The 94th Foundation Day of Bose Institute was celebrated on 30th November 2010. **Prof. André Béteille**, Professor Emeritus of Sociology, University of Delhi graced the occasion as Guest of Honour and delivered the 72nd Acharya Jagadis Chandra Bose Memorial Lecture on **'Caste and the Citizen'.**

ANNUAL REPORT OF THE BOSE INSTITUTE

2010-2011

Bose Institute
93/1, Acharya Prafulla Chandra Road
Kolkata -700 009

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

Dr. Dipankar Home *(Chairman)*
Dr. Gautam Basu *(Convener)*
Dr. Pradip Parrack *(Member)*
Dr. Debabrata Basu *(Member)*

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Acharya J. C. Bose – demonstrating an experiment to European dignitaries.

From the Director's Desk

It is my privilege to present, on behalf of Bose Institute, the report of our activities during the fiscal year 2010-11. This document is not only a statutory requirement; it attempts to provide a readable account of all our activities during the year, which we carry out mostly under the aegis of the Indian taxpayer.

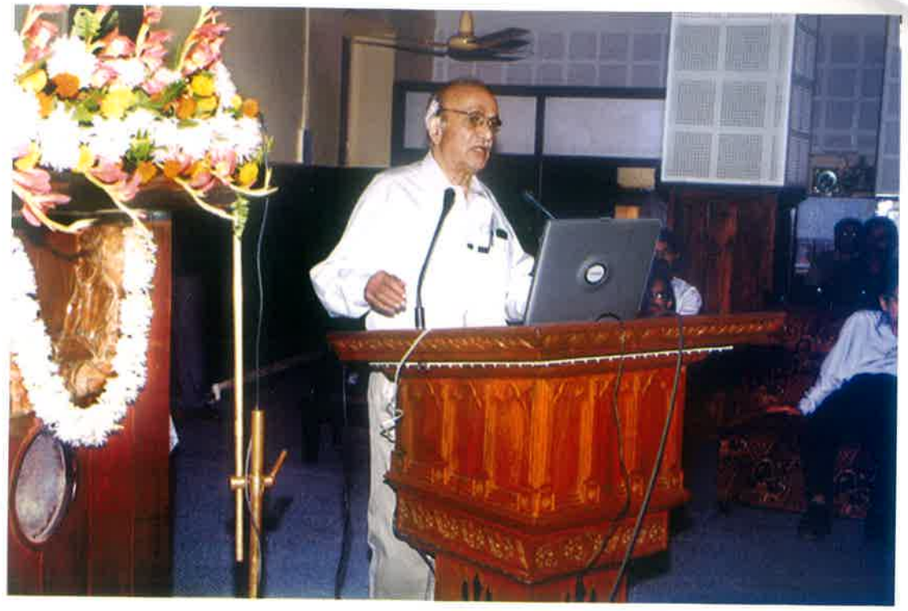
The philosophy guiding Bose Institute was stated in no uncertain terms by our beloved Founder, the doyen of modern Indian science, Acharya Sir Jagadis Chandra Bose: "The lines of physics, of physiology and psychology converge and meet. And here will assemble those who would seek oneness amidst the manifold". We have continued to endeavor to uphold this doctrine, pursue seamless science. This year also has not been an exception; we have continued to generate new knowledge and facilitate the widest possible diffusion of the same.

Our heartfelt gratitude to the Hon'ble members of our Governing Council, the Governing Body of the Bose Institute Society, the Finance Committee, the Scientific Advisory Committee and the Research Area Panels. We are indebted to the expert colleagues from all over India who have generously given us the benefit of their experience and expertise in various selection and advisory committees. Our thanks to the Department of Science & Technology, Government of India for the grants-in-aid as well as to various funding agencies, Indian and International, for extramural research support.

Lastly, but not in the least, I would like to put on record my own debt of gratitude to the members of the Publication Committee of Bose Institute for bringing out this report in a timely and aesthetically pleasing manner.

With my best wishes to all the readers,

Sibaji Raha
Director



126th Birth Day Celebration of Prof. Debendra Mohon Bose was celebrated on 26th November 2010 at Lecture Hall, Bose Institute. **Prof. S. K. Joshi**, former Director General, CSIR & Professor Emeritus, National Physical Laboratory, New Delhi graced the occasion and delivered the D. M. Bose Memorial Lecture entitled **Glimpses of Nanoscience**.

A team of delegates from Vietnam headed by **Mr. Vu Quang Diem**, Hon'ble Ambassador of S. R. Vietnam in India, visited Bose Institute on April 24, 2010.

THE BOSE INSTITUTE

Established: 30th November, 1917

Introduction

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 94 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. 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 cater regularly 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:

This group is working on different fundamental problems of plant biology and emphasis has also been given to identify the key proteins and genomic components coding for desirable phenotypes through genetical and molecular approaches. Recently initiatives have also been undertaken to understand epigenetic, transcriptional and post transcriptional regulations of selected key genes. The effective use of these novel genes and the regulatory elements in crop improvement programme by functional genomic approach has been undertaken with a view to improve the plant performance.

II. Protein Structure, Function and Engineering :

Resolution of Protein structure is the key criteria to determine 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 :

Bioinformatics Centre was incepted 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 modeling 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 & Technology 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.

