superposition. We are investigating how much entanglement must be consumed in order to implement a generic quantum operation described by a separable superoperator on two qubit systems.

Entanglement in quantum algorithms : Dr. Somshubhro Bandyopadhyay

Quantum entanglement is a critical resource for quantum information processing tasks including quantum computation. The present project investigates the role of many-body entanglement in speed-up of quantum algorithms. This work is being carried out with Kaushik Chakrabarty and Ankan Mallik (4th year B.E. students in the Computer Science Department of Jadavpur University).

Quantum spin systems : Dr. Indrani Bose

Spin systems are ideal candidates for the implementation of quantum information theoretic (QIT) protocols. Recently, a three qubit system consisting of two molecular cluster qubits based on Cr,Ni rings and coupled by an $S = 1/2$ linker ion has been engineered with possible QIT applications in mind. We have studied the entanglement properties of the three qubit system by varying the different parameters of the three-qubit Hamiltonian.

Fractional spinon excitations ($S=1/2$) are the elementary excitations of an antiferromagnetic spin-1/2 chain. The issue of the existence of spinons in higher dimensions is controversial. We have studied spin ladder models and shown that the spinon excitations are confined in bound pairs. The results obtained are in agreement with recent experiments.

Improved Synthesis of 2-Alkyl/aryl-1,8-phenanthrolines and Screening of Condensed Thiazoles for Inhibition of COX-1 and COX-2 : Dr. Manas Chakrabarty

Because of the reported diverse bioactivities of various 1,8-phenanthrolines, an improved synthesis of 2-alkyl/aryl-1,8-phenanthrolines was developed via a PTC-mediated Skraup/Doebner-von Miller Reaction of 5-aminoisoquinoline with α , β -unsaturated aldehydes. The products were unambiguously identified by thorough spectroscopic analyses including 1D and 2D NMR (^1H , ^{13}C) and LR/HR MS data. 2-Substituted thiazoloisoquinolines, thiazoloquinolines and benzobisthiazoles (Annual Report, 2008-'09) were screened for their anti-inflammatory activity by determining their inhibition of COX-1 and COX-2 using naproxen as the standard (in collaboration with Prof. Athina Geronikaki of Aristotle University of Thessaloniki, Thessaloniki, Greece). While only the 2-methylamino derivatives of all three classes showed very good inhibitions of COX-1, only the 2-methylthio and 2-amino derivatives of the benzobisthiazoles displayed cognizable inhibition of COX-2.

Studying the physics of superheated liquids using superheated drop detectors : Dr. Barun K. Chatterjee

The sound emitted during the nucleation of superheated droplets (of a superheated emulsion detector) was recorded, Fourier transformed and subsequently converted to a power spectrum. It was observed that the ratio of the central frequencies of successive peaks agree with that of the oscillating vapour bubble as theorized by Lamb. It was also observed that the modal frequencies of the power spectrum, form distinct distributions for spontaneous, and neutron induced nucleations. Such distributions, for the nucleations induced by different energies gamma rays, are different from the neutron induced nucleations, opening up a possibility of identifying particles from their sound signatures.

Crystal Structure of Cholesteryl Oleyl Carbonate (COC) : a Biomembrane model : Dr. Pradip Das

The crystal structure of COC turns out to be primitive monoclinic, space group Pc, type I monolayer having two molecules per unit cell with parameters: $a = 19.208 \pm 0.007 \text{ \AA}$, $b = 12.817 \pm 0.005 \text{ \AA}$, $c = 9.198 \pm 0.003 \text{ \AA}$ and $\beta = 92.73 \pm 0.03^\circ$. Microstructural parameters such as high isotropic strain and pronounced size anisotropy were observed. A few trivial differences apart, the biomembrane and the COC liquid crystal film share some common structural features, e.g., (1) cholesteryl moieties and lipid or fatty chain segments interacting via non-covalent forces; and (2) existence in cholesteric or fluid-layer smectic phase at/around the physiological temperature. Hence the use of COC in polymer/liquid crystal composite membranes.

Astrophysics of strongly interacting matter : Dr. Sanjay K. Ghosh, Dr. Rajarshi Ray, Dr. Sibaji Raha, Sarbani Majumdar

Quantum Chromodynamics (QCD) is the underlying theory of strong interactions and Neutron stars provide a natural laboratory to test some unique implications of QCD at extreme conditions of very high baryon density. It has been suggested that the true ground state of QCD is strange quark matter, and, consequently, neutron stars should convert to strange quark stars under suitable conditions. We have proposed that this transition may occur via a conversion front. From the surface observation of magnetic field, the presence of a large magnetic field inside Neutron stars is generally assumed. Hence, to understand the complex dynamics of this conversion front it is necessary to solve magnetohydrodynamic (MHD) equations.

The nature of magnetic field inside neutron stars is subject of study as well. It has been shown that the magnetic field near the core may neither be pure prolate nor a pure oblate kind; rather it is expected to be a mixture of prolate and oblate. We have done some studies on the MHD equation in the presence of magnetic field. It has been shown that the nature of the magnetic field has a large effect on the conversion front.

We are also using the effective models to study the QCD phase transition at large chemical potential at small temperature. This situation is not only relevant for neutron star studies; it will also help us to understand the experimental results of FAIR experiment at GSI, Germany.

Atmospheric Science : Dr. Sanjay K. Ghosh, Dr. Sibaji Raha

An extensive aerosol sampling program was conducted in Darjeeling during January-December 2005. Samples were collected using a respirable and a fine dust sampler simultaneously. Ion chromatograph was used to analyze the water soluble ionic species of aerosol. The average concentrations of fine and coarse mode aerosol were found to be $29.5 \pm 20.8 \mu\text{g m}^{-3}$ and $19.6 \pm 11.1 \mu\text{g m}^{-3}$ respectively. Fine mode aerosol dominated during dry seasons and coarse mode during monsoon. Nitrate existed as NH_4NO_3 (fine mode) during winter and as NaNO_3 (coarse mode) during monsoon. Long range transport of dust aerosol from arid regions of western India was observed during premonsoon. The acidity of fine mode aerosol was higher in dry seasons whereas the coarse mode acidity was higher in monsoon. Biomass burning, vehicular emissions and dust particles were the major types of aerosol from local and continental regions whereas sea salt particles were from marine source regions.

Present study, a substantial improvement to the heretofore poor knowledge regarding aerosol chemistry over northeastern Himalayas, would be useful for making control strategies.

Nuclear Physics with Rare Isotope Beams : Dr. Dhruva Gupta

In recent times the focus of nuclear physics has moved towards short-lived exotic nuclei. Major discoveries of unexpected new phenomena have been made such as neutron halos and skins and the modification of magic numbers far from stability. Direct reactions with

exotic beams in inverse kinematics gives access to a wide arena of nuclear structure studies far off stability. Our study of this hitherto unknown field includes elastic/inelastic scattering, few-nucleon transfer and breakup reactions, giant resonances of these loosely bound nuclei.

Low Energy Nuclear Physics : Dr. Dhruva Gupta

The study of the entrance channel dependence of fragment emission yield, helps to decipher different reaction mechanisms (quasi-elastic, deep-inelastic transfer and orbiting, fusion/fission) contributing to fragment emission. Several systems have been studied using heavy ion beams from VECC and BARC-TIFR pelletron. The enhanced yields of fragments indicate the survival of orbiting like process in ^{20}Ne , $^{16}\text{O} + ^{12}\text{C}$ system.

Foundations of Quantum Mechanics and Quantum Information : Dr. Dipankar Home

Using a suitably generated entanglement between the spin and the path variables of a single spin-(1/2) particle (qubit), a protocol has been formulated for transferring this intraparticle hybrid entanglement to an interparticle entanglement between the spin variables of two other spatially separated spin-(1/2) particles which have not interacted with each other during the entire process – this scheme of entanglement swapping demonstrates a hitherto unexplored use of path-spin intraparticle entanglement as a resource.

For spin-1/2 particles, a novel form of quantum contextuality implying path-spin interdependence at the level of subensemble statistics is shown to be a direct consequence of the quantum mechanical formalism – this predicted effect is experimentally testable.

Application of dynamical wave function collapse model in the context of cosmology has been studied by considering the continuous liberation of a species rate of energy arising from the interaction of a fluctuating scalar field with the matter wave function.

Cosmic Ray simulation studies : Dr. Partha S. Joarder, Dr. Sanjay K. Ghosh, Dr. Sibaji Raha

We have studied the low energy hadronic interaction models based on BESS observed cosmic ray proton and antiproton spectra at medium high altitude. Among the three popular low energy interaction models, FLUKA reproduces results of BESS observations on secondary proton spectrum reasonably well over the whole observed energy range, UrQMD works well at relatively higher energies whereas GHEISHA differs significantly from the measured spectrum. Simulated antiproton spectrum with FLUKA exhibits significant deviations from the BESS observation. UrQMD and GHEISHA reproduce the BESS observations within the experimental error.

Solar Plasma Physics : Dr. Partha S. Joarder, Dr. Sanjay K. Ghosh

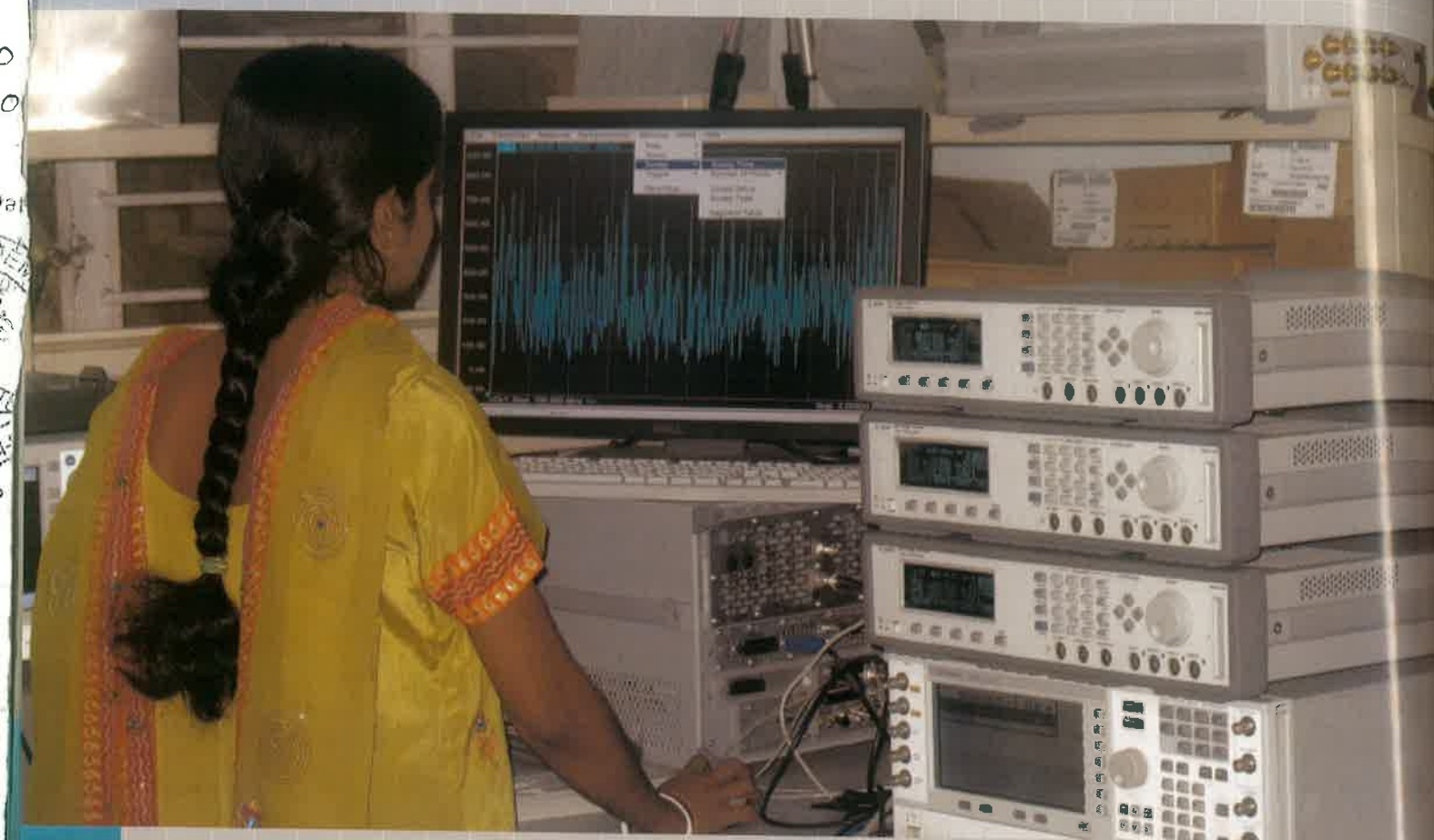
We have studied the characteristics of magnetoacoustic surface waves on the interplanetary directional discontinuities (DDs), the plasma and the magnetic structures of which have been clearly delineated by the WIND and the IMP-8 satellites. The pressure anisotropy of the plasmas on both the sides of the discontinuities have been taken into account. Single fluid, double-polytropic MHD approximation is employed to arrive at the dispersion relation governing various wave-modes on the discontinuities. The magnetosonic modal structure revealed by the dispersion relation is found to be somewhat similar to the modal structure obtained earlier by using the usual adiabatic MHD approximation except the fact that the nature and the existence of the waves now depend on the values of the double-polytropic exponents used for the MHD closure. The properties of the magnetoacoustic waves found in our study may be tested in high resolution, multispacecraft observations such as the ones presently undertaken by the cluster mission. Study of such waves on the interplanetary DDs is important as it may help in correctly identifying the DDs as the tangential (TD), rotational (RD) or other types of discontinuities. Such identification may, in turn, shed some light on the nature of structuring of the interplanetary magnetic field (IMF). Our studies may also help in determining the intrinsic thermodynamic characteristics of the plasma around the interplanetary discontinuities.

Development of software for an augmented millimeterwave high resolution Radar for 2D & 3D Imaging in simulated far field condition at millimetewaves: Dr. Amitabha Mitra, Dr. Samita Saha, Soumendra Singh, Vineet Surana, Ayona Chakraborty and Dr. Sibaji Raha

Every object on the earth/universe possesses reflectivity property on a certain band of electromagnetic wave spectrum. Exploiting this property of material in radio frequency band, in particular, millimeterwave frequencies (30 to 100 GHz), a two-dimensional imaging algorithm has been developed. Presently efforts are on for mapping the material reflectivity in high resolution format (12-15cm) in three-dimensional domain using augmented radar at higher millimeterwave band through data acquisition & processing using various techniques of digital signal processing.

Rain reflectivity measurement under clutter environment at microwaves through design & development of suitable instrumentation radar and related softwares : Dr. Amitabha Mitra, Soumendra Singh, Vineet Surana, Ayona Chakraborty, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha

Rain scattering at higher microwaves & millimeterwave frequencies plays a dominant role in remote sensing and telecommunication disciplines. An instrumentation radar at X-band has been developed as a part of multi-frequency (S to W band) experiment in order to determine radar cross section (RCS) models for various temporally and spatially diversified simulated and natural rain events at outdoor environment at Kolkata. Systematic data acquisition in automated mode from such state-of-the-art technology X-band radar for a rotating object space has been possible through indigenously developed algorithm. The



Pulsed Radar signal characterization study at Radio science Laboratory at CAPSS

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necessary circuitry for the development of radar in other frequency bands along with its related software is under way to acquire large volume of data in order to evolve suitable statistical model of RCS.

Physics of strongly interacting matter : Dr. Rajarshi Ray, Anirban Lahiri, Dr. Sanjay K. Ghosh

Effective models provide a natural laboratory to test some unique implications of Quantum Chromodynamics (QCD)- the underlying theory of strong interactions- at extreme conditions of very high temperature and baryon density. It has been suggested that there are two phase transitions that may arise under such extreme situations. One is a transition to a deconfined state of nuclear matter to quark and gluon plasma. The second is a transition associated with the axial isospin symmetry. We are actively working with the Polyakov loop extended Nambu

Jona-Lasinio model (PNJL) at finite temperature and non-zero baryon, isospin and strangeness chemical potentials. Recently we have studied the extension of the PNJL model with up to six-quark and up to eight-quark interaction term in the NJL Lagrangian. The numerical results for the two interaction Lagrangians differ by about 10% in the quantities of interest that we have computed. These include the susceptibilities of quark number, isospin number, electric charge and strangeness. The specific heat and speed of sound in the plasma have also been computed. A comparison with Lattice QCD data cannot give a clear favor to any one of these Lagrangians.

Measurement of gamma-ray and charged particle flux during the total solar eclipse on July 22, 2009 at NBU, Siliguri : Dr. Swapan K. Saha, Dr. Dhruba Gupta, Dr. Sanjay K. Ghosh, Dr. Sibaji Raha

We carried out an experiment during the total solar eclipse on July 22, 2009 at North Bengal University, Siliguri to measure the flux of g-rays (40 keV – 4 MeV) and charged particles. Our collaborators at TIFR carried out a similar experiment with identical setup at Indore. The g-rays measurement consisted of two large volume NaI detectors. The g-ray spectrum from each detector was recorded in a PC based MCA. The charged particle measurements were done by taking coincidence signals from two plastic scintillator detectors. We placed the detectors, all the required electronics, computers on the roof of the High Energy Cosmic Ray Center, NBU. The experimental site had to be prepared to carry out this experiment outside laboratory conditions. A temporary shelter was erected for this purpose. We also recorded the atmospheric parameters such as temperature, air pressure and humidity during the entire experiment for possible correlations with the g-ray flux measurements. The preliminary analysis shows no variation of flux of charged particles during the eclipse. Rain induced radioactivity needs to be deconvoluted to get the actual variation of g-ray flux during the eclipse.

**Passive Detector Array for Strangelet Search :
Dr. Swapan K. Saha, Dr. Dhruba Gupta and Dr. Sibaji Raha**

We are involved in the search for strangelets (exotic nuclear fragments of unusual charge to mass ratio) using polyethylene terephthalate (PET) passive detectors, in installing PET detectors at several different altitudes (Sandakphu and Hanle) and related lab developments. A visit to Hanle (altitude 4500 m) was made to review and select the appropriate site for the passive detector array. We also observed very low energy (~ 1 MeV/A) Coulomb fission of nuclei by exposing the PET detectors to a ^{252}Cf fission source. An experiment to carry out precise calibration of PET at the ISOLDE facility of CERN, Switzerland, has been scheduled.

**Active Detector Array for Cosmic Ray Studies :
Dr. Swapan K. Saha, Dr. Dhruba Gupta and Dr. Sibaji Raha**

We are building an active detector array at Darjeeling to study Ultra High Energy cosmic rays by measuring air showers. We employ fast plastic scintillator and PMT combination to

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detect shower particles. A CAMAC based data acquisition (DAQ) system would be used. The software for the DAQ, written in standard GNU/Linux and interfaced with ROOT for plotting the data, has been developed by us with collaboration from CRL, TIFR. The software has been tested with a test set up. Gain testing and grouping of plastic scintillator blocks, to be used for the air shower array at Darjeeling, have also been carried out.

Formation of electron dimer molecule in semiconductor quantum dots : Dr. Achintya Singha in collaboration with Dr. V. Pellegrini, SNS, NEST and Prof. A. Pinczuk, Col. Univ. NY

Electrons confined to semiconductor quantum dots (QDs) have novel ground and excited states that manifest Coulomb interactions at the nanoscale. The QDs with low electron density are of particular interest since the breakdown of the Fock-Darwin scheme leads to correlated configurations that reveal the impact of fundamental electron interactions. By employing inelastic light scattering we observe the low-lying collective excitations of a molecular dimer formed by two electrons in a GaAs semiconductor quantum dot in which the number of confined electrons is tuned by optical illumination.

Raman study on semiconductor nanowires : Dr. Achintya Singha in collaboration with Dr. L. Sorba and Dr. V. Pellegrini, SNS, NEST, Pisa and Dr. A. Roy, IIT Kharagpur, India

The InAs nanowires (NWs) have been synthesised by chemical beam epitaxy (CBE) technique. Micro-Raman spectroscopy is employed to know the detailed structure of the nanowires. The Polarization-dependent Raman scattering measurement on single nanowire reveals that it composed of both wurtzite and zinc blend phase. The study of phonon confinement effects is under progress.