MALDI TOF-TOF

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 twelve members including the Director. The management of the Institute is vested in the Bose Institute Council that has 18 members including the Secretary, DST, Govt. of India. 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. Banerjea
5. Dr. Anutosh Chatterjee
6. Dr. Manish Sekhar Chakraborty
7. Shri D. Mandal
8. Shri Dilip Bhattacharyya
9. Prof. Parul Chakrabarti
10. Prof. Bikash Sinha
11. Vacant
12. Director, Bose Institute, Secretary

Members of the Council

1. Secretary, Department of Science & Technology, Government of India or his nominee
2. Director General, CSIR or his nominee
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), Wet 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, DST nominated Scientist from outside West Bengal
10. Prof. M. Udaykumar, DST nominated Scientist from outside West Bengal
11. Director, IACS, Kolkata - Permanent Invitee
12. Director, S N Bose National Center for Basic Sciences, Kolkata Permanent Invitee
13. Prof. S. N. Chatterjee, Nominee of the Governing Body
14. Prof. Bikash Sinha, Nominee of the Governing Body
15. Registrar, Bose Institute - Secretary

Members of the Finance Committee

1. Principal Secretary, Higher Education Department, Govt. of W.B.
2. Shri Somnath Sanyal – Representative of the Governing Body
3. Joint Secretary and Financial Adviser to the Department of Science and Technology, Govt. of India or his nominee
4. Principal Accountant General (A & E), West Bengal
5. Director, Bose Institute
6. Registrar, Bose Institute – Secretary.

'Mayapuri', Darjeeling

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

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

Dr. S. Das *[(DPB) Coordinator]*
Dr. Sabita Bhattacharya *(DPB)*
Dr. Gaurab Gangopadhyay *(DPB)*
Dr. S. Gupta Bhattacharya *(DPB)*
Dr. Amita Pal *(DPB)*
Dr. P. K. Saha *(DPB)*
Dr. D. N. Sengupta *(DPB)*
Dr. D. Basu *(DPB)*
Dr. S. Chaudhuri *(DPB)*
Dr. T. K. Ghose *(DPB)*
Dr. P. Kundu *(DPB)*
Dr. A. N. Lahiri Majumder *(DPB)*
Dr. S. Sen-Mandi *(DPB)*
Dr. S. R. Sikdar *(DPB)*

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. Shubhra Ghosh Dastidar *(Bioinformatics Centre)*
Dr. Zhumur Ghosh *(Bioinformatics Centre)*
Dr. G. Basu *(Biophysics)*
Dr. Tapan K. Dutta *(Microbiology)*
Dr. T. C. Ghosh *(Bioinformatics Centre)*
Dr. Debjani Roy *(Bioinformatics Centre)*

IV. Molecular Medicine :

Dr. P. C. Sen *[Molecular Medicine (Coordinator)]*
Dr. Tanya Das *(Molecular Medicine)*
Dr. S. Majumder *(Molecular Medicine)*
Dr. N. N. Mandal *(Molecular Medicine)*
Dr. Mahadeb Pal *(Molecular Medicine)*
Dr. P. C. Sil *(Molecular Medicine)*
Dr. Kaushik Biswas *(Molecular Medicine)*
Dr. Kuladip Jana *(Molecular Medicine)*
Dr. Atin Kumar Mandal *(Molecular Medicine)*
Dr. Anup Kumar Misra *(Molecular Medicine)*
Dr. Gaurisankar Sa *(Molecular Medicine)*

V. Microbial Genomics and Infection Biology :

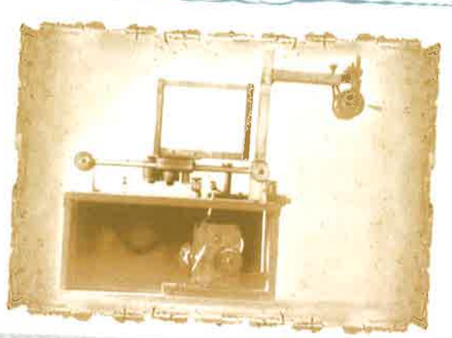
Dr. P. Sinha [Biochemistry *(Coordinator)]*
Dr. Tanya Das *(Molecular Medicine)*
Dr. Sujoy Das Gupta *(Microbiology)*
Dr. M. Kundu *(Chemistry)*
Dr. P. Parrack *(Biochemistry)*
Dr. S. Sau *(Biochemistry)*
Dr. J. Basu *(Chemistry)*
Dr. Wriddhiman Ghosh *(Microbiology)*
Dr. Tapan Dutta *(Microbiology)*
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. Soumen Roy *(Chemistry)*
Dr. Pratima Sinha *(Biochemistry)*
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. Gaurisankar Sa *(Molecular Medicine)*

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

Dr. D. Home *[Physics & CAPSS (Coordinator)]*
Dr. Indrani Bose *(Physics)*
Dr. Abhijit Chatterjee *(Environment Section)*
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)*
Dr. S. S. Bandopadhyay *(Physics & CAPSS)*
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)*



Scientific Reports

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

Identification of anther/tapetum specific genes and upstream element from Sesame : ***Dr. Debabrata Basu***

Anther/tapetum specific genes have been isolated by PCR select cDNA subtraction using cDNAs isolated from mRNA of anther and leaf tissue. The anther/tapetum specific expression of these genes has been established by real time PCR using GADPH gene as internal control. The PCR mediated walking of genomic DNA results isolation of upstream elements of the genes which shows number of already identified anther/pollen specific motifs found in the upstream elements of different plants.

Role of auxin in resistance against *Alternaria brassicicola* : ***Dr. Debabrata Basu***

Through differential screening of cDNA library and PCR select cDNA subtraction numbers of auxin responsive genes have been identified from resistant *Sinapis alba* plant challenged with *A. brassicicola.* Monitoring of the expression of these genes in susceptible *Brassica juncea* challenged with *A. brassicicola* indicate auxin responsiveness is critical for resistance. Transgenic *B. juncea* plants with auxin responsive gene 'Small auxin up RNA' (SAUR) have been raised to understand this phenomenon.