Effects of Rain Drop-size-distribution (DSD) on Earth-space Radio Path at Darjeeling : Soumendra Singh, Dr. Amitabha Mitra, Dr. Sanjay K Ghosh and Dr. Sibaji Raha

It is well known that the water in the atmosphere in its different phases imposes natural restrictions to the reception of different radio signals from the satellites and distant extraterrestrial objects. To understand its physics, efforts are on to evolve suitable rain model through collection of round the clock data from different instruments, e.g., micro-rain radar (24GHz), Micro-pulse Lidar (532nm), Photometers operating in UVA, UVB & visible bands and microwave Dual-frequency Radiometers (23 & 31GHz) together with other related instruments at a high altitude station, Darjeeling. Data analysis for surface rain record along with that of



Dual Frequency Radiometer

simultaneous vertical rain distribution during 2009 & 2010 show a Log normal trend for rain DSD as it follows a good correlation except at an altitude near boundary layer, where anomaly is observed. Detailed analysis of such data is under processing to explain such anomaly.



X-Ray Powder Diffractometer

Dielectric relaxation and relaxor behaviour in complex perovskite oxides : Dr. T. P. Sinha

The frequency dependent dielectric relaxation (a conduction process) in complex perovskite oxides (such as $\text{In}(\text{Mg}_{0.5}\text{Ti}_{0.5})\text{O}_3$, $\text{BaMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$ etc.) have been investigated at a wide temperature range. The scaling behaviour of imaginary parts of complex dielectric constant, impedance or electric modulus indicates that the relaxation describes the same mechanism at different temperatures. The frequency dependent conductivity spectra obey the power law. Ferroelectric/relaxor properties of various complex perovskite oxides such as Bi doped $\text{BaTi}_{0.75}\text{Zr}_{0.25}\text{O}_3$, $\text{Pb}_{(1-x)}\text{Ba}_x(\text{Fe}_{1/2}\text{Ta}_{1/2})\text{O}_3$ etc. have also been investigated.



Ac-Impedance analyzer with low and high temperature setup

Impedance spectroscopy study of II-VI nano-semiconductor : Dr. T. P. Sinha

Nanoparticles of II-VI semiconductors such as ZnO, CdS etc. have been synthesized by soft chemical method. The particle size is found to be less than 50 nm. The impedance spectroscopy is applied to study the electrical behaviours of these materials in a wide frequency and temperature range.

Publications

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Microbiology Department

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Physics Department

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Symposium Publications :

1. Chatterjee A, Adak A, Ghosh S K, Mitra A, Raha S and Singh A K (2010) Diurnal Aerosol Optical Depth during North-East Monsoon over Darjeeling, a High Altitude Observation site at North-Eastern Himalayas, India, Proc. of IASTA-2010 Conference on Aerosols & Clouds : Climate Change Perspectives, March 24-26, 2010 at Darjeeling, India.
2. Chatterjee A, Adak A, Ghosh S K, Mitra A, Raha S and Singh A K (2010) Spectral Dependence of Angstrom Wavelength Exponent on Dust and Anthropogenic Aerosol over Darjeeling, a High Altitude Observation Site at North-Eastern Himalayas, India, Proc. of IASTA-2010 Conference on Aerosols & Clouds : Climate Change Perspectives, March 24-26, 2010 at Darjeeling, India.
3. Johnsen R and Chatterjee B K (2009) Separation of binary gas mixtures flowing through small orifices, Proc. DAMOP 2009 Conference (Charlottesville, VA, USA), T1.00006.
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Plant Molecular & Cellular Genetics Section

1. Bhattacharya S, Das M, Ghosh J S and Pal A (2010) Morphological and molecular characterization of *Thamnocalamus spathiflorus* subsp. *spathiflorus* at population level, Plant Systematics and Evolution, 282,13-20. DOI: 10.1007/s00606-008-0092-1.
2. Chakraborti D, Sarkar A, Mondal HA and Das S (2009) Tissue specific expression of potent insecticidal *Allium sativum* leaf agglutinin (ASAL) in important pulse crop, chickpea (*Cicer arietinum* L.) to resist the phloem feeding *Aphis craccivora*; Transgenic Research, 18, 529-544.
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9. Majumder A L, Sengupta S and Goswami L (2010) Osmolyte Regulation in Abiotic Stress, In Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation (Eds. Ashwani Pareek, Sudhir K. Sopory, Hans J. Bohnert and Govindjee), Springer, Dordrecht, The Netherlands, 16, 349-370.
10. Mishra K, Chakraborty D, Pal A and Dey N (2010) In vitro interaction of quassin and neo-quassin with artemisinin against malaria-parasite *Plasmodium falciparum*, Experimental Parasitology, 124, 421-427.
11. Ray S, Patra B, Das-Chatterjee A, Ganguli A and Majumder A L (2010) Identification and organization of chloroplastic and cytosolic L-myo-inositol 1-phosphate synthase coding gene(s) in *Oryza sativa*: Comparison with the wild halophytic rice, *Porteresia coarctata*; Planta, 231, 1211-1227.
12. Sengupta S, Chakraborti D, Mondal H A and Das S (2010) Selectable antibiotic resistance marker gene-free transgenic rice harbouring the garlic leaf lectin gene exhibits resistance to sap-sucking plant hoppers, Plant Cell Reports, 29, 261-271.
13. Sengupta S and Majumder A L (2010) *Porteresia coarctata* (Roxb.) Tateoka, a wild rice: A potential model for studying salt-stress biology in rice; Plant, Cell and Environment, 33, 526-542.
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Library

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4. Chakraborty A K (2010) Digital library system : with reference to consortia; In INDEST-AICTE workshop and seventh Annual meet, 6-18.
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Bose Institute :
Falta campus

Students Awarded With Ph.D. Degree

Name of the Student
(University/Year)

Title of thesis

Supervisor

Biochemistry Department

Mainak Guha Roy (J.U., 2009)	Protein-protein interaction: an analysis of structure, function, evolutionary conservation and binding energetics	Dr. P. Chakrabarti
Dipak Manna (J.U., 2010)	Identification of active principles from Medicinal plants against <i>Entamoeba histolytica</i>	Dr. A. Lohia
Somasri Dam (J.U., 2010)	Molecular analysis of proteins regulating epigenetic mechanism in <i>Entamoeba histolytica</i>	Dr. A. Lohia
Shankar Prasad Das (J.U. 2009)	Characterization of the role of Chl1/Mcm12 protein in maintaining genome integrity in the budding yeast <i>Saccharomyces cerevisiae</i> .	Dr. P. Sinha
Soumitra Sau (J.U. 2009)	Identification and characterization of budding yeast kinetochore components for their roles in centromere clustering.	Dr. P. Sinha
Pabitra Kumar Parua (J.U., 2009)	Studies on Proteins Involved in the Lysis-Lysogenic Switching of Bacteriophage λ .	Dr. P. Parrack
Palas K Chanda (J.U., 2009)	Cloning and characterization of the heat shock- and cold shock-inducible promoters/ genes of <i>Staphylococcus aureus</i> and their biotechnological applications	Dr. S. Sau

Botany Department

Moumita Gangopadhyay (J.U., 2009)	Studies on a rare medicinal plant <i>Plumbago indica</i> (syn rosea) Linn. : rapid multiplication, conservation and establishment of an in vitro source of plumbagin by hairy root culture.	Dr. S. Bhattacharya
Jyotshna Mandal (J.U., 2009)	Aeropalynology of southern Calcutta: evaluation of atmospheric pollen counts, Biochemical and clinico-immunological studies on allergenic pollen	Dr. S. Gupta Bhattacharya
Shaonli Das (J.U., 2009)	Interpreting atmospheric fungal aerosol counts in occupational environment in West Bengal, India, in relation to respiratory allergy	Dr. S. Gupta Bhattacharya

Name of the Student (University/Year)	Title of thesis	Supervisor
Mitu De (J.U., 2010)	Rice Landraces of West Bengal: Genetic Diversity and DNA Fingerprinting	Dr. T. K. Ghose

Chemistry Department

Randhir Kumar Sinha (J.U., 2009)	Experimental Studies of molecular structure versus mesophase sequence, induction and stability in cholesterol esters and their binary mixtures	Dr. P. Das
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Division of Molecular Medicine

Mrinal Kumar Sarkar (J.U., 2010)	Studies on the Antioxidant Role of a Macromolecule from the Herb Phyllanthus niruri.	Dr. P. C. Sil
Gouri Sankar Sen (J.U., 2009)	Role of curcumin in combinatorial cancer therapy: A Mechanistic study	Dr. G. Sa
Shuvomoy Banerjee (J.U., 2010)	Induction of cell cycle phase specific cancer cell apoptosis by curcumin: A mechanistic approach	Dr. G. Sa
Juni Chakraborty (J.U., 2010)	Induction of differentiation and apoptosis by curcumin: A possible strategy in the treatment of adult acute myelogenous leukemia"	Dr. G. Sa
Chinmoy Mukherjee (J.U., 2009)	Design and synthesis of carbohydrate based Biodynamic molecules	Dr. A. K. Misra
Pintu Kumar Mandal (J.U., 2009)	Synthesis of oligosaccharides of biological importance	Dr. A. K. Misra

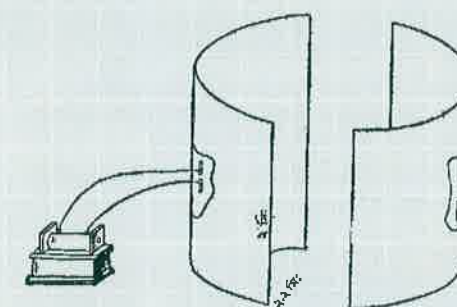
Physics Department

Indranath Chaudhuri (C.U., 2009)	Dynamics and steady state properties of self-organised systems	Dr. I. Bose
Bhaswar Ghosh (C.U., 2010)	Network: structure, function and evolution	Dr. I. Bose

Name of the Student (University/Year)	Title of thesis	Supervisor
Amit Tribedi (C.U., 2010)	Interacting spin systems: some novel features and phenomena	Dr. I. Bose
Rupa Sarkar (C.U., 2009)	Determination of nucleation efficiency of polydisperse superheated emulsions using an active device method	Dr. B. K. Chatterjee
Alo Dutta (C.U., 2009)	Dielectric and structural properties of ordered and disordered oxides	Dr. T. P. Sinha
Tamal Mukherjee (J.U., 2009)	Study of Strongly Interacting Matter Under Extreme Conditions	Dr. S. K. Ghosh
Ritam Mallick (J.U., 2010)	Nonequilibrium phenomena in high energy nuclear physics and cosmology	Dr. S. K. Ghosh

Plant Molecular & Cellular Genetics Section

Sumanti Gupta (J.U., 2010)	An approach towards understanding of resistance in chickpea (<i>Cicer arietinum</i> L.) against <i>Fusarium oxysporum</i> f.sp.ciceris	Dr. S. Das
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Grants-in-aid Schemes

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
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Scheme funded by Aeronautical Development Agency(ADA), Ministry of Defence

Dr. S. Raha Principal Coordinator Dr. A. Mitra Investigator-in-Charge	Millimeterwave Scattering(MWS-Phase-III)- Development of Radar Reflectivity Measurement & Diagnostic Imaging Facility at Multifrequency Band June 2006- June 2010	CAPSS/ Physics
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Schemes funded by CSIR

Dr. P. K. Chakrabarty	Use of plant growth promoting rhizobacteria to control bacterial wilt of tomato	Acharya J.C. Bose Biotechnology Innovation Centre
Dr S. K. Datta	Dehydration of flowers and foliage and floral craft & their commercialization	Acharya J.C. Bose Biotechnology Innovation Centre
Dr. G. Basu	Mechanism of substrate recognition by truncated glutamyl tRNA synthetase (01/07/2006 - 01/07/2009)	Biophysics
Dr. D. N. Sengupta (PI) Dr. P. C. Sil (Co-PI)	The Molecular Analysis of the Expression of the Gene for Sucrose Phosphate Synthase (SPS) in Banana Fruit Ripening in Different cultivars. (February,2008 to 2011)	Botany / Division of Molecular Medicine
Dr. J. Basu (PI)	Functional analysis of the interplay between the gene products encoded by an operon harboring serine/threonine kinase and phosphatase and its implications in mycobacterial physiology (1.1.2008-31.1.2011)	Chemistry
Dr. K. P. Das (PI)	Role of N-terminal region of α -crystallin in its structure, function and stability- a biophysical and site directed truncation study	Chemistry
Dr. P. C. Sen	Structural and Functional Characterization of a Bi-Functional Protein from Goat Spermatozoa	Division of Molecular Medicine

GRANTS-IN-AID SCHEMES

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
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Dr. S. Majumdar	Anti-leishmanial effect of mycobacterial glycolipids through immunomodulation : Strategies involving modulation of chemokine receptors (2007-2010)	Division of Molecular Medicine
Dr. N. Mandal	Isolation and Identification of natural antioxidant and anticancer product in <i>Spondias pinnata</i>	Division of Molecular Medicine
Dr. G. Sa (PI) Dr. T. Das (Co-PI)	Molecular mechanisms of immune evasion by tumor: Role of curcumin in ameliorating dendritic and T-regulator cell-mediated immune dysfunction (01.02.2010-31.01.2013)	Division of Molecular Medicine
Dr. S. R. Sikdar	Screening of aphid tolerant <i>Brassica juncea</i> limited disomic chromosome addition lines from selfed backcross progenies of the <i>Rorippobrassica</i> somatic hybrid (<i>Rorippa indica</i> + <i>Brassica juncea</i>)	PMCG

Scheme funded by CSIR NMITLI

Dr. S. Das	Novel approaches for production of hybrid seeds with characterization of improved insect resistance and higher yield.	PMCG
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Scheme funded by CCRAS, Dept. of AYUSH, Ministry of Health & Family Welfare, Govt. of India

Dr. N. Mandal	In vitro study of the antioxidant, iron chelating and DNA protective properties of medicinal plants, their formulations and usefulness to combat cancer (2008- 2010)	Division of Molecular Medicine
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Scheme funded by CCRH

Dr. T. Das (PI) Dr. G. Sa (Co-PI)	Role of homeopathic medicine in cancer regression and rejuvenation of depressed immune system: A mechanistic study (18.01.2008-17.01.2011)	Division of Molecular Medicine
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Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Schemes funded by DAE		
Dr. S. Sau (PI) Dr. T. K. Dutta (Co-PI)	Studies on the repressor and its cognate operators/promoters of temperate <i>Staphylococcus Entamoeba histolytica</i> aureus phage f 11 and development of a high expression vector for staphylococcal systems (started on 22.02.08)	Biochemistry / Microbiology
Dr. J. Basu (PI) Dr. M. Kundu	Molecular analysis of mycobacteria-induced MMP9 production in macrophage (07.08.2006-06.08.2009)	Chemistry
Dr. P. C. Sil	Further characterization of the Cl-protein from <i>Cajanus indicus</i> L: Mechanism of protective action in organ pathophysiology	Division of Molecular Medicine
Dr. S. Majumdar Dr. Nisith Pal	Signal Transduction mechanism during host-pathogen interaction: special emphasis on the changes in Th1-Th2 cytokine response in macrophages from different age groups infected with <i>M.tuberculosis</i> . Collaborative grant. (2009-2011)	Division of Molecular Medicine

Schemes funded by DBT

Dr. S. K. Datta	Employment Generation Utilizing Unutilized Rural Flora for Preparation of Value Added Products Using Dehydration Technique	Acharya J.C. Bose Biotechnology Innovation Centre
Dr. P. Sinha	Regulation of phagocytosis, cell division and motility in <i>Entamoeba</i>	Biochemistry <i>histolytica</i>
Dr. T. C. Ghosh	Evolutionary studies of duplicated genes in protein-protein interaction network of different organisms	Bioinformatic Centre
Dr. D. N. Sengupta Dr. P. C. Sil	Mapping the binding of Trans-acting factors on the upstream and promoter activity analysis of ACS2 and ACS4 genes in Fruits of wild type and mutants followed by the cloning of those trans-acting factors	Botany / Division of Molecular Medicine

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Dr. J. Basu (PI) Dr. M. Kundu	Mechanisms of modulation of host cell signaling by RDI-encoded proteins of <i>Mycobacteria</i> (16.11.2005-15.05.2009)	Chemistry
Dr. J. Basu (PI) Dr. I. Bose Dr. K. P. Das Dr. M. Kundu	Multi faceted approaches towards characterizing potential drug targets in the cell division and stress response pathways in <i>Mycobacterium tuberculosis</i> (27.10.2006-26.10.2009)	Chemistry
Dr. J. Basu (PI) Dr. M. Kundu	Understanding the mechanisms underlying mycobacterial lipoarabinomannan mediated inhibition of macrophage apoptosis (06.12.2009-05.12.2012)	Chemistry
Dr. M. Kundu (PI) Dr. J. Basu	Polyphosphate kinase and its role in mycobacterial physiology (1.1.2009-31.12.2011)	Chemistry
Dr. S. Majumdar	CD40 and Toll like receptors (TLR) at the interface of <i>Mycobacterium w</i> (M. w) and macrophage interaction: Probing the mechanism of action of M.w using <i>Leishmaniasis</i> as a model (2006-2010)	Division of Molecular Medicine
Dr. S. Majumdar	Effect of gene silencing on the modulation of cell Signaling mechanisms during the early phase of <i>Leishmania donovani</i> infection (2006-2010)	Division of Molecular Medicine
Dr. N. Mandal	Disease resistance in giant black tiger shrimp, <i>Penaeus monodon</i>	Division of Molecular Medicine
Dr. T. K. Dutta (PI)	Molecular characterization of novel catabolic genes and enzymes involved in a distinct metabolic pathway in the assimilation of phenanthrene	Microbiology
Dr. A. N. Lahiri Majumder (PI) Dr. D. N. Sengupta (Co-PI)	Novel genes and their regulatory elements for salt tolerance from the wild halophytic rice <i>Porteresia coarctata</i> : Introgression into cultivated rice.	PMCG/ Botany
Dr. S. Das (Coordinator & PI) Dr. S. R. Sikdar (Co-P.I.)	Programme Support on 'Biotic stress in Plants: A concerted approach based on functional genomic, proteomic and transgenic techniques'.	PMCG

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Dr. A. Pal (PI) Dr. K. P. Das (Co-PI) Dr. S. Das (Programme Coordinator)	Identification of effector gene/proteins implicated in resistance for yellow mosaic disease through genomic and proteomic approaches.	PMCG/ Chemistry
Dr. S. Das (PI) Dr. S. R. Sikdar (Co-PI)	A transgenic approach to develop aphid resistant <i>Brassica juncea</i> plant types and their field evaluation.	PMCG
Dr. S. Das	Study of the interaction between the receptor protein(s) isolated from <i>Helicoverpa armigera</i> and the CryIAC toxin coded by <i>Bacillus thuringiensis</i> through biochemical and bioinformatic approach.	PMCG
Dr. P. Kundu (PI) Dr. S. Das (Co-PI)	Regulation of microRNA transcription and biogenesis by fungal-stress in tomato	PMCG

Scheme funded by DRDO, Ministry of Defence

Dr. S. Raha Principal Coordinator Dr. A. Mitra Dr. S. K. Ghosh Co-Investigator	Studies on Microwave Scattering(SMS) (Feb 2007- Feb 2011) Investigator-in-Charge	CAPSS / Physics
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Scheme funded by DST

P. Chakrabarti	J.C. Bose National Fellowship	Biochemistry
Dr. G. Basu	Analysis and design of peptides with cis peptide bonds: Pro-Pro-Xaa sequence motifs (01/04/2009 - 31/03/2012)	Biophysics
Dr. J. Basu (PI) Dr. M. Kundu	Dissection of the pathway of innate immune subversion by the early secreted antigen-6 (ESAT-6) of <i>Mycobacterium tuberculosis</i> (03.12.2009-02.12.2012)	Chemistry

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Dr. T. Das (PI) Dr. G. Sa (Co-PI)	Evaluation of p53-dependent and independent signalings in theaflavin-induced human breast cancer cells (18.01.2008-17.01.2011)	Division of Molecular Medicine
Dr. T. P. Sinha	Dielectric relaxation in complex perovskite oxides	Physics
Dr. A. Pal (PI) Dr. K. P. Das (Co-PI)	A proteomic approach to identify the proteins involved in in vitro differentiation of <i>Vigna radiata</i>	PMCG/ Chemistry
Dr. N. Dey (PI) Dr. A. Pal (Co-PI)	Bioprospecting of novel gene/s and promoter/s useful for better bamboo-fiber-based merchandise production	ILS, Bhubaneswar/ PMCG

Schemes funded by DST under IRHPA, Govt. of India

Dr. S. Raha Principal Investigator	Centre for Astroparticle Physics and Space Science - a National Facility, Bose Institute.	CAPSS / Physics
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Scheme funded by DST, SERC

Dr. P. Sinha	Identifying proteins that determine the function of novel kinesins from <i>Entamoeba histolytica</i>	Biochemistry
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Scheme funded by DST : Ramanna Research Fellowship

Dr. A. K. Misra	Synthesis of heptasaccharide motifs found in the cell-wall of <i>Mycobacterium gordonae</i> towards the preparation of carbohydrate vaccines against <i>Mycobacteria</i> " (01.02.2007 to 31.01.2010) (The project has been started in Central Drug Research Institute, Lucknow and has been transferred to Bose Institute since October 03, 2008)	Division of Molecular Medicine
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Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
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Scheme funded by ICMR (Division of Basic Medical Sciences)

Dr. S. Sen-Mandi	Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants from Eastern and North Eastern India has been established at Bose Institute. In collaboration with Manipur University (MU) and Botanical Survey of India (BSI)	Botany
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Schemes funded by ICMR

Dr. J. Basu (PI) Dr. M Kundu	Molecular identification of potential drug targets of Mycobacterium tuberculosis (25.6.2007-24.6.2010)	Chemistry
Dr. M. Kundu (PI) Dr. J. Basu	Mechanism of activation of the transcription factor Sp1 and modulation of Sp1 regulated genes by the gastric pathogen Helicobacter pylori (1.1.2007-31.12.2010)	Chemistry
Dr. G. Sa (PI) Dr. T. Das (Co-PI)	Molecular Regulation of cell growth and cell death: An approach to control cancer/aging by cellular engineering (01.04.2006-31.03.2010)	Division of Molecular Medicine

Scheme funded by Indo Swiss Collaboration in Biotechnology

Dr. S. Das (PI)	Expression of insecticidal protein in chickpea (Cicer arietinum L.) in order to develop resistance to important pests, Aphis craccivora and Helicoverpa armigera.	PMCG
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Scheme funded by Institute of Biodiversity and Sustainable Development (IBSD)

Dr. S. Sen-Mandi	Memorandum of Understanding (MOU) – Collaborative arrangement will be borne by between Institute of Biodiversity and Sustainable Development (IBSD) and Bose Institute	Botany
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Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
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Scheme funded by Ministry of Earth Science (MoES) through OASTC, Berhampur University

Dr. N. Mandal	Study of shrimp Genome: Disease resistant DNA markers of Penaeus monodon	Division of Molecular Medicine
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Scheme funded by Ministry of Environment & Forests (MOEF)

Dr. T. K. Dutta (PI)	Development of a reporter strain to monitor toxic and/or carcinogenic polycyclic aromatic hydrocarbons (PAHs) in the environment	Microbiology
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Scheme funded by Rashtriya Krishi Vikas Yojana

Dr. T. K. Ghose (Co-PI)	Promotion of Bengal Aromatic Rice through improved production and processing system	Botany
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Scheme funded by NAIP

Dr. D. Basu (PI) Dr. S. Das (Co-PI) Dr. S. R. Sikdar (Co-PI)	Molecular tools for exploitation of heterosis, yield and oil quality in sesame	Botany/ PMCG
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Scheme guide for the Department of Library & Information Science, Kolkata

Dr. A. K. Chakraborty	"Library Consortia : Trends and Development" — M.Phil.	Library
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Scheme Funded by DST under PROBE program

Dr. Sanjay K Ghosh	Orography & Local Weather in Eastern Himalayas	Physics/CAPSS
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Scheme Funded by Indo-French Centre for the Promotion of Advanced Research

Dr. P. Chakrabarti	Analysis of Protein flexibility in biological recognition	Biochemistry
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Participation in Conferences/Symposia/Workshops & Invited Talks delivered at various organizations

Dr. P. Chakrabarti (Biochemistry) presented papers/talked at (i) Frontiers in Chemical Biology at IISc and JNCASR, Bangalore, July 2-6, 2009; (ii) Training Programme on Cheminformatics and Computer-aided Drug Designing at NEIST, Jorhat, August 18-20, 2009; (iii) Joint Conference of the Asian Crystallographic Association and Chinese Crystallography Society, AsCA'09, Beijing, China, October 22-25, 2009; (iv) the 2nd Platinum Jubilee Meeting of the Indian Academy of Science, Bangalore, November 12-14, 2009; (v) Platinum Jubilee Meeting of the Indian National Science Academy, Kolkata, December 7-10, 2009; (vi) Annual Meeting of the National Academy of Science, Kolkata, December 14-17, 2009; (vii) Guha Research Conference, Mangalore, December 21-24, 2009; (viii) the Eighth Asia-Pacific Bioinformatics Conference APBC2010, Bangalore, January 18-21, 2010; (ix) the 35th Mahabaleswar Seminar on Evolution of Molecular Function and Principles of Protein Design at Mahabaleswar, February 21-22, 2010.

Participation in conferences by Dr. P. Chakrabarti's group member (Biochemistry) Dr. T. Chatterjee, D. Mukherjee and Aritrika Pal attended the 50 Years of Discovery of Cholera Toxin: A Tribute to S N De, Kolkata, October 25-27, 2009; D. Chakraborty attended the International Conference on Physics Biology Interface (ICPBI-2009), SINP, Kolkata, December 13-16, 2009; Arumay Pal visited (during October 10 to December 10, 2009) and gave a talk at University of Manchester, UK; S. Dey attended the CAPRI – 4th Evaluation Meeting, Barcelona, Spain, December 9-11, 2009; S. Chakraborti attended IONSAT-2010, IIT Bombay, February 16-20, 2010; Aritrika Pal attended the Workshop on CCP4 Software for Macromolecular Xray Crystallography, New Delhi, February 15-19, 2010; D. Chakraborty attended the 35th Mahabaleswar Seminar on Evolution of Molecular Function and Principles of Protein Design at Mahabaleswar, February 21-22, 2010.

Dr. R. Chattopadhyaya (Biochemistry) presented two posters at the 16th Conversation held during June 16-20, 2009 held at the State University of New York, Albany, New York on the protease digestion studies of lambda cI repressor and RecA-mediated digestion of the same protein.

Dr. A. Lohia (Biochemistry) was an invited speaker at "Molecular Motors, Tracks and Transport" 23rd-28th January 2010, Pondicherry; delivered talk on Genetic heterogeneity in *Entamoeba histolytica*, IISc Bangalore, September 2009.

Dr. P. Parrack (Biochemistry) participated in the Guha Research Conference held at Mangalore, Karnataka, December 21-24, 2009; attended the 13th Transcription Assembly Meeting at JNU, New Delhi (February 26-28, 2010) and delivered an invited talk entitled "The effect of host protein HflD on the function of λ CII".

Dr. P. Sinha (Biochemistry) delivered a talk in an International Conference "The budding yeast protein Sum1p is a novel regulator of microtubule assembly" on the Biology of Yeasts and Filamentous Fungi (BYFF) Dec.11-14, 2009, held at Centre of Cellular and Molecular Biology, Hyderabad; delivered the talk 'Sum1p, a transcriptional repressor that associates with histone deacetylases, regulates microtubule assembly in the budding yeast' on Feb 9, 2010, IMTECH, Chandigarh.

Dr. T. C. Ghosh (Bioinformatics) participated in a workshop on Bioinformatics organized by Assam Agricultural University, Guwahati, February 2010; workshop and symposium on 'Molecular Evolution' organized by Bioinformatics Centre, North Bengal University, February 2010; in a workshop on 'Application of Data Mining Techniques in Bioinformatics' organized by National Institute of Technology Rourkela, Orissa, December 2009; in a workshop on "Genome analysis" organized by BIF centre at NEIST, Jorhat, Assam, December 2009.

Dr. G. Basu (Biophysics) delivered talks at in the Institute of Protein Research (Osaka, Japan) on "Electrostatic discrimination between cognate and non-cognate partners in Biology", May 28, 2010; at in the Tokyo University (Tokyo, Japan) on Discrimination of tRNA^{Gln} by bacterial glutamyl-tRNA synthetases, June 3, 2010; and at in the Japanese Atomic Energy Research Institute (Kyoto, Japan) "Biological role and functional control of anticancer drug binding sites in tubulin: Insights from sequence analysis and site-directed mutagenesis", June 9, 2010.

Dr. S. Bhattacharya (Botany) visited abroad as invited speaker and attended seminar on "Bioactives : New Production Technologies" held at 238th American Chemical Society (Division of Food Chemistry) Meeting and exposition, Washington DC, USA, August 16-20, 2009 and delivered lecture on "In vitro culture of roots for production of bioactive compounds".

Dr. S. Gupta Bhattacharya (Botany) participated and chaired a session in the National Conference on 'Biodiversity & Natural Resource Utilization' from 14-16th March 2010 at the Dept. of Botany, Visva-Bharati University, Santiniketan.

Mr. Himadri Serkhar Chakraborty (Botany) attended the 43rd National Conference of Indian College of Allergy, Asthma & Applied Immunology from 1-4th October 2009, at Government Medical College & Hospital, Chandigarh; presented paper on "Aerobiological & Allergic Significance of the outdoor fungal aerosol in suburbia near Kolkata"; attended "National Conference on Biodiversity & Natural Resource Utilization' from 14-16th March 2010 at Dept. of Botany, Visva-Bharati University, Santiniketan; presented a paper on "Aeromycological diversity in two different regions of Kolkata and their seasonal variation".

Dr. Gaurab Gangopadhyay (Botany) participated in DBT, Govt. of India and Center of Excellence in Genomics (CEG) sponsored Workshop entitled "Application of Genomics Technologies in Plant Breeding" held during 16-27 November 2009 at the ICRISAT (International Crop Research Institute for the Semi Arid Tropics) Campus at Patancheru, Greater Hyderabad, India.

Dr. T. K. Ghose (Botany) was an active participant in the Integrated MSc-PhD programme in Plant Molecular Biology and Biotechnology; he was the Coordinator, Plant Sciences in the NESST BASE during May 14th- 15th 2010 and the North East Teachers Training in Basic Sciences

Dr. S. Sen Mandi (Botany) delivered four Summer School lectures for B. Sc (Hons) student on (i) "Metabolomics to Functional Genomics: Identifying a common genetic control for vigour and longevity of rice seed"; (ii) "Plant Molecular Markers"; (iii) "UV Damage and Repair in Plants"; (iv) "UV defense in plants" at Botany Department (Biotechnology Section) NEHU, Shillong, 20th - 22nd May, 2009. Delivered lecture on "Activities of the Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants from Eastern and North Eastern India at Bose Institute" at Department of Biotechnology, NEHU, Shillong, 22nd May, 2009; lecture on "Activities of the Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants from Eastern and North Eastern India at Bose Institute" delivered at Dept. of Biotechnology, Gauhati University, Assam, 25th May 2009; delivered invited lecture on molecular characterization of plants at Institute of Bioresources and Sustainable Development (IBSD), Imphal, Manipur, 28th August, 2009; delivered invited lecture on DNA Fingerprinting of Ayurvedic Drugs at Shri B. M. Kankanawadi Ayurveda Mahavidyalaya, Belgaum, Karnataka 8th September, 2009; delivered invited lecture on Trait related DNA marker in plants at the symposium on plant Biodiversity, Nanotechnology and Food Security at Indian Science News Association (ISNA), Acharya Prafulla Chandra Road, Kolkata, 25th February 2010; delivered invited lecture on Identifying a common DNA marker and associated gene for vigour and viability of rice seed at the National Science Day seminar of the Science Association of Bengal, Jadavpur University Campus, 27th February, 2010; An MOU has been established between Institute of Biodiversity and Sustainable Development (IBSD), Manipur and Bose Institute for hands-on-training to their young scientists on plant DNA fingerprinting techniques.

Dr. P. K. Saha (Botany) (i) acted a member of the Advisory Board in the National Workshop for College Teachers on DNA isolation Sponsored by UGC and organized by Scottish Church, Kolkata held during May 5-6, 2009; (ii) delivered, Prof. S. M. Memorial Lecture on Seed Germination and Genotyping Organized by The Botanical Society of Bengal & T. M. Das Foundation for Development of Life Sciences, held at the Department of Botany, Calcutta University on 17th June, 2009; (iii) participated in the National Seminar on Silver Jubilee Symposium organized by Plant Physiology Forum and Department of Botany, Viswa Bharati held at Santiniketan on August 2, 2010; (iv) participated in the Seventy-Ninth Annual Session and National Symposium on "Science and Technology and the Young", organized by The National Academy of Sciences, India, held at R.K. Mission, Kolkata during December 14-17, 2009; (v) participated in the National Symposium on "Angiosperm Taxonomy" organized by

The Botanical Society of Bengal & Department of Botany, Calcutta University, held on 9th January, 2010; (vi) participated in the National Symposium on "New Perspective in Plant Research" and presented a poster entitled "Comparative studies of phenotypic diversity, dormancy status and water uptake patterns in the seeds of the wild (*Sesamum mullayanum* Nair) and cultivated (*S. indicum* L.) Sesame. Organized by Center for Applied Science and Technology (CAST), Kolkata held at University of Calcutta during January 29-31, 2010. The poster won 2nd Prize by Suranjana Sarkar Nee: Roy, SRF; (vii) presented poster entitled- Retention of totipotency and regeneration capacity of long term *Aloe barbadensis* culture- in the National Symposium organized by PTCA held at R.K. Mission, Kolkata during March 1-3, 2010; (viii) participated in the "National Conference on Biodiversity & Natural Resource Utilization" and delivered lecture on Biodiversity conservation perspective held at Department of Botany, Visva Bharati, Santiniketan during March 14-16, 2010; (ix) participated in the Golden Jubilee Symposium on "Contemporary Trends in Plant and Microbial Sciences" organized by Department of Botany, University of Burdwan, Burdwan during March 19-20, 2010.

Dr. D. N. Sengupta (Botany) attended the Symposium on Plant Cell and Tissue Culture held at Ramakrishna Mission, Kolkata, during March, 2010 and his students presented five posters.

Dr. J. Basu (Chemistry) delivered a lecture in the 3rd Congress of European Microbiologists (FEMS 2009) at Gothenburg, Sweden from June 28 to July 2, 2009; delivered a lecture in the International Cell Death Society Symposium on "Cell Death in Infectious Diseases" held in Muldersdrift, South Africa from June 5 to June 8, 2009; delivered an invited talk in the XXX All Indian Cell Biology Conference at the University of Hyderabad in November 2010; delivered an invited talk in the 78th Annual Meeting of the Society of Biological Chemists held in Pune from October 30th to November 1, 2009; delivered an invited talk in the symposium on "Optimization of Inhaled Tuberculosis Therapies and Implications for Host-Pathogen Interactions" organized by CDRI, November 3-5, 2009, New Delhi; delivered an invited talk in the symposium on "Emerging Trends in the Diagnosis and Chemotherapy of Tuberculosis" held at NIPR from December 2 to 4, 2009; delivered an invited talk in the symposium on "Emerging Trends in Infectious Diseases: TB & GI infections" held at the Indian Institute of Technology, Kharagpur, from January 5 to 7, 2010; delivered a talk in the India-San Francisco Bay Area TB Summit held on 11-13 January, 2010 at the CSIR Science Centre, New Delhi.

Dr. Manas Chakrabarty (Chemistry) delivered (i) a Lecture entitled "Mass Spectrometry: Basics and Soft Ionisation Techniques" on the 24th August, 2009 in the Refresher Course in Chemistry entitled "Basic Fac ets of Chemistry and Beyond" held at the Academic Staff College, University of Calcutta, Kolkata and (ii) a few Lectures in the Training programme on "Bioinformatics and Its Application in Drug Designing" held in the Bioinformatics Centre (DBT-BIF), Assam University, Silchar during September 14-20, 2009.

Dr. K. P. Das (Chemistry) attended the 46th Annual Convention of Chemists held at Vellore Institute of Technology during December 2-6, 2009. He gave an invited talk and also chaired a session.

Dr. M. Kundu (Chemistry) delivered an invited talk in the symposium on "Optimization of Inhaled Tuberculosis Therapies and Implications for Host-Pathogen Interactions" organized by CDRI from November 3-5, 2009, New Delhi; delivered an invited talk in the symposium on "Emerging Trends in Infectious Diseases: TB & GI infections held at the Indian Institute of Technology, Kharagpur, from January 5 to 7, 2010

Dr. Tanya Das (Division of Molecular Medicine) delivered Special Invited Lecture in ONCON-2010 at Haldia Institute of Technology on January 2010; delivered an invited talk in the National symposium on new perspectives in plant research organized by CAST, held in Kolkata during January 29 to 31, 2010; delivered, special lecture in the International Conference on Advancement in Biomedical Research, on 13th-14th November 2009, KIIT University, Bhubaneswar; invited to give a talk at the 14th All India Congress of Cytology and Genetics, held at Kolkata during December 1-4, 2009; delivered invited lecture on 'Multiple signal modulation therapy of cancer :From cancer to cancer stem cells' at the Orientation course in Physiology at the Dept. of Physiology, Calcutta University, Kolkata in March, 2010; delivered a special lecture on 'Cancer: Myth vs. Reality' at the Victoria Institution, Kolkata, in March, 2010; invited by Pashchimbango Bijgyan Mancha to deliver a lecture entitled 'Can we cure cancer? Not at all a million dollar question' at the 'For woman by woman' workshop at Sonagachhi, Kolkata, in February, 2010.

Dr. S. Majumdar (Division of Molecular Medicine) presented an invited talk at the Indian Immunology Forum at Fort Raddison, Raichak, Janary, 2010; presented an invited talk at WHO TDR meeting at NII, New Delhi, March, 2010; was invited as a member of the Governing Body and Finance Committee meeting of DBT sponsored Institute (National Institute of Biomedical Genomics) at Toshali Sands, Puri, Orissa in February, 2010.

Dr. N. Mandal (Division of Molecular Medicine) attended the National Symposium on "Parasite Taxonomy, Biodiversity and Fish Health: Environmental Impact", March 12- 13, 2010 organized by the Department of Zoology, Andhra University, Visakhapatnam, Andhra Pradesh; delivered Plenary Lecture on "Importance of DNA markers for developing disease free shrimp (*Peneaus monodon*) aquaculture" at the National Symposium on Parasite Taxonomy, Biodiversity and Fish Health: Environmental Impact, March 12- 13, 2010, organized by Department of Zoology, Andhra University, Visakhapatnam, Andhra Pradesh, India; Delivered Plenary Lecture and presided over as Co-chairman of a session in the National Symposium on "Parasite Taxonomy, Biodiversity and Fish Health: Environmental Impact", March 12- 13, 2010 organized by the Department of Zoology, Andhra University, Visakhapatnam, Andhra Pradesh.

Dr. A. K. Roy (Division of Molecular Medicine) delivered an invited lecture on "Thyroid hormone and adult mammalian brain function: A journey over two decades" at the International Conference on Integrative Physiology: Modern Perspective (2009). organized by the Physiological Society of India, Kolkata; Special lecture delivered on: "Hormonal regulation of brain function", in Dept of Human Physiology with Community Health , Vidyasagar University, February, 2010.

Dr. P. C. Sen (Division of Molecular Medicine) delivered invited Lecture on the occasion of Acharya Prafulla Chandra Ray Memorial Symposium on "Chemistry Today" on 3rd August 2009 organized by Indian Chemical Society; chaired a Session in the National Seminar on wealth from waste, September 5-6, 2009 organised by the National Environmental Science Academy, West Bengal Chapter; chaired a Session in the International Conference on "Discovery of Cholera Toxin, on the occasion of Hundred years of Birth Anniversary of S.N. De", at Kolkata during October 25-27, 2009; delivered an invited talk in the International Symposium on "Bio-inorganic Chemistry" held at TIFR, Mumbai, during November 4-7, 2009; delivered an invited talk in the INSA Platinum Jubilee International Symposium on Research in "Molecular Medicine Based on Natural Resources and Traditional Knowledge" at National Chemical Laboratory, Pune during 21-23 November, 2009; delivered an invited talk at Haldia Institute of Technology in the "Current Trends in Cancer Research" on January 12, 2010; delivered an invited talk in the National Conference on "Cellular and Molecular Medicine" held at Rajiv Gandhi Technical University, Bhopal, during February 4-6, 2010; chaired a Technical Session in the 17th State Science and Technology Congress, at West Bengal University of Animal and Fishery Sciences, March 4-5, 2010; delivered an invited talk in the field of "Modern Areas of Life Sciences" at Visva Bharati University on March 13, 2010.

Dr. G. Sa (Division of Molecular Medicine) was invited to deliver a special lecture in the International Conference on Advancement in Biomedical Research, on 13th-14th November 2009, KIIT University, Bhubaneswar. Prof. Sa was invited to give a talk at the 14th All India Congress of Cytology and Genetics, held at Kolkata from December 1- 4, 2009. He was invited to deliver special invited lecture at the scientific session in the International Seminar on Recent Advances in Homeopathy at Kolkata on 19th to 21st February, 2010, and on Recent Trends in Disease Research organized by Indian Science Congress on 31st March 2010 at Kolkata. Prof. Sa was invited to give an invited talk in the National symposium on New perspectives in plant research organized by CAST, Kolkata from January 29 to 31, 2010. and delivered Special Invited Lecture in ONCON-2010 at Haldia Institute of Technology on January 2010; was invited by the Department of Genetics, Calcutta University to deliver a talk on "Turmeric: An expedition from ancient spice to modern anti-cancer drug" in their UGC sponsored Refreshers course in January 2010.