Production of improved germplasm with the aid of biotechnology : ***Dr. Sabita Bhattacharya***

Transformed (Tf) clone of *Plumbago indica* having higher potential of rooting and plumbagin synthesis in roots, has been established *in-vitro*. Distinctly different morphology, anatomy and DNA banding pattern of the clone revealed its separate genetic status from the species' wild form.

Microbe-free cultures of ginger, haldi and amhaldi have been grown in vitro with a view to standardize protocol for high frequency production of disease-free planting materials.

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

Reprogramming of cell differentiation in response to external stress stimuli is one of the important mechanism by which plants adapt to the environment. The adaptive reprogramming requires alteration of numerous gene expressions and pre- as well as posttranscriptional and/or translational modifications of factors. In eukaryotes, the accessibility of DNA sequence to transcription machinery is critically determined by the

degree of packaging of the DNA into condensed and open chromatin structure. The remodeling of higher order chromatin structure can be achieved by loosening either the DNA-histone contact points or the histone-histone contact points. One of the key players responsible for causing structural changes in the chromatin is the high mobility group (HMG) proteins superfamily. A novel high mobility group protein has been identified in plants called ARID/HMG. The present research is focused on the role of ARID/HMG in modulating chromatin structure of plants.

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

Antibiotic resistant marker gene free *Allium sativum* leaf lectin expressing insect resistant rice, mustard lines developed through transgenic approach were multiplied and advanced progenies are being analysed.

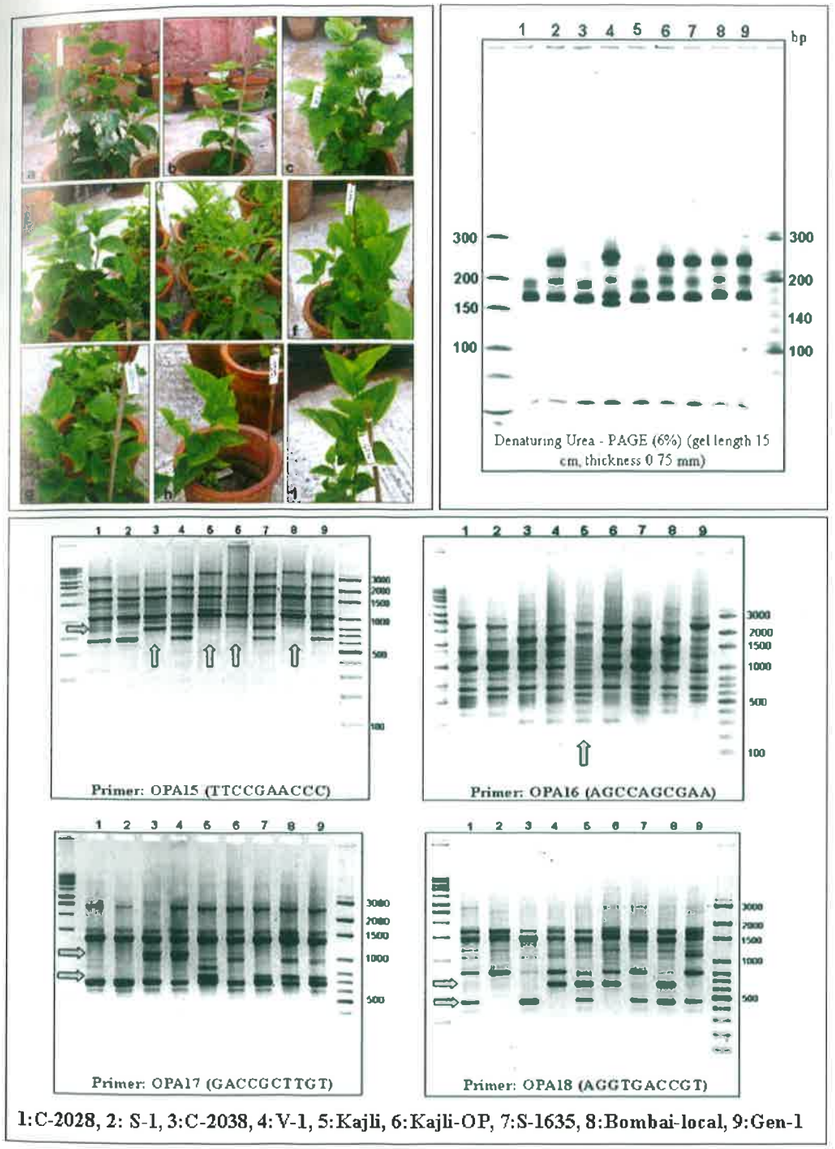
Altered binding of membrane bound alkaline phosphatase receptor from *Helicoverpa armigera* to native and mutated version of Cry1Ac toxin were monitored that correlates with the differential insecticidal efficacy of the mutated toxins

Functional genomic analysis for understanding defense mechanism of chickpea against wilt causing *Fusarium oxysporum* detected up and down-regulated signaling molecules. The activity of some of the signaling molecules are detected to be in line with the 'Guard/ Decoy Model' in chickpea-*Fusarium* encounter.

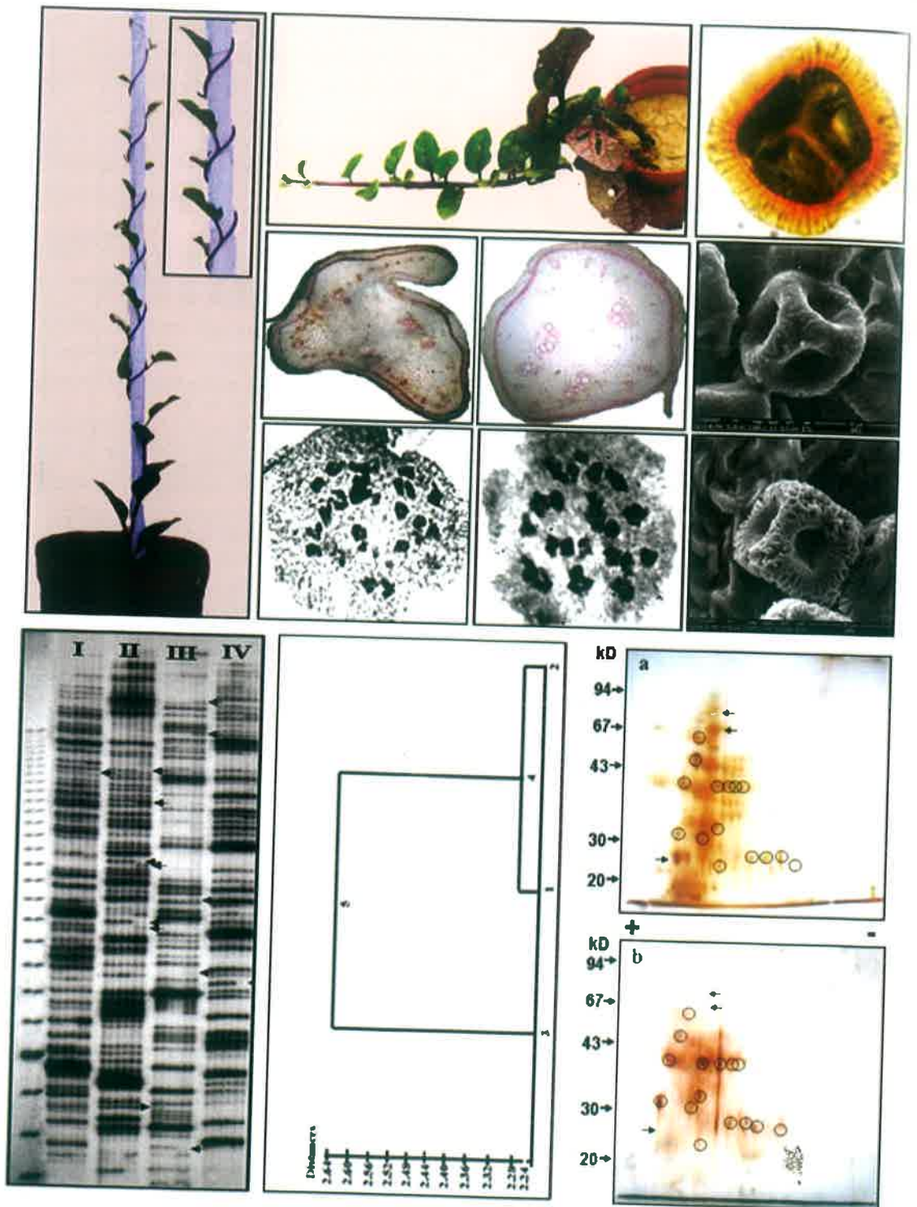
A Microarray based comparative transcript analysis between susceptible and resistant genotypes of rice against bacterial blight is under way for developing understanding of early defense responses in rice against *Xanthomonas oryzae*.

Improvement of cultivated sesame varieties : ***Dr. Gaurab Gangopadhyay***

A phenomic approach was undertaken to characterize seventy one accessions of sesame (*Sesamum indicum* L.) procured from India, Venezuela and USDA following the descriptor of NBPGR and IPGRI. The phenotypic traits varied extensively and the degree of polymorphism was highest in case of seed coat colour while few traits exhibited only binary type character state. Morphological observation revealed Venezuelan genotypes as the most derived ones while the Indian accessions, be it under NBPGR or USDA repository possess some of the wild character state of the traits. The hierarchical axial representation of phenogram indicated that one Indian accession under USDA repository (USIN06) was unique while the Venezuelan genotypes fell in a common cluster in neighbour-joining WPGMA tree. Principal coordinate analysis further resolved the relative distances between genotypes within each cluster / sub cluster. The traits related to trichome of different plant parts showed highest correlation coefficients. A simple homology based algorithm; considering the character states as different colour codes and comparison of the codes of each genotype with that of a postulated 'target sesame' resulted in few Indian and exotic accessions of sesame on the basis of high 'scores', which will probably lead to a more precise means of selection of genotypes for future Marker



Characterization of nine selected Mulberry genotypes through PCR based (RAPD and SSR) techniques : project work carried out by one of the integrated M.Sc. – Ph.D. Students in Plant Molecular Biology and Biotechnology for partial fulfillment of his M.Sc. Degree from Bose Institute in collaboration with University of Calcutta.



A naturally occurring stem twinning form of Basella, established by Genomics and Proteomics, published in Current Science, 2010, vol. 98 (10); 1370-1375

Assisted Breeding program. On the basis of high 'scores' twenty three genotypes (ten from NBPGR and thirteen from USDA repository) have been selected and subsequently been worked out with RAPD, ISSR and SSR primers for identification of genotype specific PCR based markers with a futuristic approach to improve cultivated Sesame, taking in account both genotyping and molecular marker-trait association.

Genetic Diversity Assessment of rice landraces : ***Dr. Tapas Kumar Ghose***

Genetic diversity of a total of 116 rice landraces was assessed using 23 mapped SSR markers and 34 pairs of primers designed from 7 bacterial leaf blight resistance genes. A total of 57 polymorphic bands generated from the bacterial leaf blight resistance genes were sequenced, submitted to GenBank, and accession numbers obtained.