Dr. W. Ghosh (Microbiology) presented a poster paper at the EMBO (European Molecular Biology Organization) - FEMS (Federation of European Microbiological Societies) Workshop on Microbial Sulfur Metabolism held between 15th and 18th March 2009 at Tomar, Portugal.

Dr. S. Bandyopadhyay (Physics/CAPSS) delivered invited talk in ICTS Condensed Matter Program 2009, December 5-23, 2009, Mahabaleshwar, "Entanglement inequalities in spin 1/2 particles"; invited talk in IPQI 2010 (International Program on Quantum Information) January 4-30, 2010, Institute of Physics, Bhubaneswar, "Entanglement cost of nonlocal measurements"; invited talk at Physics Department, IIT Kanpur, March 24, 2010 on "Entanglement cost of nonlocal measurements".

Dr. I. Bose (Physics) delivered an invited talk on "Stochastic Gene Expression: a single molecule view" at the one-day Workshop on Recent Trends in Atomic and Molecular Physics Research at Ramkrishna Mission Vivekananda University on 13/2/10; delivered Keynote Address on "Disordered Systems: Models, Concepts and Phenomena" at State Level Seminar on Disordered Systems at Jogesh Chandra Chaudhuri College, Calcutta on 20/2/10; delivered an invited talk on "Nonlinearity and stochasticity govern competence development in B. subtilis" at the National Seminar on Interdisciplinary Problems in Nonlinear Dynamics: Computational and Other Techniques at the Department of Applied Mathematics, Calcutta University during 24-25/2/10; delivered an invited talk on "Bacterial survival strategies: A search for physical principles" in the One-Day Seminar Spectrum at St. Xavier's College on 8/3/10; delivered an invited talk on It pays to be different: phenotypic heterogeneity in microorganisms at the One-Day National Symposium on Frontiers in Biochemistry at the Department of Biochemistry, Calcutta University on 22/3/10; delivered on invitation four lectures on Statistical Mechanics of Phase Transitions at the UGC Refresher Course for College Teachers at the Physics Department, Calcutta University (July 21-24, 2009); two lectures on "Physics in Biology: Challenges and New Directions" at the West Bengal State University, Barasat on 28/10/09; one lecture on "Systems Biology: An Introduction" at the Indian Institute of Chemical Biology on 8/12/09 in the Advanced Course Work Programme; delivered Prof. Bidhubhusan Ray Memorial Lecture on "Biological Networks" at the National Council of Education, Bengal on 31/1/10.

Dr. B. K. Chatterjee (Physics) attended the seminar on Trends in Surface Science and Related Areas held at Bose Institute, on November 6, 2009.

Prasanna K. Mondal (Physics) attended and delivered an invited lecture on "Acoustic emissions during nucleation of superheated droplets" at Trends in Surface Science and Related Areas held at Bose Institute, on November 6, 2009. He also attended and presented a poster on "Gamma induced nucleation of R-114 SED" at the Eighteenth National Symposium on Radiation Physics (Udaipur), November 19-21, 2009.

Dr. Sanjay K. Ghosh (Physics) delivered invited talk in the Workshop on Astroparticle Physics, December 10-12, 2009, Darjeeling, "On Centre for Astroparticle Physics & Space Science", delivered invited talk in the 3rd Winter School on Astroparticle Physics, December 13-22, 2009, Darjeeling, "Strange Universe, talk delivered at NESTT-BASE held at Bose Institute, Kolkata, January 2010, "Recent Developments in Asparticle Physics", plenary talk delivered at IASTA-2010 held at Bose Institute, Darjeeling, March 24-26, 2010, "Cosmic Ray - Cloud connection".

Dr. Dhruba Gupta (Physics) served as the Joint Convener of the Workshop and Winter School on Astroparticle Physics (WAPP 2009) held at Bose Institute, Darjeeling, December 10-22, 2009; attended and delivered an invited talk on "Interaction of Radiation with Matter" at WAPP 2009; delivered an invited talk on "Exotica in Nuclear Physics Experiments and Cosmic Rays" at Bose Institute, Kolkata on April 24, 2009.

Dr. A. Mitra (Physics/CAPSS) delivered an invited talk on Stealth Technology at the Aeronautical Development Agency (ADA), Bangalore during Aug 2009; two invited lectures were delivered at the CEP course on RCS Measurement Technology at millimeter and sub-millimeter wave at DRDO, Hyderabad during 7-11 Sep 2009.

Dr. R. Ray (Physics/CAPSS) served as resource person in the NESST-BASE 2010 program held at Mayapuri Campus, Bose Institute, Darjeeling, in May 2010; served as resource person in the IASTA 2010 program held at Mayapuri Campus, Bose Institute, Darjeeling, in May 2010; group discussions for generating research problems in the Workshop on High Energy Physics Phenomenology (WHEPP) held at Physical Research Laboratory, Ahmedabad, India, in January, 2010; lecture on "Fluctuation, Susceptibility and the QCD critical point" in the Mini Workshop held by Jammu University, Jammu, in September 2009; served as resource person in the WAPP 2009 program held at Mayapuri Campus, Bose Institute, Darjeeling, in December 2009.

Dr. Swapan K. Saha (Physics/CAPSS) served as a member of the Scientific Advisory Committee of the Workshop and Winter School on Astroparticle Physics (WAPP 2009) held at Bose Institute, Darjeeling, December 10-22, 2009; attended and delivered an invited talk on "Search for Strangelets at high altitude" at WAPP 2009.

Mr. Atanu Maulik (Physics/CAPSS) presented a paper entitled "Characterization of Polyethylene Terephthalate (PET) Detector to Search for Rare Events in Cosmic Rays" at the 31st International Cosmic Ray Conference, held in Lodz, Poland, July 7-15, 2009. Also, as a member of the local organizing committee he was involved in the organization of the 4th Workshop and Winter School on Astroparticle Physics (WAPP) at Darjeeling, December 10-22, 2009 and conducted laboratory sessions for participating students.

Dr. Supriya Das (Physics/CAPSS) served as a member of the local organizing committee of the 4th Winter School and Workshop on Astroparticle Physics (WAPP09) at Bose Institute, Darjeeling, December 10-22, 2009, conducted experimental sections of the school and delivered a lecture on "Basic Electronics for Nuclear and Particle Physics Experiments".

Ms. Sumana Das (Physics/CAPSS) was involved in organizing the 4th Winter School on Astroparticle Physics (WAPP) at Darjeeling, December 10-22, 2009 and conducted laboratory sessions for participating students.

Dr. Sandhya Dey (Mondal) (Physics/CAPSS) conducted laboratory sessions for participating students at the 4th Winter School on Astroparticle Physics (WAPP) at Darjeeling, December 10-22, 2009.

Dr. T. P. Sinha (Physics) presented ten papers in the International Conference on Electroceramics held at the Department of Physics, Delhi University, Delhi during December 13-17, 2009.

Dr. S. Das (PMCG) delivered a tribute lecture in a colloquium on "Norman Borlaug and Food Security" on 12th October, 2009 at the Directorate of Extension Education, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur. She has served as a resource person in DBT sponsored lab intensive training Programme at IIT Guwahati during November 16-21, 2009. She delivered an invited talk in the 7th BT Rim Conference at IARI, New Delhi during 25-28th November, 2009, delivered an invited lecture in the National Symposium on Climate Change, Plant Protection and Food Security Interface Organized by the Association for Advancement in Plant Protection at Bidhan Chandra Krishi Viswavidyalaya on 19th December, 2009, an invited talk entitled "Trends in Plant Biotechnological Research in India - A scope for industrial - academic convergence" on 30th January, 2009 in a national seminar organized by the Centre for Applied Science and Technology at Kolkata, delivered an invited talk in a National seminar on Biodiversity and Food Security on 25th February, 2010 organised by the Indian Science News Association at the Bose Institute. She delivered an invited talk in a National Symposium on Plant Cell Tissue & Organ Culture: The Present Scenario on 3rd March, 2010, and an invited lecture in a National Conference on Biodiversity & Natural Resource Utilisation on a "Utilisation of Natural Resources in Crop Biotechnology for Global Food Security" on 15th March, 2010 at the Viswabharathi University, delivered a key note address entitled "Contemporary research in the area of Plant Biotechnology in India : Possibility for industrial - academic convergence" on 19th March, 2010 in a Golden Jubilee Symposium on Contemporary Trends in Plant and Microbial Sciences at the Burdwan University.

Dr. A. N. Lahiri Majumder (PMCG) delivered a series of lectures as Visiting Professor during May-June, 2009 at the School of Life Sciences, North Eastern Hill University, Shillong having being nominated by the Department of Science & Technology, Govt. of India, and interacted with the Faculty & research students there. Delivered invited talks at the Refreshers Course, Dept of Botany, Calcutta and in the symposium organized by CAST. Delivered radio-talk on Acharya J C Bose at the Gynan Bani, FM Channel.

Dr. A. Pal (PMCG) delivered an invited talk on "Identification of Superior Fiber-Trait-Yielding Genetic Resources of *Bambusa balcooa*: Analysis of Physico-Chemical Properties of Fibers" in the 8th World Bamboo Congress, World Bamboo Organizer, Thailand, held during 16th to 19th September, 2009. Her group presented two papers on "A genomic approach to identify genes that confer resistance against MYMIV in *Vigna mungo*" and "Salicylic acid induced differential leaf proteome expression and activity of antioxidant enzymes in MYMIV susceptible and tolerant genotypes" during the 14th All India Congress of Cytology and Genetics, Kolkata, December 1-4, 2009. During the conference one of her posters entitled "Clonal propagation, chromosome analysis and DNA fingerprinting pattern in *Bulbophyllum auricomum* Lindl.", presented by Myo Ma Ma Than received the best poster award the presented two papers on "Proteomic approach to understand molecular basis of differential regeneration response in two cotyledons of *Vigna radiata*" and on "Enhanced shoot regeneration in *Vigna radiata* mediated by diffusible metabolite/s produced *in vitro*" during the National Symposium on Plant Cell Tissue and Organ Culture: Present Scenario and 31st Annual Meeting of PTCA (I) on 3rd to 5th March, 2010. The second one presented by Dr. Saswati Sengupta, received the best poster award. Dr. Pal delivered an invited lecture on

"Development of molecular markers and a CLSM-based non-invasive method of fiber quality determination of *Bambusa balcooa* for commercial exploitation" in the National Seminar on "Recent trends in Biotechnology", Department of Biotechnology, University of Burdwan, Burdwan, on 12th March, 2010; served as a resource person in the North East Teachers Training on Basic Sciences and delivered a talk on "Phylogenetic relationship assessment and genetic diversity analysis in tropical bamboos", 28th January, 2010; served as a resource person in the 'Refreshers' Course in Life Science for College and University Teachers' organized by the Academic Staff College, University of Calcutta during February 01 to 20, 2010 on two topics "An overview of molecular mechanism of plant disease resistance: current understanding" delivered on 02.02.2010 and "Proteomics and its Applications in Plant Biology" delivered on 11.02.2010 to keep then abreast of the advancement in the specific subject and to enlighten them on new methods and techniques of imparting knowledge to their students and to develop their own model of teaching.

Dr. S. R. Sikdar (PMCG) participated in the training programme on "Science for Rural Societies' Programme" held during 20.04.2009-01.05.2009 at the Centre for Disaster Management, Lal Bahadur Shastri Academy of Administration, Mussoorie, Uttarakhand. He also participated in the training programme on "Administrative Vigilance" for Vigilance Officers under the Department of Science & Technology, Govt. of India held during 30.11.2009-04.12.2009 at CBI Academy, Ghaziabad (UP).

Dr. S. K. Datta (Acharya J.C. Bose Biotechnology Innovation Centre) attended the "National Symposium on Lifestyle Floriculture : Challenges and Opportunities" held at Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan during March 19-21, 2010 and presented papers; delivered a lecture on "Technological advancement for the development of new ornamental varieties" at the Department of Botany, Kalyani University on 18.02.2010 organized by the Department and Alumni Association, Botany.

Dr. A. K. Chakraborty (Library) participated in IASLIC Conference at KIIT University, Bhubaneswar from 26 - 29 Dec., 2009; attended LISA-VI (Library & Information Science in Astronomy) International Conference, held at IUCAA, Pune during Feb 14 - 17, 2010. He was invited to deliver lecture in the Academic Staff College, University of Calcutta for a Course for library professionals on Digital Archiving System on 16th March, 2010; participated as one of the expert committee members of the National Library, Kolkata, for initiating procurement of e-journals; was invited to deliver lecture in the Academic Staff College, University of Calcutta for a Refresher Course for faculty and college librarians on Digital Archiving System on 4th March, 2010; invited to deliver lecture to MLISc. students of Kalyani University on 26th February, 2010 on Application of ICT in LIS; invited to participate in LISA meeting during LISA-VI (International Seminar on Library & Information Services in Astronomy and Astrophysics) meeting in IUCAA, Pune. 14th February, 2010 to 18th February, 2010; invited to deliver to lecture on 14th January, 2010 for the seminar - "Digital Library System Management : With reference to Consortia" and also acted as one of the panelist, on "Consortia Management" in IIT-INDEST Consortium 2010 held at IIT Kharagpur from 13-15th January, 2010; invited for panel discussions and presented paper in IASLIC Conference at KIIT

University, Bhubaneswar as well as to attend the meeting of the Governing Body and AGM of IASLIC during 25th December, 2009 – 29th December, 2009; invited to attend discussions on "Indic Script vs. Roman Script on 17th December, 2009 at the Central Reference Library, National Library, Kolkata; invited to attend the "Negotiation Committee of CSIR – DST e-journal Consortium" now known as National Knowledge Resource Consortia (NKRC). He is one of the core members of the committee and also attended the LISA-VI meeting in IUCA, Pune; was invited to participate in the Conference on "Recent trends in Patinformatics from 10-13th December, 2009 in URDIP, Pune; invited to deliver lecture to MLISc. students Semester-I on 15th October, 2009 in the University of Kalyani; invited to deliver lecture on 10th October, 2009 in a Conference at Tirupati; invited to attend the International Meeting (Standing Committee of Genealogy and Local History Section" of IFLA on 22nd August, 2009) and 75th IFLA General Conference and Assembly, Milan, Italy, 23-27th August, 2009 as one of the first members of the Standing Committee from India. The programme was sponsored by DST, Govt. of India under DST International Travel fund for scientists; invited to deliver lecture in the National workshop at SOA University Bhubaneswar during August 4-6, August, 2009 under the auspices of IASLIC; invited to deliver talk as one of the Inaugural panel members in the Seminar "Role of Libraries in Rural Development organized by the Burdwan University jointly with IASLIC, BLA and WBPLeA and RRRLF to celebrate Librarian's Day to mark the Birth anniversary of S.R. Ranganathan, father of LIS, on 10th August, 2008; Academic Counselor for Post Graduate Diploma in Library Automation and Networking (PGDLAN) in IGNOU; Guest faculty for M.Phil course of DLIS, University of Calcutta, Guest faculty in the Rabindra Bharati University, Kolkata for MLISc. and BLISc, guest faculty for Kalyani University and external examiner of different universities in Kolkata.

Dr. (Mrs.) Rukmini Mitra (Library) participated in the IASLIC Conference at KIIT University, Bhubaneswar from 26 – 29 ec., 2009; attended LISA-VI (Library & Information Science in Astronomy) International Conference, held at IUCAA, Pune during Feb 14 – 17, 2010.

Sri Pradip Kumar Sarkar (Library) attended the 3rd International Conference on Digital Libraries (ICDL-2010) on "Shaping the Information paradigm" held at India Habitat Centre, New Delhi, February 23 – 26, 2010.

Honour Received

Annanda Sankar Sau (Botany, Institute SRF) was awarded prize for the poster presentation on "Molecular profiling of genomes and evaluation of medicinal potential in some elite varieties of *Curcuma longa* of Manipur" at the Science Association of Bengal, Jadavpur University Campus, 27th February, 2010

Dr. S. K. Datta (Acharya J.C. Bose Biotechnology Innovation Centre) was elected as a Member of the "Departmental Research Committee in Botany", and attended meeting in the Department of Botany, Kalyani University on 11.03.2010.

Dr. Manas Chakrabarty (Chemistry) acted as a Member of the UGC-nominated Advisory Committee of SAP-DRS II of the Department of Chemistry of the University of North Bengal in a meeting with the Vice-Chancellor of NBU in his office held on the 25th March, 2010.

Dr. K. P. Das (Chemistry) received Prof. S. C. Ameta Award of the Indian Chemical Society for the year 2008 at the Annual Convention of Chemists held at the Vellore Institute of Technology during December 2-5, 2009.

Sarbani Karmakar (Chemistry, Institute SRF) received award for her poster "Binding interaction of Zn^{+2} with α -crystallin – a MALDITOF Study" presented at the International Conference on Physics Biology Interface held at Saha Institute of Nuclear Physics, Kolkata during December 13-16, 2009.

Dr. Arun Kr. Chakraborty (Librarian) Bose Institute, Kolkata is being nominated as one of the members of the International Federation of Library Association (IFLA), Genealogy and local History for the period 2009 – 2013.

Patents

Dr. S. Sen Mandi (Botany) :

- A PCT routed patent applied by DBT and BI on "A novel DNA marker for drought tolerance in tea plants" (inventor: Swati Sen-Mandi) on a DBT sponsored project has been granted by the Indian patent office (no.PO/KOL/2007-08/2009). Response in this regard from other countries is awaited.
- Patent Application has been filed jointly by DBT and BI on "A process for enhancing flavour in tea using UV radiation" (inventor Swati Sen-Mandi). This has been filed separately in Kenya under application no. KE/P/07/ 00594 – first maintenance fee has been paid for the period up to 17/4/2009 and in Srilanka under application no. 14443 — awaiting examination report.
- Patent on "A marker DNA fragment and associated gene identifying enhanced vigour and viability of seed" (inventor: Swati Sen-Mandi). This is the modification of a main patent (application no. 253/KOL/2004 dated 18th May 2004). Award of a National patent on her rice research has been received (no. 216326).

Dr. Sampa Das (PMCG) :

An Indian patent on: A new mannose binding insecticidal lectin isolated from seeds of *Annona squamosa*, and process for its preparation has been granted on 25th March, 2010.

Symposia and Seminars Organized

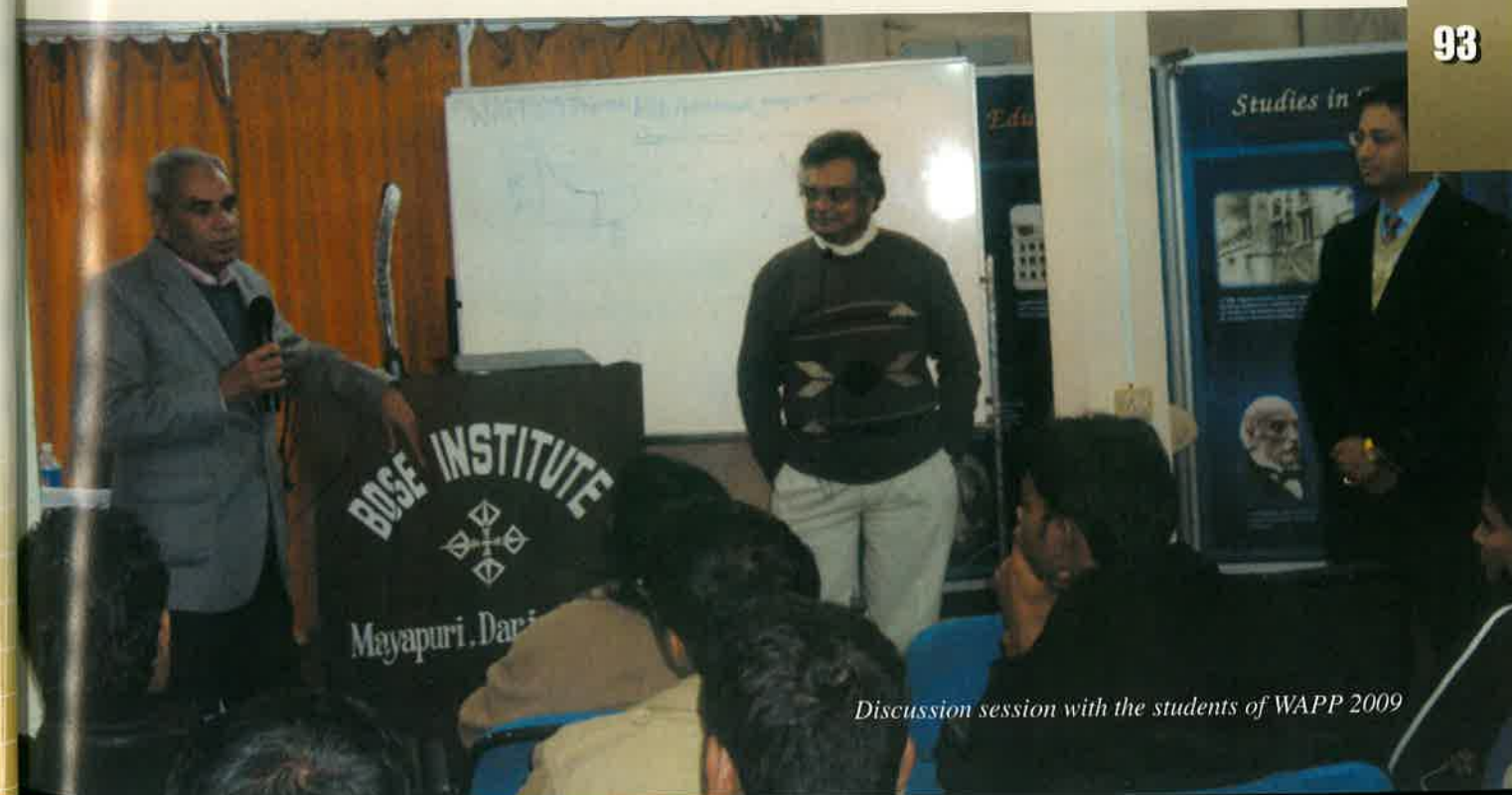
Dr. G. Basu (Biophysics) organized a one day Symposium of the Indian Peptide Society, at Bose Institute on Jan 08, 2010.