Genetic Diversity Assessment of Papaya : ***Dr. Tapas Kumar Ghose***

In collaboration with Dr. P. Acharya, Calcutta University, genetic diversity of 41 genotypes of papaya was assessed using 20 SSR primers and 16 resistance gene analogue primer pairs. A total of 134 DNA sequences was obtained, submitted to GenBank and accession numbers obtained.

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

Coconut pollen grains have been reported to contain allergenic proteins and has been validated by skin prick test and ELISA on a large group of patients in and around West Bengal. Total protein has been isolated from pollen grains. Western blotting with patient specific sera has led to identification of 3 bands which are further processed for purification by chromatographic techniques. 2D gel electrophoresis to identify allergenic proteins in the crude pollen extract is under experimentation. Allergenic viable & non-viable airborne fungal spore calendars and Kolkata-based prediction model has been developed. Detail study of aerospora in the suburbs has been done. Health impacts of different aero-allergens on respiratory allergic patients have been studied in details. Clinical and biochemical studies of the allergenic protein detected in *Rhizopus stolonifer* (45.50 kD and 67.12 kDa) are in progress.

Regulation of microRNA transcription by *Alternaria* fungal-stress in tomato : ***Dr. Pallob Kundu***

miRNAs are important for reprogramming of gene expression cascade during stress response in tomato. As a prerequisite for identifying *Alternaria*-stress regulated miRNAs, a fungal-infection system has been developed in laboratory and miRNAs are isolated from infected tissues. Sly-miR159 and Sly-miR160 are differentially regulated compared to uninfected plants. Further experiments are in progress to confirm this result along with several other miRNAs. Tomato protoplast transformation system has also been standardized; this will be useful in analysing miR gene regulation.

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

Earlier identification of the stress regulatory upstream elements in the PcIno1-1 and PcIno1-2 genes was followed by making marker-gene tagged constructs having individual elements for expression in model plant systems for functional validation under different stress conditions. Mutant protein products of the salt-sensitive OsIno1 gene, exhibiting salt-tolerance character, were generated by specific *in vitro* mutagenesis of the target gene. Protocols for transformation of rice (IR64 var.) has been standardized and transgenic IR64 rice plants are being generated with the PcIno1 and PcImt1 genes. Selected putative transgenic plants have been analyzed for their growth and photosynthetic performance under saline environment.

Search for MYMIV- resistance genes/proteins in *Vigna mungo* : ***Dr. Amita Pal***

A candidate disease resistant (*R*) gene, *CYR1* that co-segregates with MYMIV-resistant populations of *V. mungo* has been isolated. *CYR1* coded *in silico* translated protein sequence comprised of 1176 amino acids with coiled coil structure at the N-terminus, central nucleotide binding site (NBS) and C-terminal leucine-reach repeats (LRR) that belongs to non-TIR-NBS-LRR subfamily of plant *R* genes. *CYR1* transcript was unambiguously expressed during incompatible plant virus interactions. Enhanced transcript level upon MYMIV infection suggests involvement of the *CYR1* gene in conferring resistance against the virus. *In silico* constructed 3D models of LRR region of the host protein and MYMIV-coat protein (CP) revealed that the unique CYR1-LRR forms an active pocket and successively interacts with MYMIV-CP during docking, like that of receptor-ligand interaction.

A reference proteome map of MYMIV resistant *V mungo* has been generated; identified proteins are registered in PRIDE data base (Accession No. 15318). Functional annotations of these proteins using BLAST2GO (V.2.4.3) software revealed their role in different biochemical processes including defense responses.

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* Nair., 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 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***

The transcript level of the genes known to be inducible by abiotic stress were compared in salt sensitive (SS) and salt tolerant (ST) rice cultivars. Total RNA was prepared and RT-PCR was done. The transcript level for OSBZ8, A bZIP class of transcription factor, and DREBP2 and CRT/DRE binding factor were found to differ in roots and shoots of IR29 (SS), Pokkali and Nonabokra (ST) after treatment with NaCl, 20% PEG, cold and ABA treatment. The cDNAs for SAM decarboxylase and OSBZ8 were amplified and preparation to construct for introduction in rice, to test their efficacy against salt and drought tolerance, has been started. The upstream of DNA Pol λ has been amplified from rice and been cloned, sequenced and expressed in transgenic tobacco. The cis-acting elements like light responsive element eg SORLIP, Dehydration responsive element, and heat shock element were detected. Transgenic plants were characterized and expression GUS as the reporter gene was detected from different parts and expression was detected in response to light, heat and dehydration.

Molecular analysis of fruit ripening in tomato , banana and mango were continued. The role of RIN, a MADS box type transcription factor , necessary to turn on ethylene producing genes like ACS4 and ACS2 was studied and binding on their upstream was detected . Role of light particularly Red light was found to turn the ripening process and the genes necessary for ripening were also upregulated by red light earlier than the blue light. Work is going on to detect the role of light to turn on the RIN gene and to detect the precise mechanism on the role of cryptochrome and phytochrome. Since the upstream of the RIN gene contains anaerobic regulated cis-acting elements the fruit ripening was studied in detail and the inhibitory effect was found to be highly effective to turn off all the genes necessary for fruit ripening .

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

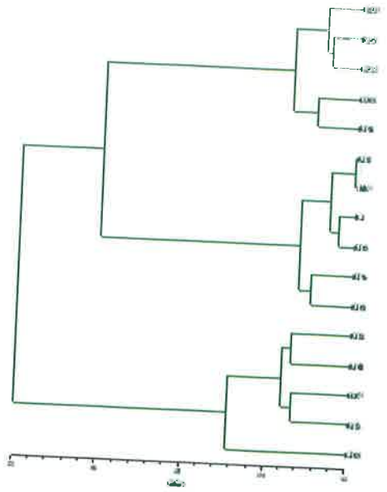
Zingiber sp.

Levels of 6-Gingerol content in 16 landraces of *Zingiber officinale* collected from different locations in Eastern and North Eastern India showed correlation with AFLP based dendogram. (Fig. 1)

Total antioxidant potential of these 16 landraces of *Zingiber officinale* also showed correlation with distinct clustering in RAPD based dendogram.

Panax sp.

Species specific AFLP alleles (markers) have been developed for *Panax assamicus* R.N. Banerjee and *Panax bipinnatifidus* Seem using several landraces under each species for authentication / documentation of plant genetic resource. (Fig. 2)



Sample name	6-Gingerol content
GCP-18	98.6(mg/g)
G-05-07	102.7(mg/g)
G-03-05	96.5(mg/g)
PGS-8	110.6(mg/g)
G-23-05	110.7(mg/g)
IG-1	69.60(mg/g)
GCP-27	66.36(mg/g)
GCP-05	71.11(mg/g)
GCP-8	64.81(mg/g)
G-04-07	66.41(mg/g)
GCP-16	77.42(mg/g)
G-01-07	36.34(mg/g)
GCP-22	44.24(mg/g)
GCP-29	31.62(mg/g)
G-17-05	28.44(mg/g)
GCP-44	47.41(mg/g)

Fig.-1

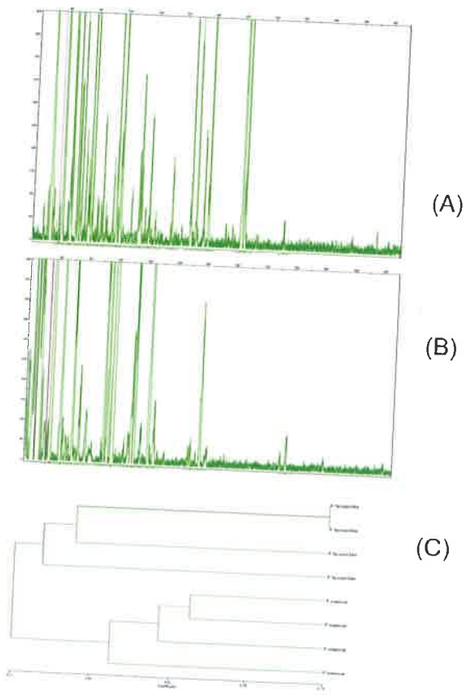


Fig.-2

Podophyllum sp.

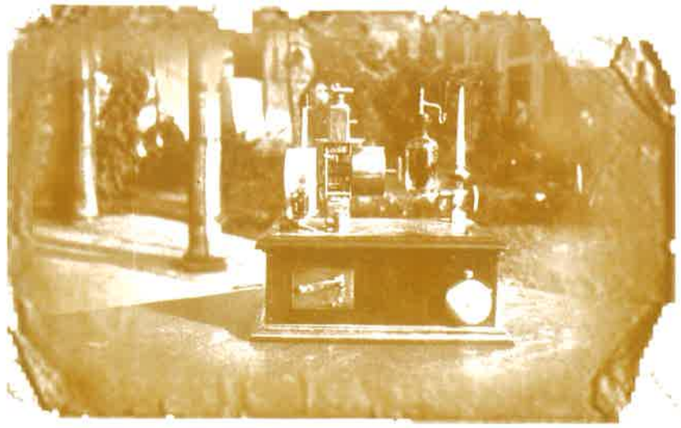
ISSR and AFLP fingerprinting patterns of some landraces of *Podophyllum aurantiocaule* Hand.-Mazz. collected from different areas in and around Arunachal Pradesh are being developed to study genomic polymorphism among closely related genotypes.

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

This study aims towards identification of genes involved in resistance against mustard aphid *Lipaphis erysimi* from wild crucifer *Rorippa indica*. Hundred sixteen transcript derived fragments, including both up and down regulated ones were obtained from *R. indica*, an aphid tolerant wild crucifer unchallenged and challenged with the mustard aphid, through cDNA AFLP using 40 selective primer combinations. Fifty-five cDNA fragments were successfully cloned and sequenced. Bioinformatics analysis revealed that 25 out of 55 sequences were excluded either being repetitive or having no significant similarity; while the rest 30 cDNA fragments revealed similarity to defense related genes, signaling molecules and some hypothetical proteins of unknown function.

Production and characterization 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 in the first fusion programme and from 6 out of 12 hybrid strains in the second fusion programme. Phenotypic analysis based on morphology, fruit body production and genotypic analysis based on isozyme, RAPD and ISSR of all the hybrid strains showed significant polymorphism compared to their respective parents.



II. Protein Structure, Function and Engineering

Domain-domain interaction of *E. coli* GluRS : ***Dr. Gautam Basu***

We had earlier shown that the N-terminal catalytic domain of *E. coli* GluRS possesses intrinsic discriminatory signals against the non-cognate tRNAGln. By mutating two Arg residues located at the C- and the N-termini, and from extensive biochemical and biophysical studies, we have shown how the two domains communicate with each other during the function of GluRS. A manuscript is being written reporting our work.