Dr. K. P. Das (Chemistry) acted as the convener of a one day seminar on Trends in Surface Science and Related Areas organized by Indian Society for Surface Science and Technology held at Bose Institute on November 6, 2009.

Dr. Sanjay K. Ghosh (Physics) Convener of IASTA-2010 which is a biennial National Conference of Indian Aerosol Science and Technology Association. This conference was organized at Darjeeling during March 24-26, 2010, Joint Convener (with Gautam Basu) of NESST-BASE 2009, a summer training programme for North-East students' in basic sciences

Dr. D. Gupta (Physics/CAPSS) and Dr. S. Bandyopadhyay (Physics/CAPSS) served as Joint Conveners of the Workshop and Winter School on Astroparticle Physics (WAPP 2009) held at Bose Institute, Darjeeling, December 10-22, 2009 to commemorate the 150th Birth Anniversary of Acharya J. C. Bose.

Dr. A. K. Chakraborty (Library) organized a half day Seminar on "Usage of Electronic Resources and Training on ENDNOTE WEB" for faculty members research scholars of Bose Institute, Kolkata on 18th June, 2009; Organized a half day training programme SciFinder Scholar for faculty members and research scholars of Bose Institute, on 16th June, 2009; Organized "16th Ranganathan Memorial Lecture-2009" in association with IASLIC on 4th March, 2010 at Bose Institute, Kolkata.



Discussion session with the students of WAPP 2009

Service Departments

Acharya J.C. Bose Biotechnology Innovation Centre : (Madhyamgram Experimental Farm)

Development of the Acharya J C Bose Biotechnology Innovation Centre at the Madhyamgram Experimental Farm was initiated in 2006 with the mandate of providing proof-of-concept of the laboratory-based research for translating them into future technologies and is currently been engaged primarily in Plant biotechnological work. In addition to providing facilities for field experimentation with non-transgenic plants, requisite infrastructure and facilities have also been developed for raising transgenic plants in biosafe green houses and Insectry under controlled environment. New green houses have been developed through currently funded DBT projects. The transgenic research laboratory is used for plant transformation work by Institute scientists & scholars as well as their collaborators. Three research projects led by CSIR Emeritus scientists & their team and work on sensory reception in plant movement constitute an integral part of the Centre.

Use of plant growth promoting rhizobacteria to control bacterial wilt of tomato :
Dr. P. K. Chakrabartty

Three new strains of *R. solanacearum* have been isolated on 2,3,5-triphenyl tetrazolium plates, and identified as bv. IIIA and bv. I strains and their pathogenicity established by their inhibition of tomato seed germination. Five putative antagonists (BH 25, T1, R6, AM 12 and AM 13) against these strains have been isolated from rhizospheric soil which predominantly selects for species of *Pseudomonas*. Two of these viz. T1 and BH25 have been identified as *P. aeruginosa* and another *Pseudomonas* sp. through 16S rDNA sequencing. The antagonists have been examined for siderophore production, utilization of ACC as nitrogen source and HCN production during growth suggesting them as PGPR.

Dehydration of flowers and foliage and floral craft for their commercialization :
Dr S. K.Datta

Naturally growing seasonal wild flowers and leaves with decorative colours, shapes and borders were dehydrated by press drying. Flowers & petals of Bougainvillea, Ixora, Lagerstromia, Peltophorum, Phlox, Cosmos, Brassica, Tithonia, Cosmos, Gomphrena, Aster, Tithonia, Antirrhinum, Marigold (African var), Zinnia, Salvia, etc were embeded in river sand and silica gel and dehydrated using hot air oven and micro wave oven. Other materials

included a number of angiosperm flowers and ferns. For good dried material both the temperature and duration of treatment were standardized. The press dried leaves and petals were used for making floral crafts like greetings cards, Table mats, Coasters, Landscapes, page markers etc.

Plant movement and sensitivity towards "touch" : Dr. A. N. Lahiri Majumder

In an attempt to search for the mechanism for touch-induced movement of Mimosa leaflets, bioinformatic analysis of the "touch genes" (TCH1) reported from different plant sources were performed. Such analysis revealed that the TCH1 is closely associated with the Calmodulin or Calmodulin-like CaM genes. As preliminary to isolate such genes from Mimosa, procedure for extraction of PCR-compatible genomic DNA from the source has been worked out by suitable modification of the reported ones.

Centre for Astroparticle Physics & Space Science

Centre for Astroparticle Physics & Space Science has taken up many projects which are under progress.

IRHPA project :

- Substantial progress has been made in the areas of Cosmic Ray research as well as atmospheric science studies, which are being carried out at Centre for Astroparticle Physics & Space Science: A National facility at Darjeeling.

Atmospheric Science – Changing airspace environment in eastern Himalayas

- All the instruments, including different gas analyzers, particulate matter samplers, athelometer, radiometer, micro-rain radar, Lidar and automatic weather monitoring system, have been installed and are working satisfactorily. Important data are being generated which would help us in our effort to understand the changing airspace environment in eastern Himalayas.
- Recently, comparative studies of seasonal variation of different sized aerosols (fine and coarse) and their characteristics have been reported to a journal. Fine mode aerosol was found to dominate during dry seasons, whereas, coarse mode aerosol has been found to dominate during monsoon. Long range transport of dust aerosol has also been observed.
- A typical feature of Indian monsoon is that, several dry days are observed even between the rain events. Several natural and anthropogenic aerosol components are washed out by the rain and start building-up after the rain. Degree of scavenging of several aerosol components during rain and their building-up before and after the rain has been studied during monsoon seasons. Loading of natural species in coarse

mode aerosol was found to be higher compared to fine mode and loading of anthropogenic species in fine mode aerosol is higher compared to coarse mode after the rain, which in turn affects the aerosol acidity. This study is first of its kind.

- Several aerosol measurements have been performed, such as seasonal and diurnal variations of aerosols and black carbon concentrations, trace metal distribution between suspended and free fall aerosols, black carbon removal with rain fall scavenging and aerosol optical depth. The findings were reported in IATA-2010 conference.
- Radiometric measurements using micro rain radar for the vertical profile of rain intensity and rain drop size distribution along with Ku-band satellite signal for rain induced attenuation of signal and optical gauge for ground based instantaneous precipitation rate measurement. Following observations have been made: (a) there is a seasonal variation in the rain height, (b) In a particular rain event, the DSD changes for different range gates. For example, the DSD in the range 150-300m shows substantial difference from the DSD observed in the range 300-450m and so on. (c) For a particular season, for example, monsoon season, the rain rate and DSD shows yearly variation and (d) the DSD and rain rate do not follow the standard models generally used for tropical countries. These results necessitate the formulation of new model and/or new values of existing model parameters. Detailed analysis is under progress and our findings will be reported to journal shortly. Some of these results were also presented at IASTA-2010 conference.

Cosmic Ray studies at high altitude

- Cosmic ray group is involved in the search for strangelets using polyethylene terephthalate (PET) passive detectors, in installing PET detectors at several different sites with high altitudes and related lab developments. A visit to Hanle (altitude 4500 m) was made to review and select the appropriate site for the passive detector array. Recently, an extremely interesting observation of very low energy (~ 1 MeV/A) Coulomb fission of nuclei was made by exposing the PET detectors to a ^{252}Cf fission source. An experiment to carry out precise calibration of PET at the ISOLDE facility of CERN, Switzerland has been scheduled.
- At present, an active detector array is being built at Darjeeling to study the Ultra High Energy cosmic rays components of cosmic ray air showers. The software for the CAMAC based data acquisition has been developed by the group with collaboration from CRL, TIFR. The software has been tested with a test set up. Gain testing and grouping of plastic scintillator blocks, to be used for the air shower array at Darjeeling, has also been carried out.
- Laboratory testing and calibration for setting up of passive detector array at Sandakphu is in progress. Application for the acquisition of required land at Sandakphu has been approved by the local authorities and awaiting the final approval from central ministry.
- An experiment was carried out during the total solar eclipse on July 22, 2009 at North Bengal University, Siliguri to measure the flux of g-rays and charged particles in collaboration with TIFR, Mumbai. Atmospheric parameters such as temperature,

air pressure and humidity were also recorded during the entire experiment for possible correlations with the g-ray flux measurements. The preliminary analysis shows no variation of flux of charged particles during the eclipse. Rain induced radioactivity needs to be deconvoluted to get the actual variation of g-ray flux during the eclipse.

- New results have been obtained in Cosmic ray air shower simulation. The low energy hadronic interaction models based on BESS observed cosmic ray proton and antiproton spectra at medium high altitude has been compared. Simulated antiproton spectrum with FLUKA was found to exhibit significant deviations from the BESS observation. UrQMD and GHEISHA reproduce the BESS observations within the experimental error. A paper with these results has already been published. Further analysis of anti proton spectrum is under progress.

Manpower Development

Winter school on Astroparticle Physics:

- In collaboration with Cosmic Ray Laboratory, TIFR, Ooty a winter school on Astroparticle Physics is organized every year since 2006. This school is held at Ooty and Darjeeling in alternate years. First school was held at Ooty and last school, in 2009, was held at Darjeeling. This school is meant for B.Sc final year and M.Sc students of physics. The main aim of this school is to give the students a hands-on training on experimental techniques of Astroparticle physics. Lectures are also arranged to make the students aware of the recent progress in this area of research. Faculties from both TIFR as well as Bose Institute participate in this programme. Some of the leading experts from abroad are also invited in this school.
- Every year this winter school is preceded by a Workshop on Astroparticle physics where many of the leading experts of Astroparticle physics, from India as well as abroad, participate to discuss the recent progress and trends in this area.

M.Sc Course in Physics with special emphasis on Astrophysics & Space Science (in Collaboration with St. Xavier's College, Kolkata)

Dr. Sanjay K. Ghosh : Coordinator

Resource persons from Bose Institute: Dr. S. Das, Dr. R. Ray, Dr. S. Bandyopadhyay, Dr. D. Gupta, Dr. A. Mitra, Dr. P. S. Joarder, Dr. S. K. Ghosh, Dr. S. Saha

- This postgraduate course was started in collaboration with St. Xavier's College, Kolkata, in September 2007. Classes are held at both St. Xavier's College and at Bose Institute. Degree of this course is awarded by University of Calcutta. Presently, 1st semester classes are held twice a week and 3rd semester classes are held thrice in a week at the Salt Lake campus of Bose Institute on the Rest of the days classes are held at St. Xavier's College, Kolkata. Every year 16 students are admitted through

written test and interview. The fourth batch will start their classes in August 2010. Out of 32 students who have passed out in last two years, some have already joined various Institutes to pursue their research careers after qualifying in the NET/GATE examination.

Outreach Programme

PROBE Project :

- The PROBE (PaRticipation of youth in Real-time/ field Observations for the Benefit of Education) project, with the financial support from Department of Science & technology, Govt. of India, was initiated in 2005. Under this project, 20 meteorological instruments were installed at different schools around Darjeeling. The project was initially for three years and was given an extension of one year, till 2009. The main goal of this project, as is evident from the name, was to acquaint the students with the meteorological measurements techniques and data analysis. For this purpose a group of students, under the supervision of a science teacher was given the responsibility to collect the data. The scientists and technical staff from our Institute visit the schools regularly to collect the data and check the instruments. They also interact with the students and hold scientific discussion with them. Data taken from schools have been collected and sent to DST, Govt. of India.



NESST-BASE programme:

- The north-east students' summer training programme on Basic sciences was initiated during May-June 2007. This has now become an annual event of the Institute and is held at Darjeeling. Every year during May-June, 27 students (three students each from seven north-east states along with Sikkim and Darjeeling) along with one science teacher (from each place) participate in this programme. The students are selected by the state authorities. These students are given hands-on training on physical, chemical and biological sciences. There is also a session with the aim to introduce the students with the fun of mathematics. In 2009, the program focussed on girl students of science of class XI. It was held during June 21- July 2, 2009. The students from most places were accompanied by one lady teacher of science.

IASTA-2010 Conference

- The biennial national conference of Indian Aerosol Science and Technology Association (IASTA) was organized this year by Bose Institute at Darjeeling during

March 24-26, 2010. The understanding of changes in climate and weather conditions, especially the significant changes which has occurred in past decade, necessitates a good knowledge of all the factors contributing to the global radiation budget, aerosols and clouds being the most important ones. Aerosols, small particles suspended in air, may occur naturally, originating from volcanoes, dust storms, forest and grassland fires, living vegetation, and sea spray. Human activities, such as the burning of fossil fuels also generate aerosols. Aerosols, natural and anthropogenic, have a large impact on the radiative balance of the Earth and subsequently on climatic change through the scattering of incoming sunlight, cloud formation, or enhanced absorption of sunlight by soot. On the other hand, clouds also play a major role in climate through their direct interactions with solar radiation and also through a variety of indirect effects, for example cloud lifetime, precipitation and energy redistribution. Clouds absorb the infrared radiation emitted by the earth. So they play an important role in the radiative balance of the earth and also influence the speed of the photochemical reactions. Since the role of aerosols and clouds and their interaction is extremely important for the understanding of climate and weather related studies, "Aerosols & Clouds: Climate change perspectives" was chosen as the theme topic of IASTA-2010 conference.

- Nearly 130 participants from various parts of India attended the conference. Around 180 extended abstracts were submitted, out of which 173 (70 oral and rest poster) were finally selected by the reviewers for presentation at the conference. A proceeding containing all the accepted extended abstracts was published on this occasion.

Environmental Sciences Section

The Environmental Sciences Section is playing major role in studying atmospheric aerosols and other pollutants over Darjeeling, Siliguri and Kolkata. Extensive studies have been made in collecting and chemically characterizing aerosols in different sizes (aerosols with diameter less than 2.5 and 10 microns). Aerosols were characterized in terms of several water soluble ionic species. Several source regions along with source types have been identified. In addition to the local anthropogenic sources, other transported aerosols from distant regions like arid and semi arid regions of western India and even west-Asia, and transported marine airmass enriched with sea-salt aerosols from marine sources like Bay of Bengal and Arabian Sea have been detected.

The effect of wet precipitation (rainwater) on the scavenging (wash-out removal) of aerosol components have also been studied. The studies have also been made on how the rains of different rate scavenged several components which in turn affects various chemical properties of aerosols.

The Black Carbon (BC) aerosols are also being characterized and studied to apportionment for biomass and fossil fuel combustion sources.

In addition to the studies on aerosol chemistry, physical properties (aerosol-radiation interaction) of aerosols have also been made to find out the effect of aerosol components on the aerosol optical depth (AOD).

Other than ongoing research activities, instrumental facilities (HPLC, AAS, IC etc.) are being provided to other institutional scholars for their respective research activities. Practical analytical classes are being taken for the students of M.Sc. in Astrophysics and Space Science.



Prof. Sibaji Raha, Director Bose Institute was addressing the trainees in the inaugural session of the training programme on "Mushroom cultivation and Vermicomposting" held during 12th August to 16th September 2009. The other members sitting on the dais were (from left to right) Mr. L.C. Porel, Prof. D.K. Chakravorty, Mr. Hiral Ghosh, Prof. P.K. Saha and Prof. A.K. Ray.



Some trainees with their mushroom produce cultivated during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 11th January to 19th March 2010.

Falta Experimental Farm

In the Rural Biotechnology Programme at Falta Experimental Farm two training programmes were conducted during 10th August-16th September 2009 and 11th January-19th March 2010; the first one was on "Mushroom cultivation, preservation and spawn production" and the second one was on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture". Twenty-three and Thirty-one trainees were trained in the above two training programmes respectively.

Integrated M.Sc. Ph.D. Programme in Plant Molecular Biology and Biotechnology

Prof. Sampa Das (PMCG) and Prof. D. N. Sengupta (Botany) : Joint Coordinators

Prof. P. C. Sen, Prof. I. Bose, Prof. S. Dasgupta, Prof. G. Basu, Prof. P. Parrack, Prof. P. C. Sil, Prof. G. Sa, Prof. T. Das, Prof. T.C. Ghosh, Dr. Jayanta Mukhopadhyay and all plant scientists have participated in teaching the course curriculum.

The Integrated M.Sc. Ph.D. Programme in Plant Molecular Biology and Biotechnology completed its second year in the month of August, 2009. The first batch of six students has been awarded the M.Sc. degree, of which three have joined the Ph.D. programme at the Bose Institute. The second batch of nine students has completed the third semester in February, 2010; and third batch of nine students has successfully completed the first semester course.

J C Bose Centre

(Publication and Museum)

J C Bose Centre comprising the Museum and the Publication section. From the very beginning of the establishment of the Museum, people take a lot of interest to visit it. The museum has been visited by many renowned scientist and also social dignitaries. Beside that it has also been visited by school children from many famous schools, Institutions of India and also from abroad. The main object of this museum to project in every walks of the society for highlighting about the invaluable works of Sir J C Bose and people can easily understand how the scientific works of Sir J C Bose give a useful effect to the society. Further development of our museum, the progressive work is going on with the help of many scientist and renowned members of the society.

Since its inception in 1980 the Publication Section has been doing all sorts of publication, i.e. Annual Report (both English & Hindi Versions); BI News; Memorial Lecture, Director's folders; Posters and leaflets of different Symposia, Seminars and Training Programmes and works of Sir J.C. Bose. Soft copy of Annual Report and BI News are available in the net (boseinst@ernet.in).

The following publications are now available for sale : J. C. Bose and Microwaves – A collection : Rs.200.00; Science and Society – Reflections : Rs.1050.00; J.C. Bose A Scientist and A dreamer – Vol. 1 : Rs.1250.00; Vol. II : Rs.1250.00; Vol. III : Rs.600.00; Vol. IV : 1500.00 ; Vol. V : Rs.550.00; Patrabali (Bengali) Rs.150.00; Acharya Jagadis Chandra Bose (Bengali) Rs.12.00; Abyakta (Bengali book written by Sir J.C. Bose) Rs.50.00; Picture Post Cards (five sets) Rs.125.00; Acharya Jagadis Chandra Bose (Bengali Combined) Rs.325.00; A. J. C. Bose (life & works) – VCD Version Rs. 100.00.

Library

The Institute Library system is one of the best Science Reference Libraries in Eastern India, set up in the main campus in 1917 and a wing at the Centenary building opened in 1983. In the year 2007 a small library is being set-up in the Salt Lake Campus of the Institute. At present Library is located in above mentioned three campuses. Library collection (online journals can

be accessed from all the seven campuses of Bose Institute. Library provides latest information to the BI faculty, researchers and staff in their day-to-day research and development work and also to extend its facilities to other Institutions / universities in and around Kolkata. Faculty / researchers from Eastern India use the library extensively for reference. The library has total collection of 39,419 reading materials out of which 26601 Bound journals, 12794 Books, 453 Theses as on 31.03.2010. During this year library subscribed to 300 numbers of foreign and Indian periodicals out of which print only 25 numbers. Library has subscribed to more than 4000 online journals in different packages. Library also subscribed to online-only full-text journals / databases of different academic societies such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier etc., Century of Science, Science Citation Index Expanded and ENDNOTE Web of ISI Web of Science, Thompson, USA., Blackwell / John Wiley Journal's Premier Online, Current Protocols (Online) of John Wiley / Blackwell, Annual Reviews Online (Back volume), Methods in Enzymology (Online back volume) and Current Year Trial Access, E-Books of E-brary (2400 e-books), E-Books – of Cambridge University Physics E-Books package, E-Books package of Elsevier: (a) Agricultural and Biological Sciences (202); (b). Biochemistry, Genetics and Molecular Biology (260); (3). Environmental Science (113), Current Protocols package of Springer (20225 e-books), Knovel E-Book Collections : Biochemistry, Biology & Biotechnology, H. W. WILSON.

The library has also databases of SCIFINDER of ACS and SCOPUS : the largest abstracting and citation database of research literature and quality web sources of Elsevier. Bose Institute also subscribed to Sciencedirect of Elsevier and all Nature Group Journals online. All these journals access is from 1997 onwards. BI Library has gone for Open Access membership of Nucleic Acid Research of Oxford University Press, Biomed Central (BMC) and Public Library of Science (PLOS). This membership allows discount for paper handling charges for our faculty members and research scholars. Library is also subscribed to ENDNOTE web for managing references.

During the year, 1628 readers used the Library (both campuses) for their reference work. 24 permission cards were issued to the outside readers. Under Inter Library Loan system book / journals were issued to other institutions and also books / journals were taken on loan. Library has provided scanning service to users for research work—more than 1,23,053 documents were scanned for faculty members as well as research scholars and more than 4321 hours computer / internet used for accessing in full-text subscribed / free journals by the scholar from the Library itself. Library also provided article services to its faculty members from different institutions in India and abroad. Library also provides citation services to its faculty members. Library Computer are used by researchers for accessing full-text subscribed / free journals by the faculty / research scholars apart from their laboratory / department computers.

Photocopy services are provided to outside users. A total 2,70,873 pages of photocopying (Xerox) services were given to our faculty and outside users. Some 547 bound volumes of book / journals and 325 loose periodicals were issued by our research scholars and faculty members throughout the year for their reference work.

Bose Institute Library is member of the following consortia (1) Forum for Resources Sharing in Astronomy and Astrophysics (FORSA), Bangalore, (2) CSIR-DST e-Journal Consortia. Through consortia library has subscribed to and access to a large number of online journals. It is expected to have more journal purchase through consortia from next year.

Central Instrumentation Facility

Apart from the old Instruments, XRD, GC. the newly commissioned Instruments like SEM, FPLC, HPLC & RT-PCR have started catering services to the Scientific Community both within the institute and out side satisfactorily. Liquid Scintillation (LS) Counter has been installed & commissioned satisfactorily. Another new Instrument, Atomic Absorption Spectrophotometer (AAS) already installed and working satisfactorily. Training of the research workers as well as students from different organization are being carried out on regular basis.

Workshop

The Workshop of Bose Institute consisting the following units of maintenance, repair and fabrication of different instruments as needed. The units are as follows.

Units	Requisition Receipts	Job Discharged	Continuing Job
Electrical	774 (M.c. & N.c.)	100%	Nil
Mechanical	57	100%	Nil
Carpentry	53	99%	1%
Refrigeration	10	100%	Nil
Drafting	30	100%	Nil
Lecture, Seminars & Course Work class attended	Above 300 (M.C & N.C.)	100%	Nil

Sri Panchugopal Karak, Technician, GR-I (Carpenter) has fabricated a big laboratory computer table with cover self, lighting, door & lock arrangement and fully sun mica finishing of Physics Dept. He has also fabricated wooden Replica of Photo Synthesis Bubbler of Acharya J.C. Bose Museum. Sri Karak also completed one wooden Lens stand and 12 nos. Poster stand as requested by Prof. D.N. Das, Presidency College, Kolkata.

Electrical renovation work has been carried out through enlisted vendors for Botany, Chemistry, Biochemistry, Bio-physics & CAPSS. Electrical AMC has been awarded to four campuses i.e. Main campus, Centenary Campus, Salt lake campus & MEF.

Socially Relevant

Dr. S. Sen Mandi (Botany) Research in this laboratory focuses on understanding the cell molecular events associated with physiological and biochemical manifestations of desirable traits relevant to the present day problems of climate change in commercially important plants. In this context 2 patents (DNA marker for seed vigour and drought tolerance in tea plants) have already been granted by India Patent Office; international report is awaited for the drought tolerance marker. Another international patent on Darjeeling tea aroma has been filed by DBT and BI.

Through the years different systems of Traditional Indian Medicines (viz. the Ayurvedic as well as Folk medicine systems) have stood the test of time. The plant resource needed for such health curing systems constitute natural wealth of our country and have been used as the starting material of many allopathic drugs developed world wide.

In this, India with its rich natural plant resource and commendable traditional knowledge and wisdom for the medicinal value of these plants is expected to be involved as a major partner. In order that such involvement / contribution may be appropriately visible internationally and commercially recognized in the Benefit Sharing Regime of the Convention of Biological Diversity (CBD), to which India is a signatory, it is important to authentically characterize and precisely evaluate the rich medicinal plant diversity of our country using modern biotechnological tools. This would also help to supplement conventional drug assessment protocols to ensure high and uniform efficacy of medicines manufactures by pharmaceutical compounds as well as Ayurved. To ensure fair benefit sharing and to prevent unwarranted biopiracy of indigenous plant genetic resource urgent efforts are necessary to develop unambiguous inventory of our plant diversity using a precise documentation system. Further, for export of plant genetic resource, passport data of the plant to be exported is now considered essential. In this context I have taken up research on medicinal plants of the Eastern and North Eastern region of our country.

Dr. M. Chakrabarti (Chemistry) A variety of novel heterocyclic compounds have so far been synthesised with a view to finding out, if feasible, "lead molecules" for being elaborated into drugs. The social relevance of the work is thus quite obvious.

Dr. Tanya Das (Division of Molecular Medicine) Cancer is considered not a disease but a global social problem. Over the years, cancer therapy had witnessed many exciting developments, but cure of cancer has still remained as complex as the disease itself. In fact, apart from the struggle in identifying the proper effective measure for cure, gain-of-adaptation towards the potential drugs that leads to resistance is another major obstacle in front of the

SOCIALLY RELEVANT

cancer scientists. Identification of modalities for functional switch-over of the cancer cell environment from resistance to apoptosis is therefore of utmost necessity for making therapy successful. Like many other countries, cancer is now being appreciated in India as an emerging public health problem. The emerging problem has received attention of Govt. of India, and some state governments within the Indian federation have formulated National and State Cancer Control Programs to deal with the situation. Under this circumstance the knowledge gathered from our work will help to unravel not only the mechanisms responsible for the emergence but also the targets that can be utilized for prevention of resistance in cancers.

Therefore, the research, performed in Bose Institute, has high potential towards the development of targeted therapy so far as the treatment of drug resistant cancers is concerned and, therefore, has tremendous social relevance.

Dr. N. Mandal (Division of Molecular Medicine) The shrimp aquaculture industry directly involves a large number of rural farmers along with their hardship and investment, which results a circulation of billions of dollars in this industry not only in India, but also worldwide. The outbreak of this pandemic white spot disease brings about a loss in a great deal of money thus destructing the socio-economic backbone of the region. The success so far achieved from Dr. N. Mandal's laboratory under Marine Biotechnology program has given a glimpse of light in preventing this loss. The aim to generate a disease-free brood stock as well as progeny for this industry will be highly beneficial to the farmers and society, thus establishing once again that "Prevention is better than cure".

Increased stresses, prone to diabetes, hypertension and many other factors have contributed quite drastically in increment of Coronary Heart Disease (CHD). Conventional risk factor alone is only partially explaining the causes of this predisposed CHD. The effort from Dr. N. Mandal's laboratory under Medical Biotechnology program have resulted some novel parameters for prediction of predisposed CHD among Asian Indian population in the Eastern part of India. This prediction will be useful for early diagnosis and prognosis of CHD, thus becoming advantageous to the society for preventive point of view.

The use of expensive chemico-synthetic drugs in treatment (leave apart curing) of non-communicable diseases like Cancer, Thalassemia, Arthritis, Psoriasis, etc. has taken quite a toll with their detrimental side-effects. This hard-earned knowledge has grown interest for many scientists to develop alternative natural medicine, thus making the search for it a hotspot for research. Dr. N. Mandal's group in the field of Medical Biotechnology has found some quite interesting outcome in this regard that will have immense importance in society, for it will bring about a new era in the field of medical biology to combat nearly non-curable diseases in a financially viable and scientific way without any side-effects. The findings will also cause building up of large industries that will help the government in mass employment.

Dr. G. Sa (Division of Molecular Medicine) Chemotherapy uses powerful drugs designed to induce cancer cells to commit suicide. So why don't all tumors succumb to these drugs?

The answer is that cancer cells have an in-built urge to survive, so any genetic change that favors survival amidst adverse conditions will be selected for. The effort being made by the scientists all over the world is to inhibit the survival pathways in one hand and to activate death pathways on the other to ensure cancer cell death. Interestingly, the in-built pro-survival programming of cancer cells acts as double sword by not only helping the components involved in the pathways that mediate survival to flourish, but also making pro-death factors inactive. One perfect example is tumor suppressor protein p53, that imparts sensitivity to chemotherapy and mutation of which is observed in >50% of various cancers. Cancer cell in which functional p53 is absent is usually more metastatic and is highly resistant to therapeutic attacks. Targeting such absence to regain the lost apoptotic program of cancer cells is a major challenge before the cancer therapists. Our work describing "gain of cellular adaptation" towards altering the cell microenvironment from pro-survival to pro-death not only unveiled a hitherto unexplained mechanism underlying the functional switch-over from one tumor suppressor to another one, but also raised the hope of development of alternative weapon of drug targeting in not-easily-curable cancer with non-functional p53. This work therefore has tremendous social relevance and importance since non-functionality of p53 is present in most of the prevalent cancers of not only India but also all over the world.

Rural Biotechnology Programme

Bose Institute is working for the rural people throughout the year in its Rural Biotechnology Centre at Falta Experimental Farm. This year two hands on training programmes were conducted. The first training programme was on "Mushroom Cultivation and Vermicompost

Production" and it was held during 10th August-16th September 2009. Twenty-three trainees were trained in that training programme. The second training programme was conducted during 11th January-19th March 2010 and was on "Mushroom Cultivation, Vermicompost Production, Apiculture and sericulture". Thirty-one trainees were trained in the second training programme. Besides training all the four programmes had been running by Bose Institute throughout the year and Bose Institute provided facility, guidance and advice to the trainees and local rural people regarding the above four programmes.



Mr. Biswarup Bhakta, Resource Person for apiculture programme was demonstrating application of smoker as a part of the apiculture programme during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 11th January to 19th March 2010.

Mr. Biswarup Bhakta, Resource Person for apiculture programme was demonstrating honeycomb holder as a part of the apiculture programme during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 11th January to 19th March 2010.



Some trainees with their vermicompost produced during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 11th January to 19th March 2010.



One trainee was demonstrating bee keeping to the Director, Registrar, Mr. Hirak Ghosh and other dignitaries after the valedictory session of the training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 11th January to 19th March 2010.

List of Personnel

Administration

Dr. Sibaji Raha, Sr. Professor & Director
Sri Tushar Kanti Ghorui, Registrar
Dr. Utpal Sadhu, Deputy Registrar

Centenary Campus: Kazal Chaudhuri (Retd. on 31.10.09), Ram Krishna Kundu, Debidas Saha, Satyananda Pal, Parimal Ch. Das, Arup Kr. Sengupta, Sankar Nath Sinha, Sukumar Moitra, Subir Sen, Ashis Chakraborty, Sisir Chakraborty, Bidyut Kr. Mandal, Manick Ch. Das, Tapan Chakraborty, Ankur Dutta, Nikhilesh Roy Ghatak, Madhusudan Mitra (Retd. on 31.01.10), Amit Kr. Ghosh, Baldeb Goswami, Rina Roy, Ram Raj Pandey, Elizabeth Pal, Swapan Kr. Sinha, Dhrubajyoti Sen, Rubi Sarkar, Sudam Jana, Bably Marick, Rina Das, Somnath Das, Prodip Kr. Mullick, Sanjoy Krishna Chaki, Debasis Kaley, Angshuman Bhowmik, Sanjib Kr. Das, Biplab Malakar, Satyabrata Chatterjee, Ramesh Chandra Sarkar, Dipak Dutta, Chotelal Rangwa, Tapan Kr. Banerjee, Jubaraj Paul, Krishna Turi, Sudhir Turi, Khoirul Basar Malla, Nagnarayan Yadav, Kanai Hazra, Prafulla Bhunya, Kanak Baran Hazra, Duryodhan Nayak, Bablu Mandal, Sukanta Chakraborty, Subrata Banerjee, Amarnath Hela, Ranjit Das, Sarada Devi, Sukumar Mandal, Bulaki Das, Jagabandhu Nayak, Jagannath Das.

Main Campus: Tarun Kumar Maji, Rabindra Nath Karmakar, Chandra Kanta Sasmal, Tarun Chakraborty, Sanat Kr. Dey, Mahendra Nath Shee, Madhusudhan Marick, Sanat Kr. Dhara, Harekrishna Thoyal, Fulchanda Sardar, Kalicharan Turi, Kissan Das, Munna Turi, Kodan Das, Sk. Mohammad Illias (Retd. on 30.09.09), Nagaswar Das, Rajbrat Ram, Rajkumari Balmiki, Tapas Chakraborty, Prabir Halder (I).

Acharya J.C. Bose Biotechnology Innovation Centre (Madhyamgram Experimental Farm)

Faculty : Dr A N Lahiri Majumder (Chairman), Dr P K Saha (Co-Chairman), Dr. P K Chakraborty (CSIR-ES), Dr S K Datta (CSIR-ES),

Supporting Staff : (Lab) : Dr Supriya Roy, Dr Sutanu Maji, Mr. Asis Dalal, Mr. Atanu Deb, Mr. Sudipta Roy, Mr. Prabir Banerjee, (Field) : Mr Pulak Roy, Mr Rakhal Jana, Mr Sukumar Das, Mr Subhas Senapati, Mr Raj Kishore Lenka, Mr. Rabin Talukdar, Mr. Laxmi Kanta Pradhan, Sk. Inal Ali, Mr Bhanu Kisku, Mr. Mahesh Dasgupta

LIST OF PERSONNEL

Biochemistry Department

Faculty : Dr. B. Bhattacharyya, Sr. Professor, Dr. Pratima Sinha, Sr. Professor & Chairperson, Dr. Pinakpani Chakrabarti, Sr. Professor, Dr. Anuradha Lohia, Sr. Professor, Dr. Rajagopal Chattopadhyaya, Professor, Dr. Pradip Kumar Parrack, Associate Professor, Dr. Subrata Sau, Associate Professor

Students/RA/Project Assistant : Dr. Subhash Haldar, Dr. Sumana Sarkhel (Resigned as on 20.07.09), Mr. Sourav Sarkar (upto 30.04.09), Mr. Soumyananda Chakraborty, Mr. Himadri Biswas, Mr. Rajkrishna Mondal, Dr. Tanaya Chatterjee, Mr. Kaustav Bondyopadhyay (Upto 28.02.10), Ms. Debadrita Mukherjee, Mr. Abinit Saha, Mr. Avishek Mondal, Mr. Dipak Kumar Manna, Mr. Amitava Bandhu, Mr. Arumoy Pal (Upto 31.03.09), Ms. Tanusree Bhattacharyya, Mr. Prabal Chakraborty, Mr. Jaspreet Singh Grewal, Mr. Biswanath Jana, Dr. Malabika Das (Upto 30.06.09), Ms. Somasri Pal, Ms. Aharna Guin (From 05.05.09 to 20.08.09), Mr. Pabitra K. Parua (From 04.05.09 to 05.07.09), Ms. Subhanwita Sarkar (From 15.05.09), Ms. Sohini Guha (From 15.05.09 to 09.11.09), Ms. Aditi Ghosh (From 18.06.09), Ms. Aritrika Pal (From 31.07.09), Ms. Sudeshna Saha (From 18.08.09), Ms. Devlina Chakraborty (From 07.10.09), Dr. Snehasish Basu (From 01.01.10)

Supporting Staff : Mr. Durga Charan Das, Mr. Swapan Kumar. Das, Mr. Ashim Kumar. Banerjee, Mr. Narayan Chandra Datta, Mr. Subhash Chakraborty, Mr. Asim Kumar Poddar, Ms. Debarati Kanjilal, Md. Asrafali Molla, Mr. Sudhanshu S. Maity, Mr. Basudev Ghorui, Mr. Dulal Chandra Mondal, Ms. Ranubala Das

Bioinformatics Centre

Faculty: Prof. Pinakpani Chakrabarti (Scientist-in-Charge), Prof. Tapash Chandra Ghosh, Dr. Debjani Roy.

Students: Mrs. Pamela Mukhopadhyay, Miss Madhurima Das, Miss. Bratati Kahali, Mrs. Sangeeta Kundu, Mr. S. Srihari, Miss. Sucharita Dey, Miss. Tina Begum, Miss. Soumita Podder, Miss Baisali Manna, Mr. Sumit Biswas, Miss. Tanusree Bhattacharya, Mr. Sandip Chakrabarti, Mr. Arumoy Pal, Mr. Mainak Guha Roy, Mr. Pabitra K. Parua, Mrs. Kamalika Sen.

Supporting Staff: Mr. Tushar K. Bhattacharya, Mrs. Sujata Roy, Mr. Sanjib Kumar Gupta, Mr. Jibananda Mondal.

Biophysics Department

Faculty : Dr. Gautam Basu

Students : Saumya Dasgupta, Himal Ganguly, Abhishek Mandal, Madhurima Das, Sarbani Chattopadhyay, Dr. Sumana Banerjee

Supporting Staff : Basudeb Marick, Barun Majumder, Bijoy Munshi, Swapan Jogsharma

Botany Department

Faculty : Dr. Swati Sen-Mandi, Dr. Prabir Kr. Saha, Dr. Dibeyendu Narayan Sengupta (Acting Chairman), Dr. Sabita Bhattacharya, Dr. Swati Gupta-Bhattacharya, Dr. Tapas Kumar Ghose, Dr. Debabrata Basu, Dr. Gaurab Gangopadhyay

Students : Dr. Subhash Kanti Roy (till 12.04.09), Dr. Yasmin Begum, Mr. Annanda Sankar Sau (till 12.03.2010), Dr. Swarup Roy Chaudhury, Mr. Sanjay K. Singh, Mr. Supratim Basu, Mr. Kaushik Ghose (till 05.01.2010), Ms. Madhuvanti Chatterjee, Dr. Sanjukta Dey, Ms. Moumita Gangopadhyay (till 14.03.2010), Mr. Anindy Bhattacharya, Miss Jyotshna Mandal, Mr. Himadri Shekhar Chakrabarti, Mr. Mrinmoy Majumder, Ms. Basabdatta Das, Ms. Suranjana Sarkar, Ms. Priyanka Paul (Join on 04.05.2009), Ms. Shakri Banerjee (Join on 04.05.2009), Ms. Upala Saha, Mr. Subhobrata Ghosh, Ms. Maitra Chatterjee (till 13.08.2009), Ms. Manisha Debnath (till 31.10.2009), Ms. Shealee Chakraborty, Mr. Debabrata Paul, Mrs. Kavita Ghosal (Join on 15.01.2010)

Supporting Staffs: Dr. Romit Poddar, Mr. Sukumar Majumder, Mr. Chanchal Chakraborty, Ms. Chaitali Roy, Mr. Binoy K Modak, (till 23.07.09 and then transferred to M.Sc. Ph. D. Section) Mr. Jadab Kr. Ghosh, Ms. Kaberi Ghosh, Mr. Sasanka sekhar Bera, Mr. Siddhartha Roy, Mr. Bipul Kr. Nag, Mrs. Sarama Pradhan, Ms. Moumita Basu Roy.