Mechanism of amino acid specificity of GlxRS during its molecular evolution : ***Dr. Gautam Basu and Dr. Siddhartha Roy***

We have investigated the evolutionary role of a C-terminal domain loop present in *E. coli* GlnRS in modulating the amino acid binding specificity of GlxRS during the evolution of GlnRS from GluRS. Specifically the equilibrium unfolding behavior of GluRS and its isolated truncated domains, and GlnRS along with a number of analogs (a GluRS-GlnRS chimera, a loop deleted mutant, a mutant with mutated loop residues) were extensively studied. The C-terminal loop in GlnRS was identified as the origin of a molten glubule intermediate in GlnRS and implicated to play an important role in amino acid specificity of GlxRS during its molecular evolution. A manuscript is being written reporting our work.

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

We had earlier experimentally shown the effect of mutating two residues in the β-tubulin of *Saccharomyces cerevisa* on colchicine binding affinity. Further studies were performed to confirm this both *in vivo* and *in vitro*.

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

We had earlier shown, from NMR studies on a series of peptides with the general sequence Pro-Pro-Xaa, that when Xaa is aromatic, the cis conformer of the Pro-Pro bond is stabilized by CH-pi interaction. Further studies were carried out on similar but different sequence motifs. Also, the effect of capping Pro-Pro-Aro in modulating the cis population of the Pro-Pro bond was also studied.

Curcumin recognizes a unique binding site of tubulin : ***Dr.B. Bhattacharyya***

Curcumin is known for its anti-carcinogenic properties, but the exact mechanism of its action or the structure function relation of drug-protein interaction was not understood. Studies on a series of curcumin analogs, synthesized to investigate their tubulin binding affinities and

tubulin self-assembly inhibition, showed that: i) curcumin acts as a bifunctional ligand, ii) analogs with substitution at the diketone and acetylation of the terminal phenolic groups of curcumin are less effective, iii) a benzylidiene derivative is more effective than curcumin in inhibiting tubulin self-assembly. Cell-based studies also showed that benzylidiene derivative of curcumin is more effective than normal curcumin. Thermodynamics of curcumin binding to tubulin has been studied in detail using isothermal titration calorimetry, the calorimetric enthalpy of association of curcumin with tubulin is negative. The binding is achieved by simultaneous participation of both hydrophobic and hydrogen bonding forces with unfavorable negative entropic contribution at room temperature. Competitive drug binding assay and Dixon plot analysis clearly shows that curcumin binds tubulin at vinblastin binding site. A further study indicates that curcumin binds tubulin with a association constant of $4.4 \times 10^5\ M^{-1}$. To validate our experimental finding, a molecular modeling study was carried out to visualize putative binding site of curcumin in tubulin. Together these results suggest that tubulin is a target of curcumins and curcumin-tubulin interaction may inhibit cancer cell proliferation by perturbing microtubule assembly.

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. Vibrio cholerae accessory cholera enterotoxin (Ace) is the third toxin other than cholera toxin (CT) and zonula occludens toxin (Zot) that causes the endemic disease cholera. Structural characterization of Ace has been restricted because of the limited production of this toxic protein by V. cholerae. We have cloned, over-expressed and purified Ace from *V. cholerae* strain O395 in *E. coli* to homogeneity, determined its biological activity, carried out biophysical studies to study its unfolding, virstatin binding, and a homology model has been proposed.

Protein-nanoparticle interaction : ***Dr. P. Chakrabarti***

A project has been initiated to understand the interaction of some model, as well as recombinant proteins with ZnO and drug-capped gold nanoparticles. The ZnO nanoparticles have antibacterial and anti-tumor properties. The thermodynamics of interaction, the effect on protein structures, biodistribution (binding site in bovine serum albumin) have been worked out. While the nanoparticles do not perturb the structure of lysozyme or lactalbumin, these have deleterious effect on the structure of some recombinant proteins, such as the periplasmic domain of the *Vibrio cholerae* ToxR protein.

Isolation, characterization of different plant lectins : ***Dr. Rajagopal Chattopadhyaya***

Plant lectins, a special group of sugar-binding proteins of non immune origin are able to agglutinate cells and/or precipitate glucoconjugates. Lectins are found abundantly in seeds of dicotyledonous species (leguminous plants) and non-seed portions from monocotyledonous ones (*Amaryllidaceae*, *Alliaceae*, etc.). A 12 kDa, dimeric, mannose-binding, garlic leaf lectin (ASAL) has detrimental effects on growth and survival of two important homopteran insect pests, *Lypaphis erysimi* (aphids) and *Dysdercus cingulatus* (red cotton bug). We propose to investigate the biophysical behavior and attempt crystallographic structures of this and other lectins after purification, such as *Amorphophallus paeonifolius* (common Bengali name : *Ol*) tuber lectin (AMTL), *Colocasia esculentum* (*kochu*) tuber agglutinin (CEA), *Curcuma longa rhizome agglutinin* (*holud*) (*CLA*), all highly homologous to ASAL (109/110, 109/110 and 108/110 sequence identities in aligned positions respectively). Though all of those lectins have significant sequence identity, they differ in terms of agglutination activity as well as insecticidal properties. The genes AMTL, ASAL, and CEA were expressed individually under Ptac promoter based modified vector, pMAL-C2X as maltose-binding proteinlectin (MBP-lectin) fusion protein in Escherichia coli, strain NEB Express. All three lectins were expressed in soluble form and sufficient amount of pure recombinant proteins could be recovered through Ni-NTA metal affinity chromatography. Agglutination assays were performed in microtiter plates with Heparin-treated rabbit erythrocytes to monitor the activity of recombinant lectin.