Chemistry Department

Faculty : Dr. Joyoti Basu (Chairperson till 28th February, 2010), Dr. K.P. Das (Chairman from 1st March, 2010), Dr. Manas Chakrabarty, Dr. Manikuntala Kundu, Dr. Pradip Das, Dr. Suman Kr. Banik and Dr. Jayanta Mukhopadhyay

Student: Sri Taraknath Kundu (till 24.04.09), Sri Partha Mukherjee (till 09.09.09), Sri Joyes De, Ms. Priyanka Halder, Ms. Ajanta Mukherjee, Ms. Ratna Mukherjee, Ms. Sanchita Basu (till 31.08.09), Sri Victor Banerjee, Ms. Srabani Karmakar, Dr. Sujit Ray, Ms. Gargi Chatterjee, Ms. Paromita Chatterjee, Sri Debarun Ray, Sri Tofajjen Hossain (till 16.03.10), Ms. Kamakshi Sureka, Sri Kuldeep Kumawat, Sri Subhasish Barik, Sri Sourav Sanyal, Sri Sambha Gupta (from 20.4.09), Sri Rajdeep Banerjee (from 18.05.09), Ms. Amrita Kundu (from 09.06.09), Sri Arnab Bandyopadhyay (from 30.07.09), Sri Ranjit Kr. Prajapati (from 03.08.09), Ms. Paulami Rudra (from 03.08.09), Sri Ajay Kumar (from 12.08.09 to 05.02.10), Sri Ranjeet Kumar (from 12.08.09), Ms. Rinku Dey (from 19.08.09), Ms. Shreya Sengupta (from 17.08.09), Sri Sauradipta Banerjee (from 19.01.10), Sri Arun Kumar Sharma (from 05.03.10), Ms. Soumi Biswas (Summer Trainee, from 01.02.10)

Supporting Staff: Dr. Aniruddha Aich, Sri Pranab Kr. Dey, Sri Bhabani Prasad Banerjee, Sri Tapas Ghosh, Sri Dipak Chandra Konar, Sri Debdas Nandy, Smt. Rama Chatterjee, Sri Amarnath Bhatta, Sri Subhas Chandra Paul, Sri Asoke Kr. Maity, Sri Sachchidanand Ram

Central Instrumentation Facility (CIF)

Faculty : Dr. P. C. Sen, Sr. Professor & Scientist in-charge (MC), Dr. Pratima Sinha, Sr. Professor & Scientist in-charge (CB)

Supporting Staff : Tapan Datta; Gobinda Das; Shyamsundar Kundu; Amit Kr. Mahinder; Joydeb Chatterjee; Jaganmoy Guin; Arup Kr. Sen; Subhas Ch. Maikap; Samir Kr. Mukherjee; Pradip Kr. Karmakar; Tanimod Modak Dhar; Ranjan Dutta, Smriti Ranjan Maji, Mrinal Das Ranjit Kr. Ghosh; Debabrata Polley; Sankar Kr. Santra; Saraswati Sarkar Sen, Alphana Bhattacharyya.

Division of Molecular Medicine

Faculty : Dr. Tanya Das, Associate Professor, Dr. Nripendranath Mandal, Associate Professor, Dr. Subrata Majumdar, Professor, Dr. Anup Kumar Misra, Assistant Professor, Dr. Gaurisankar Sa, Professor, Dr. Parimal C. Sen, Senior Professor and Head, Dr. Parames Ch. Sil, Professor, Dr. Baisakhi Saha (upto 03.09.2009, DST Project Scientist)

Students : Dr. Suchandra Majumdar, Dr. Minakshi Mazumdar (upto 28.7.09), Dr. Kaushik Das (upto 03.11.2009), Dr. Minakshi Mazumdar (from 29.07.09), Pallab Ray, Santanu Biswas, Pinki Nandi, Gaurav Gupta, Mrinal Kumar Sarkar (upto 08.03.2010), Argha Adhikari, Prasenjit Manna, Suchismita Mohanty, Pintu Kumar Mandal (upto 31.08.2009), Rajib Panchadhyayee, Parna Bhattacharya, Anupam Adhikari (from 01.01.2010), Bibhabasu Hazra (from 01.01.2010), Joydeep Das-I (from 01.02.10), Jyotirmoy Ghosh (from 01.02.10), Swatilekha Ghosh, Jyotirmoy Ghosh (upto 31.01.2010), Joydeep Das-I (upto 31.01.10), Saikat Majumdar, Gautam Guchhait, Abhishek Santra, Anupam Adhikari (upto 31.12.2009), Shrivati Mukherjee (from 25.01.2010), Pabitra Bikas Pal (from 17.08.2009), Sayantan Banerjee (from 01.09.09), Sri Abhijit Sau (from 18.12.09), Joydeep Das (from 30.10.09), Monoranjan Ghosh (from 02.02.10), Kuntal Halder (from 04.02.10), Samik Chakraborty, Samir Ghosh (upto 03.4.09), Abir Kumar Panda (from 18.02.09), Mander Sengupta (upto 31.8.09), Anirban Sarkar (from 09.10.09), Bibhabasu Hazra (upto 31.12.09), Surav Dutta (from 05.03.10), Rihajit Sarkar, Shilpi Saha, Shrivati Mukherjee (upto 24.01.2010), Payel Bhattacharya (upto 22.06.2009), Argha Manna (from 05.10.09), Sourav Mandal (from 31.8.2009), Juni Chakraborty (upto 31.01.2010), Subhomoy Banerjee (11.10.2009), Samir Ghosh (from 04.04.09), Surojit Bhattacharya (from 10.11.2009), Dewan M.S. Hossain, Shyamtanu Datta (from 09.10.09), Sankhadeep Pal (from 15.01.2010), Sukhendu Dolui (DBT Project Assistant)

Supporting Staff : Pransanta Pal, Indrajit Ray, Sukumar Maitra, Barindra Nath Mandal, Prabal Gupta, Uttam Kumar Ghosh, Arindam Basu, Debasish Majumdar (from 01.01.2010), Amartya Sen, Kalyan Das, Ranjit Das, Purnendu Manna, Shankar Prasad Bari, Kanan Singh

Environmental Science Section

Faculty : Dr. Sibaji Raha, Sr. Professor, Head & Director

Research Fellow: Abhijit Chatterjee (extended SRF up to 18 July 2009), Chirantar Sarkar (JRF)

Supporting Staff : Anandamay Adak, Saral Chandra Das, Bhaskar Roy (IRHPA Project)

Falta Experimental Farm

Faculty: Dr. S.R. Sikdar (PMCG Section), Professor & Coordinator Rural Biotechnology Programme, Dr. K.K. Mukherjee (Consultant and resource person), Dr. A.K. Ray (Consultant and Resource person, Molecular Medicine Division), Sr. Professor

Supporting Staff: Sk. Ansar Ali (Mali)

Microbiology Department

Faculty: Dr. Sujoy K. Dasgupta, Professor, Dr. Tapan K. Dutta, Assoc. Professor, Dr. Wriddhiman Ghosh, Faculty Fellow from 14/12/09, Dr. Parimal C. Sen Sr. Professor & Chairman upto 1/2/10, Dr. Sibaji Raha, Sr. Professor & Chairman from 1/2/10

Students : Nabanita Giri (upto 2/8/10), Joydeep Chakrabarty (upto 31/12/09), Arnab Basu, Sm. Madhumita Roy, Sri Boudhyan Bandhopadhyay, Sm. Joyita Sarkar, Sri Debajyoti Ghosal, Sm. Priyanka Bhowmick, Pratick Khara, Sri Prithwiraj Kirtania, Sm. Piyali Pal Chowdhury, Dr. Wriddhiman Ghosh upto 30/11/09, Sm. Soumita Dutta, Masrura Alam (from 28/1/10)

Supporting Staff: Biswanath De Sarkar, Provat K. Chattopadhyay, Saifullah Gazi, Debashis Sarkar, Prabir Halder, Debashis Mazumder (transfer to Molecular Medicine from 1/1/10), Dilip Bhattacharyya, Ramesh Prasad, Robin Paul, Narayan Patali.

Physics Department

Faculty: Dr. Sibaji Raha, Sr. Professor, Chairman & Director, Chairman till 31.01.2010, Dr. Indrani Bose, Sr. Professor & Chairperson, Chairperson w.e.f. 01.02.2010, Dr. Dipankar Home (Physics & CAPSS), Sr. Professor, Dr. Barun Kumar Chatterjee, Sr. Professor, Dr. Swapan Kr. Saha (Physics & CAPSS), Professor, Dr. Tripurari Prasad Sinha, Professor, Dr. Sanjay Kumar Ghosh (Physics & CAPSS), Assoc. Professor, Dr. Amitabha Mitra (Physics & CAPSS), Asstt. Professor, Dr. Dhruva Gupta (Physics & CAPSS), Asstt. Professor, Dr. Somshubhro Bandyopadhyay (Physics & CAPSS), Asstt. Professor, Dr. Rajarshi Ray, (Physics & CAPSS), Asstt. Professor, Dr. Achintya Singha, Faculty Fellow.

Students: Dr. Partha S. Joarder, Project Scientist, (IRHPA Project), Dr. Supriya Das, Project Scientist, (IRHPA Project), Dr. Ajay Singh, Project Scientist (IRHPA), Dr. Samita Saha, Project Scientist, (MWS Project), Dr. Rajesh Gopal, Research Associate (Institute), Dr. Alok Kr. Pan, Research Associate (Institute), Dr. Sandhya Dey (Mandal), Research Associate, (IRHPA Project), Alo Dutta, Ritam Mallick (Physics & CAPSS), Prasanna Kumar Mandal, Atanu Maulik, (SRF, IRHPA Project), Anirban Lahiri (Physics & CAPSS), Sarbani Majumder, (Physics & CAPSS), Gautam Manna, (Physics & CAPSS), Amit Pal, Sayantri Ghosh, Chandras Bharti, (SRF, DST Project).

Supporting Staff: Sankar Prasad Singha, Shyamsundar Mallick, Rita Chakraborty, Subhasis Banerjee, Manas Dutta, Subrata Das, (Physics, CAPSS), Bharat Prasad Ram, Bonsi Dutta, Dayakant Thakur, Sujit Basu, (Physics, CAPSS), Rajkumar Mourya.

DRDO Project SMS: Dr. Ajay K. Datta, Scientist-E, Shri Manabendra Maiti, Scientist-C, Shri. Soumendra Singh, Scientist-B, Shri. Vineet Surana, Scientist-B, Smt. Ayona Chakraborty, Scientist-B, Shri Arun K. Dasgupta, Consultant (Administration), Shri Krishna Kishore Mazumdar, Administrative Officer (Technical), Smt Sarmistha Saha, Technical Assistant, Shri Abhirup Biswas, Technical Assistant, Shri Bikram Mahatha, Technical Assistant.

Plant Molecular & Cellular Genetics Section

Faculty : Dr. A.N. Lahiri Majumder, Dr. Amita Pal, Dr. Sampa Das, Dr. S.R. Sikdar, Dr. Pallob Kundu and Dr. Shubho Chowdhuri

Supporting Staff: Mrs. Puspita Mukherjee, Mr. Ashim Kumar Nath, Mr. Subal Basak, Mr. Motilal Singh, Mr. Arup Kumar Dey, Mr. Nadiram Kayal, Mr. Birendra Kumar Bari, Mr. Thakur Gond, Mr. Chiranjib Chakraborty, Mr. Uttam Das, Mr. Swarna Das, Mr. Abhishek Mukherjee, Dipak Roy Mondal.

Students : Ms. Nilanjana Banerjee, Mr. Soumitra Maiti, Mr. Pijush Mullick, Ms. Jolly Chatterjee, Ms. Sonali Sengupta, Ms. Sumanti Gupta, Ms. Rumdeep Kaur Grewal, Mr. Sudipta Ray, Mr. Barunava Patra, Mr. Hossain Ali Mondal, Ms. Subhodipa Sengupta, Ms. Lekha Bandopadhyay, Mr. Subrata Kundu, Mr. Anirban Kundu, Ms. Anindita Sengupta, Ms. Suparna Ghosh, Ms. Arpita Bala, Mr. Amit Roy, Mr. Ayan Das, Mr. Anirban Jyoti Debnath, Ms. Sritama Mukherjee, Dr. Saswati Sengupta, Dr. Sujay Paul, Ms. Monia Chatterjee, Mr. Anirban Bhar, Dr. Rajeswari Mukherjee, Ms. Shiny Ch. Sangma, Ms. Niranjana Behlura, Mr. Prithwi Ghosh, Mr. Ritesh Ghosh, Mr. Arunava Mondal.

J. C. Bose Centre

Publication and Museum

Faculty : Dr. Sibaji Raha (Chairman), Dr. K K Mukherjee (Consultant/Advisor)

Supporting Staff : Tarun Kumar Maji, Chandra Kanta Sasmal

Library

Dr. Arun Kumar Chakraborty, Librarian

Supporting Staff : Dr.(Mrs.) Rukmini Mitra, Mr. Kalipada Hait, Mr. Samir Kumar Pal, Mr. Pradip Kumar Sarkar, Dr.(Mrs.) Banhisikha Chaudhuri, Mrs. Gopa Dasgupta, Mr. Gautam Mukherjee, Mr. Sarat Chandra Bhuiyan, Mr. Mrityunjoy Jogsharma, Mr. Arun Kumar Nandi, Mr. Dinanath Das.

Workshop

Mr. A.K. Mukherjee, Workshop Supdt.

Main Campus : Ashutosh Sarkar, Samar Dutta, Sisir Ghosal, Dipen Sen, Sk. Md. Ehia Hossain, Basanta Kr. Shit, Bholanath Saren, Abdul Rahaman Molla, Panchanan Santra, Panchugopal Karak, Goplal Ch. Das, Sk. Md. Farruck, W.D. Rozario, Kalachand Sen, Rajkumar Das, Pranab Banerjee, Brahmdeo Prasad, Subrata Basak, Sanjoy Santra.

New Campus : Alok Kundu, Tapan Mondal, Ashit Bsnrejee, Md. Raffick, Murari Mohan Shee, Baidya Nath Murmu.

Audited Accounts For The Year
2009-2010

S. GHOSE & CO.
Chartered Accountants

11. OLD POST OFFICE STREET
KOLKATA-700 001
Phone : 2231-1995/1996/1997
Fax: 91-033-22485167
E-mail: sghose1943@yahoo.com

AUDITOR'S REPORT

To The Members of the Council of the Bose Institute, Kolkata

- 1.0 We have audited the attached Balance Sheet of the Bose Institute as on 31st March, 2010 and also the Income and Expenditure Account and Receipts & Payments Account for the year ended on that date annexed thereto. These financial statements are the responsibility of the management of the Institute. Our responsibility is to express an opinion on these financial statements based on our audit.

We have conducted our audit in accordance with the auditing standards generally accepted in India. These Standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation. We believe that our audit provides a reasonable basis for our opinion.

- 2.0 We enclose in the Annexure (Audit Observations), a statement on the matters observed by us in course of our audit.

- 3.0 On the basis of audit indicated in paragraph 1.0 & 2.0 above, we report that :

- i. We have obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purpose of our audit.
- ii. In our opinion, proper books of account as required by law have been maintained by the Institute so far as appears from our examination of those books;
- iii. The Balance Sheet, Income & Expenditure Account and Receipts & Payments Account dealt with by this report are in agreement with the books of account. The Auditor's Report on Governing Body Accounts has been forwarded to us and appropriately dealt with in this report.

- iv. In our opinion and subject to our comments in Para 4.0 & 5.0 below, the Balance Sheet, Income & Expenditure Account and Receipts and Payments Account dealt with by this report have been prepared in the specified form applicable to Central Autonomous Bodies (NPOs) and in accordance with applicable accounting standards issued by the ICAI, except as stated elsewhere in this report.

4.0 Attention is invited to the following "Audit Observations" annexed to the Auditor's Report:

- i. Para No. 2.0 preparation of Fixed Asset Register for 2009-10 is in progress.
- ii. Para No. 3.0 regarding absence of insurance coverage in respect of House Building Advances and non-recovery of penal interest @2.5% from the defaulting employees.
- iii. Para No. 4.0 regarding non-availability of Trust Deed of Bose Institute Pension Fund, Contributory Provident Fund and General Provident Fund and consequential absence of any structured investment plan of the aforesaid funds.
- iv. Para No. 5.0 regarding incorporation of assets valued Rs. 69,72,452.75 out of terminated project without any approval of the appropriate authority.
- v. Para No. 6.0 regarding non-recovery/adjustment of long pending LTC & Medical Advances over the years.
- vi. Para No. 7.0 regarding Non-indentification of imported Equipment being debited to WIP.
- vii. Para No. 8.0 regarding lump sum payment of Grant of Rs. 15 lakhs by the Bose Institute, being itself a Grant in aid Educational Institution to Jagadish Bose National Science Talent Search located at 1300, Rajdanga Main Road, Kasba, Kolkata-700107 which is exclusively a separate entity from the Bose Institute, Kolkata.
- viii. Para No. 9.0 regarding non reconciliation of funds and corresponding investments thereof.

5.0 Further attention is drawn to the following paragraphs of Accounting Policies (Schedule-18) & Notes on Accounts (Schedule-19) enclosed to the Financial Statements :

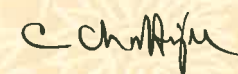
- i. Para No. 2.4 (b) regarding non-identification of Assets relating to terminated Projects for 2006-07 to 2009-10 (Sch. 19).
- ii. Para No. 2.4 (c) regarding non-identification of impairment of assets (Sch. 19).

- iii. Para No. 3.2 regarding charging depreciation irrespective of dates of putting the assets in use (Sch. 18).
- iv. Para No. 6 regarding payment of employees benefits on cash basis in contrary to AS-15 issued by the ICAI which requires provisioning of the same on Actuarial basis (Sch. 18).
- v. Para No. 6.1 regarding unreconciled Tax liability totaling to Rs. 14,61,241.02 (Sch. 19).
- vi. Para No. 6.2 regarding unreconciled Bank Balance (Credit) Rs. 5,50,000/- and Bank Balance (Debit) of Rs. 46,035,90/- (Sch. 19).
- vii. Para No. 7.0 regarding pending recovery/adjustment of advances totalling to Rs.10,19,689/- (Sch. 19).

6.0 In our opinion and to the best of our information and according to the explanations given to us, the said accounts read with the schedules 1 to 19 enclosed thereto and subject to our comments in Para 4.0 & 5.0 above, given the information in the manner so required and give a true and fair view :

- i. In the case of the Balance Sheet, of the state of affairs of the Institute, as at 31st March, 2010.
- ii. In the case of the Income & Expenditure Account, of the surplus for the year ended on the date.

For S. Ghose & Co. (FRN302184E)
Chartered Accountants



(Chandan Chattopadhyay)
Partner
MemberShip No. 51254

Place : Kolkata
Date : 30.09.2010

S. GHOSE & CO.
Chartered Accountants

11. OLD POST OFFICE STREET
KOLKATA-700 001
Phone : 2231-1995/1996/1997
Fax: 91-033-22485167
E-mail: sghose1943@yahoo.com

Annexure to Auditor's Report

AUDIT OBSERVATIONS :

1.0 Balance Sheet of the Institute

The council's Balance Sheet has been drawn after consolidation of the separately audited Statement of Affairs of the Governing body.

2.0 Fixed Assets

- The Fixed Asset Register is being updated by the Institute till 2009-10.
- As informed to us, management has conducted physical verification of the assets during the year.

3.0 House Building Loan

The recipient of the House Building Advances is required to take Insurance coverage of the House/Flats purchased by them. However, it is observed that some of the employees of the Institute have not complied with this requirement. A Circular dated 12.09.2008 has been issued by the Institute reminding the defaulting employees to regularize the position at the earliest. However, no positive outcome has been noticed in this regard.

In terms of Government Notification No. OM No. 1/17011/4/78/H-III dated 20.05.1980 penal interest is required to be additionally recovered @ 2.5% from the defaulting employees by the Institute and implementation of recovery of penal interest should be followed up vigorously.

4.0 Pension and Provident Fund

No Trust Deed of Bose Institute Pension Fund, Contributory Provident Fund and General Provident Fund are available for verification. No recognition has yet been obtained for the said Funds from the Commissioner of Provident Fund. Hence, there is no structured Investment Plan of the aforesaid funds. However, steps have been taken by the Institute to create the necessary Trust and frame the Trust Deed.

5.0 Terminated Project/Schemes

The Institute has incorporated assets valued at Rs. 69,72,452.75 available from terminated project/schemes in its books without any permission/approval from the appropriate authorities.

6.0 L.T.C. & Medical Advance

L.T.C. Advance Rs. 13,800/- and Medical Advance – Rs. 31,000/- are not being recovered from the concerned employees over a long period.

7.0 Import of Equipment-in-Progress – Rs.7,56,694.60/- (Schedule – 4)

The above includes a sum of Rs. 6,37,352/- being payment made to the foreign suppliers for import of equipment. However, due to non-identification of the equipment already received by the Institute, the amount is shown under WIP instead of capitalization of the asset.

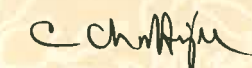
8.0 Amount Paid as Lumpsum Grant to JBNSTS (Schedule – 15)

The request of honorary Director JBNSTS to sponsor a one time grant of Rs 15 lakhs to set up a laboratory/workshop was approved by the finance committee in its meeting held on 21.11.2008. In terms of the approval, an amount of Rs. 15 lakhs was paid to JBNSTS on 16.02.2010 out of the plan fund of the Institute for the current Financial year 2009-10.

9.0 Reconciliation of Funds and Investments thereof

Reconciliation of funds credited for different purposes and corresponding investment thereof is pending. The impact of such non-reconciliation is not ascertainable.

For S. Ghose & Co.
Chartered Accountants



(Chandan Chattopadhyay)
Partner
MemberShip No. 51254

Place : Kolkata
Date : 30.09.2010

BOSE INSTITUTE
Receipts & Payments Account for the year 2009-10

RECEIPTS					PAYMENTS				
Particulars	Sch.	Council (Rs.)	Project (Rs.)	Total (Rs.)	Particulars	Sch.	Council (Rs.)	Project (Rs.)	Total (Rs.)
To Opening Balance	1	8120976.01	90997925.87	9918901.88	By Other Administrative Expenses	2	29781353.21	0.00	29781353.21
" Interest Earned	9	673832.63	0.00	673832.63	" Establishment Expenses	3	288906671.00	0.00	288906671.00
" Other Income	10	467152.50	0.00	467152.50	" Laboratory Expenses	4	47179155.73	0.00	47179155.73
" Income from Services	11	549808.00	0.00	549808.00	" Work-in-Progress	5	3986289.00	0.00	3986289.00
" Sponsored Project Grant	12	0.00	60676627.00	60676627.00	" Grant Expenses	6	0.00	105360396.85	105360396.85
" Receipt of IRHPA Project	13	0.00	1203486.00	1203486.00	" Payments of IRHPA Project	7	0.00	5424516.40	5424516.40
" Bank Interest (ICAR NAIP) D Basu		0.00	21152.00	21152.00	" Advances	8	9126621.00	0.00	9126621.00
" Bank Margin FD		0.00	20160000.00	20160000.00	" MARGIN CUM FD		0.00	39433000.00	39433000.00
" Bank suspense (Grant)		0.00	550000.00	550000.00	" BI Mod Fund		16528478.00	0.00	16528478.00
" Bose Institute		0.00	468284079.72	468284079.72	" BIC		218400.00	0.00	218400.00
" Administration		14658.00	0.00	14658.00	" Liability		0.00	120515.00	120515.00
" N/R Books and Journals		15549.10	0.00	15549.10	" Bose Institute		0.00	469454311.73	469454311.73
" Insurance Premium		2422438.00	0.00	2422438.00	" CPC New Pension scheme		997206.00	0.00	997206.00
" Party Income Tax		826583.00	0.00	826583.00	" Bank Suspense		958200719	0.00	958200719
" Photocopy Charges		1286.00	0.00	1286.00	" Equipment & Apparatus System		27868536.50	0.00	27868536.50
" Astro Particle Physics (CAPSS)		249038.00	0.00	249038.00	" E-Governance (NIR)		163890.00	0.00	163890.00
" Instrument Usage		2207.00	0.00	2207.00	" Darjeeling Experimental Station		1617236.00	0.00	1617236.00
" Misc Astro Physics		6951.00	0.00	6951.00	" E-Governance		64426.00	0.00	64426.00
" Office Contribution New Pension		203397.00	0.00	203397.00	" Furniture & Fitting		6768083.00	0.00	6768083.00
" Payable to Party		6.00	0.00	6.00	" Internet & E-mail System		1838314.00	0.00	1838314.00
" Library Caution Money		27000.00	0.00	27000.00	" Indo Bell Joint Venture		31440.00	0.00	31440.00
" TA Non Plan		4064.00	0.00	4064.00	" Books & Journal NIR		39652821.65	0.00	39652821.65
" Employees Welfare Fund (Investment)		158629.78	0.00	158629.78	" Air Condition		1987050.00	0.00	1987050.00
" Building Repair		18778.00	0.00	18778.00	" Electric Installation		628042.00	0.00	628042.00
" Bio Chemistry		7381.00	0.00	7381.00	" NESST Base Programme		1125566.00	0.00	1125566.00
" Advance		4032441.00	0.00	4032441.00	" Party Income Tax		546144.00	0.00	546144.00
" Bank Suspense		9526877.19	0.00	9526877.19	" Receivable from Institute Staff		25803.00	0.00	25803.00
" Central Instrument Facility		2582.00	0.00	2582.00	" Security Guard		3201798.00	0.00	3201798.00
" Division of Molecular Medicine		213370.00	0.00	213370.00	" Sales Tax		237946.00	0.00	237946.00
" Earnest Money		244000.00	0.00	244000.00	" Security Deposit / Earnest Money		1052977.00	0.00	1052977.00
" Equipment and Apparatus		29635.00	0.00	29635.00	" Security Deposit		84335.92	0.00	84335.92
" OPD		25945.00	0.00	25945.00	" Co-operative		13927267.00	0.00	13927267.00
" National Travel Grant		9338.00	0.00	9338.00	" Institute's Sample Testing		30167.00	0.00	30167.00
" Advertisement		14098.00	0.00	14098.00	" C.P.F. Subscription		343172.00	0.00	343172.00
" GPF Subscription		21666939.00	0.00	21666939.00	" G.P.F. Subscription		22954969.00	0.00	22954969.00
" Grant in aid - Non Plan (Recurring)		20000000.00	0.00	20000000.00	" Group Insurance		256598.25	0.00	256598.25
Balance C/d		69534960.21	641893270.59	711428230.80	Balance B/d		531569763.45	619792739.98	1151362503.43

Cont.

RECEIPTS					PAYMENTS				
Particulars	Sch.	Council (Rs.)	Project (Rs.)	Total (Rs.)	Particulars	Sch.	Council (Rs.)	Project (Rs.)	Total (Rs.)
Balance B/d		69534960.21	641893270.59	711428230.80	Balance B/d		531569763.45	619792739.98	1151362503.43
Grant in aid - Plan (Recurring)		41000000.00	0.00	41000000.00	Governing Body		202639.00	0.00	202639.00
Darjeeling Experimental Station		492845.00	0.00	492845.00	Corporate Membership		551500.00	0.00	551500.00
Group Insurance		273662.00	0.00	273662.00	Income Tax		30610083.00	0.00	30610083.00
Hindi Cell		44500.00	0.00	44500.00	Professional Tax		598695.00	0.00	598695.00
House Building Advance		1299022.00	0.00	1299022.00	Refund of P.F. Advance		1321155.00	0.00	1321155.00
Internet / Web-site Maintenance		970508.00	0.00	970508.00	Renovation of Lecture Hall		571658.00	0.00	571658.00
Income Tax		22825097.00	0.00	22825097.00	Employees Welfare Investment Account		158677.00	0.00	158677.00
Accrued Grant		10000000.00	0.00	10000000.00	IRHPA Prof A. Lohia		100757.00	0.00	100757.00
L.T.C. Advance		1037497.00	0.00	1037497.00	IRHPA Prof S. Raha		3922119.00	0.00	3922119.00
L.T.C. Leave Cashment		5330.00	0.00	5330.00	Scheme		441093531.00	0.00	441093531.00
MotorCarAdvance		302391.00	0.00	302391.00	Sample Testing (FTNMR)		1868.00	0.00	1868.00
Professional Tax		574855.00	0.00	574855.00	Institute's Contribution to Pension fund		59576603.00	0.00	59576603.00
Sales Tax		438187.00	0.00	438187.00	IASIA-2010		401942.00	0.00	401942.00
Security Deposit / Earnest Money		2961346.00	0.00	2961346.00	Liability		12986815.00	0.00	12986815.00
Receivable from Institute Staff		43934.00	0.00	43934.00	IRHPA - Profomic and Gnomics		2314.00	0.00	2314.00
Publication		18727.00	0.00	18727.00	FACS- CALIBAR		99270.00	0.00	99270.00
Travelling (Plan)		49091.00	0.00	49091.00	Travelling		228308.00	0.00	228308.00
Arreardues 6th CPC		13767497.00	0.00	13767497.00	Construction of Wall at Darjeeling		1052873.00	0.00	1052873.00
B.I. Mod & Dev Fund Investment		11900000.00	0.00	11900000.00	DA on TA (Non Plan)		404374.00	0.00	404374.00
Canteen Assistance		12000.00	0.00	12000.00	Honorarium		152000.00	0.00	152000.00
Chemistry		26043.00	0.00	26043.00	Miscellaneous		343617.00	0.00	343617.00
Co-operative		1401392.00	0.00	1401392.00	Insurance Premium		2455526.00	0.00	2455526.00
CPC New Pension Scheme		1005126.16	0.00	1005126.16	DA on TA (Plan)		903118.00	0.00	903118.00
C.P.F. Subscription		336886.00	0.00	336886.00	Payable to Institute Staff		44272.00	0.00	44272.00
C.P.F. Office Contribution		55441.00	0.00	55441.00	Other Allowances		12832.00	0.00	12832.00
C.M.B.S. (Regular Employee)		534080.00	0.00	534080.00	Office Contribution (New Pension)		644703.00	0.00	644703.00
C.M.B.S. (Pensioners)		435970.00	0.00	435970.00	Construction of Electrical Meter room at Falta		80898.00	0.00	80898.00
DA (Non-Plan)		66.00	0.00	66.00	Registration fees		4691.00	0.00	4691.00
Bank Charges		25.00	0.00	25.00	UK - IERI Prog IISC -Bangalore		191554.00	0.00	191554.00
Director & Admn. (Non Plan)		20190.90	0.00	20190.90	Renovation of Main and Central Campus				
Falta ExptStation		21342.00	0.00	21342.00	Acoustical Treatment at Lecture Hall.		133450.00	0.00	133450.00
General Charges		9405.00	0.00	9405.00					
Honorarium		150000.00	0.00	150000.00					
Library		2000.00	0.00	2000.00					
Library (Plan)		536445.00	0.00	536445.00					
Balance C/d		563695861.27	641893270.59	1205589131.86	Balance C/d		1090421605.45	619792739.98	1710214345.43

Particulars	RECEIPTS			PAYMENTS			Total (Rs.)	Particulars	Total (Rs.)
	Sch.	Council (Rs.)	Project (Rs.)	Sch.	Council (Rs.)	Project (Rs.)			
Balance b/d		563695861.27	641893270.59		1090421605.45	619792739.98	1205589131.86		1710214345.43
.. Research Staff (Plan)		7556508.80	0.00				7556508.80		
.. Festival Advance		2636000.00	0.00				2636000.00		
.. Governing Body		25600.00	0.00				25600.00		
.. H.R.A. (Plan)		1643141.00	0.00				1643141.00		
.. IASTA-2010		150000.00	0.00				150000.00		
.. Internet on HBL		513027.00	0.00				513027.00		
.. IRHPA (Prof A. Lohia)		230000.00	0.00				230000.00		
.. IRHPA (Prof S. Raha)		597984.00	0.00				597984.00		
.. J C Bose Publication		520.00	0.00				520.00		
.. Labour Welfare		221653.00	0.00				221653.00		
.. Miscellaneous Salary Exp.		1500.00	0.00				1500.00		
.. Medical Advance		325251.00	0.00				325251.00		
.. Medical Reimbursement		256194.00	0.00				256194.00		
.. Motor Car		20000.00	0.00				20000.00		
.. PMCG		5600.00	0.00				5600.00		
.. Service Tax		50858.00	0.00				50858.00		
.. Tender Fees		9000.00	0.00				9000.00		
.. UK - IERI Prog IISC - Bangalore		200000.00	0.00				200000.00		
.. M.Sc. Ph.D Course		171000.00	0.00				171000.00		
.. Pension Fund		59576603.00	0.00				59576603.00		
.. Pasteur Memorial Oration Fund		275000.00	0.00				275000.00		
.. Payable to Institute Staff		2000.00	0.00				2000.00		
.. Intellectual Property		1500000.00	0.00				1500000.00		
.. Party Advance (EPF)		90000.00	0.00				90000.00		
.. Refund of PF advance		1432765.00	0.00				1432765.00		
.. Rent from Lecture Hall- Public Address system		2500.00	0.00				2500.00		
.. Liability		12954209.00	0.00				12954209.00		
.. Telephone		5558.00	0.00				5558.00		
.. Rental Charges Hostel and Guest House		250671.00	0.00				250671.00		
.. Library (Non Plan)		5960.00	0.00				5960.00		
.. Sample Testing FTNMR		20000.00	0.00				20000.00		
.. Scheme		44896515.73	0.00				44896515.73		
.. Summer Training Falta		10450.00	0.00				10450.00		
.. Training Fees		6000.00	0.00				6000.00		
.. Sales Proceeds of Farm Product		21976.00	0.00				21976.00		
.. Sales Proceeds of SirJC Bose's Publication		97171.50	0.00				97171.50		
.. TA, (Plan)		429524.00	0.00				429524.00		
.. 150 th Birth Anniversary of Sir J.C Bose		100000.00	0.00				100000.00		
TOTAL		1104055201.30	641893270.59		1104055201.30	641893270.59	1745948471.89		1745948471.89

We have prepared the revised Statement of Receipts & Payments Account of Bose Institute, Kolkata for the year ended 31st March, 2010 based on the separate columnar Cash Trials of Council and Projects which are in agreement with the respective Cash Books and General Ledgers of the Institute.

Date : 30.09.10
Place : Kolkata

For S. Ghosh & Co. (FRN302184E)
Chartered Accountant
Chandan Chattopadhyay
Partner
Membership No. 51254

BOSE INSTITUTE Kolkata

Balance Sheet as at 31st March, 2010

Amount in Rs.

Capital Fund and Liabilities	Schedules	Current Year	Previous Year
Capital Fund	01	371286121.47	330106924.47
Earmarked Funds	02	283620181.31	257962689.24
Current Liabilities	03	91892254.02	131968135.13
Total		746798556.80	720037748.84
Assets			
Fixed Assets	04	390625605.25	348280527.25
Investments-from Earmarked Funds	05	98868985.15	97386944.15
Investments - Others	06	147689932.13	125837027.80
Current Assets, Loans, Advances Etc.	07	109614034.27	148533249.64
Total		746798556.80	720037748.84
Significant Accounting Policies	18		
Notes on Accounts	19		

Place : Kolkata

Date : 30 Sep., 2010

Sd/-
(T. K. Ghorui)
Registrar

Sd/-
(P. C. Das)
Audit & Finance Officer

Sd/-
(Prof. S. Raha)
Director

Sd/-
(S. Pal)
Accounts Officer

This is the Balance Sheet referred to in our
Report of even date.

For **S. Ghose & Co.**
Chartered Accountants
C. Chattopadhyay
(C. Chattopadhyay)
Partner

BOSE INSTITUTE
Income and Expenditure Account For The Year Ended 31.03.2010

Amount in Rs

Income	Schedule	Current Year	Previous Year
Income From Services	9	3346952.00	11830822.00
Grants	10	430000000.00	325900000.00
Interest Earned	11	5028697.29	1931462.45
Other Income	12	1255835.00	1089972.81
Fund for Capital Expenditure Written Back	13	0.00	14048352.00
Total (A)		439631484.29	354800609.26
Expenditure			
Establishment Expenses	14	263840548.30	193118532.85
Other Administrative	15	39008573.94	44869695.45
Laboratory Expenses	16	55071334.00	37181913.00
Fund for Capital Expenditure	17	89014289.05	109764082.00
Total (B)		446934745.29	384934223.30
Balance (A - B) Being Deficit/Surplus		(-) 7303261.00	(-) 30133614.04
Balance Being Deficit/Surplus			
Carried To Special Reserve			30099823.45
Carried To Current Assets Part - B		7303261.00	33790.59
Under Receivable Head			
SIGNIFICANT ACCOUNTING POLICIES	18		
NOTES ON ACCOUNTS	19		

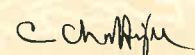
Place : Kolkata
Date : 30 Sep., 2010

Sd/-
(T. K. Ghorui)
Registrar

Sd/-
(Prof. S. Raha)
Director

This is the Balance Sheet referred to in our
Report of even date.

For **S. Ghose & Co.**
Chartered Accountants


(C. Chattopadhyay)
Partner

Sd/-
(P. C. Das)
Audit & Finance Officer

Sd/-
(S. Pal)
Accounts Officer

BOSE INSTITUTE
93/1, Acharya Proafulla Chandra Road, Kolkata – 700 009.

Compliance Report of The Institute on the Audit Observations Financial Year 2009-2010

SL NO	AUDIT OBSERVATIONS	REPLIES
1.0 Balance Sheet of the Institute :		
	The Council's Balance Sheet has been drawn after consolidation of the separately audited Statement of Affairs of the Governing Body.	Observation is self explicit, hence no comment.
2.0 Fixed Assets :		
a)	The Fixed Asset Register is being updated by the Institute till 2009-10.	Updating of Asset Registrar for the Year 2009-10 has been completed and ready for production before the next audit
b)	As informed to us, management has conducted physical verification of the assets during the year.	Physical verification of Asset for the year 2009-10 is over and duly informed to the audit.
3.0 House Building Loan :		
	The recipient of the House Building Advances is required to take Insurance coverage of the House/Flats purchased by them. However, it is observed that some of the employees of the Institute have not complied with this requirement. A circular dated 12.09.2008 has been issued by the Institute reminding the defaulting employees to regularize the position at the earliest. However, no positive outcome has been noticed in this regard.	The record shows that after taking necessary administrative action over the matter the number of defaulter loanees comes to 12 only. However, further efforts have already been initiated to comply with the Government Rules in all respect in this matter. The out come will be shown to the next audit.
4.0 Pension and Provident Fund :		
	No Trust Deed of Bose Institute Pension Fund, Contributory Provident Fund and General Provident Fund are available for verification. No recognition has yet been obtained for the said Funds from the Commissioner of Provident Fund. Hence, there is no structured Investment Plan of the aforesaid funds. However, steps have been taken by the Institute to create the necessary Trust and frame the Trust Deed.	Institute has GPF, CPF and Pension Scheme based on CCS (Pension Rules 1972) and duly approved by the DST. Trust Deed in respect of GPF for the employees prior to 01.01.2004 is ready for execution with the appropriate authority. It would be shown in the next audit. As regards pension, it is regulated under CCS (Pension) Rules 1972.

SL NO AUDIT OBSERVATIONS**REPLIES****5.0 Terminated Projects/Schemes :**

The Institute has incorporated Assets valued at Rs.69,72,452.75 available from terminated projects/schemes.

Observation is self explicit and hence no comment.

6.0 L.T.C. & Medical Advance :

L.T.C Advance Rs.13,800/- and Medical Advance- Rs.31,000/- are not being recovered from the concerned employees over a long period.

LTC advance of Rs. 13,800/- paid to Sri Jagabandhu Nayak has been taken care of against LTC bill awaiting adjustment. Regarding realization/ adjustment of medical advance of Rs. 31,000/- an amount of Rs. 20,000/- in favour of Sri Ramesh Sarkar has been put in the process to complete realization within Dec'10 against his salary. Same mechanism has been adopted towards realization of Medical Advance of Rs. 5,000/- each, one for Sri Amartya Sen and the other for Sri Kodan Das against Salary for the Month of Oct'10.

7.0 Import of Equipment in Progress -Rs.7,56,694.60/- (Schedule - 4) :

The above includes a sum of Rs. 6,37,352/- being payment made to the foreign suppliers for import of equipment. However, due to non-identification of the equipments already received by the Institute, the amount is shown under WIP instead of capitalization of the asset.

Administrative exercise has been initiated to identify the equipments totaling Rs. 6,37,352/- for capitalization which will be ready for production before the next audit.

8.0 Amount paid as Lump sum Grant to JBNSTS (Schedule - 15) :

The request of honorary Director JBNSTS to sponsor a one time grant of Rs.15 lakhs to set up a laboratory / Workshop was approved by the finance committee in its meeting held on 21.11.08. In terms of the approval, an amount of Rs.15 lakhs was paid to JBNSTS on 16.02.2010 out of the plan fund of the Institute for the current Financial year 2009-10.

The observation is self explicit and hence does not warrant any further explanation.

9.0 Reconciliation of Funds and Investments thereof :

Reconciliation of funds credited for different purposes and corresponding investment thereof is pending. The impact of such non-reconciliation is not ascertainable.

Noted for compliance during 2010-11 and accordingly matching investment as required will be shown to the next audit for their verification.



Bose Institute had the proud privilege of hosting a visit from Professor Harald zur Hausen from Deutsche Krebsforschungszentrum (DKFZ), Germany, winner of the Noble Prize in the Physiology and Medicine for the year 2008, on December 3, 2009. Professor Harald zur Hausen delivered an enchanting semi-technical talk on the history of his researches leading to the discovery of the Human Papilloma Virus and the HPV Vaccine Programme. After the lecture, Professor Harald zur Hausen interacted freely with the research students and faculty members of the institute, and discussed various issues related to future directions in Biomedical Researches, ethical questions and so on. He also visited the J. C. Bose Museum at the Main Campus.