Identification of metal binding sites in the molecular chaperone α-crystallin : ***Dr. K. P. Das***

Binding of Zn^{+2} significantly alters the conformation, stability and chaperone function of α crystallin. We have undertaken a mass spectrometric approach together with chemical modification by DEPC and identify the histidine residues modified in presence and absence of zinc ions after proteolytic digestion followed by peptide mass matching. We have clearly identified three histidines both from recombinant human αÁ- and αB- crystallin involved in Zn^{2+} binding. The results are further confirmed by chymotryptic digestions and chemical modification.

Amyloid fibrillation of insulin role of modulating agent TFE : ***Dr. K. P. Das***

We are studying the role of a modulating agent TFE on the fibrillation pathways of insulin. While a detail study of the pathways is underway, from the results obtained so far it appears that TFE alters the pathway of fibril formation and that oligomeric species are not observed during fibrillation. Since the soluble aggregates are believed to be the most toxic element of the fibril, our observation could have impact on the cellular toxicity.

Understanding the interactions with sigma factors with RNA polymerase in *M. Tuberculosis* : ***Dr. Jayanta Mukhopadhyay***

We have developed methods to purify recombinant Mt RNAP core enzyme. The methods involve co-expression of genes for α, β, β', and ω of Mt RNAP core *in vivo* in *E. coli*. The methods

employ two duet vectors: one for expression of β, β' genes and another compatible duet vector for expression of α, ω genes. These two plasmids, containing β, β' and α, ω genes respectively, are transformed in *E. coli* BL21 cells. Three different combinations of two-plasmid-expression methods have been employed to test the yield of RNAP core enzyme. Mass spectrometry analysis of trypsin-digested products of Mt RNAP subunits show that the preparation is devoid of any contamination of *E. coli* RNAP subunits. Radioactive assays show that the RNAP from three different combinations have similar transcriptional activities and the activities are at least 10 fold higher than those of Mt RNAP reconstituted *in vitro*.

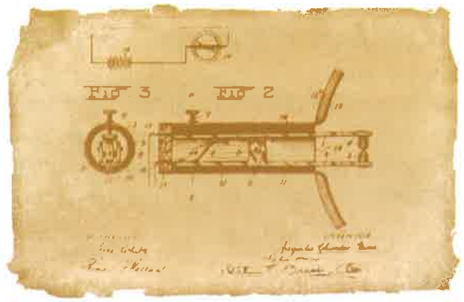
We have developed procedures that enable preparation of RNAP core incorporating an intein-CBD tag at either C-terminus of β, or β' subunit. These RNAP preparations will be used for subsequent labeling with a fluorescent probe for studying interactions of RNAP with σ factors.

We have also developed procedures that enable preparation of several recombinant σ factors and their single-cysteine derivatives. Single-cysteine derivates of σ factors will be subsequently labeled by fluorescent probes for studying their interactions with RNAP and promoter DNA.

Studies on the structure of the protein C1 from Salmonella phage P22 : ***Dr. P. Parrack***

The C1 protein of phage P22 is the counterpart of lambda CII in P22. It is a homotetrameric protein that is involved in the lysis/lysogeny decision of P22. However, some important differences from lambda CII make this protein interesting. The gene encoding C1 has an overlap with its operator sequence to which C1 binds for transcription activation. The so-called *osi* mutant causes a mutation in the recognition sequence of C1, and also causes a point mutation in the N-terminal part (T6A) of C1. The mutant protein recognizes the mutant operator but not the wild type. Likewise, the wild type protein fails to recognize the mutant operator. These results are enigmatic, they cannot be explained on a simple extrapolation of the lambda CII (4 X 97 residues) for P22 C1 (4 X 92 residues).

In order to resolve this puzzle, we have purified the P22 C1 protein in order to find out its three dimensional structure. Crystallization trials have so far been partially successful. We have obtained single crystals which are too tiny for X-ray diffraction. Optimization of crustallization conditions and efforts to obtain larger crystals are going on.



III. Bioinformatics and Computational Biology

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

We had earlier shown that subunit orientations in protein-protein complexes are electrostatically optimized. Our data have now been correlated with experimentally determined rates of formation of protein-protein complexes. A manuscript is being written reporting our work.

Molecular Dynamics simulations of peptides and proteins : *Dr. Gautam Basu*

Our earlier results on MD simulations on a fragment of p53 and its Aib analog was completed. We also started a project where MD simulations will be performed on yeast tubulin (only homology modeled structure available) where we would like to focus on the colchicine-binding site residues, especially a beta-strand residue that was shown to be crucial in colchicine-binding to animal tubulin.

Sequence analysis of $tRNA^{Glx}$ from bacterial whole genomes : *Dr. Gautam Basu*

Availability of bacterial whole genomes offer unique opportunities to answer questions that involve co-evolution of a large number of interacting biological molecules. We have analyzed about 300 bacterial whole genomes and analyzed sequences of $tRNA^{Glx}$ and associated proteins. Our analyses have yielded a unique picture of $tRNA^{Glx}$-discrimination by bacterial GluRS.

Physicochemical features of protein-protein interfaces : *Dr. P. Chakrabarti*

To delineate features that characterize protein-protein interactions is a long-standing theme in our group. Towards this goal we have created a dataset of homodimeric proteins that are also known to exist in equilibrium with the monomeric form in solution. A comparison has been made of the interfaces in these proteins to those found in permanent homodimeric molecules. In addition it has been shown that interfaces in protein-protein complexes contain conserved residues which tend to be clustered, and such clustering can be useful in identifying the interface region from any random surface patch in protein structures in ~50% of the cases.

Use of SVM in the identification of the active site cavity : *Dr. P. Chakrabarti*

In the recent past we have analyzed the 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 solvation, etc. Cavities and surface pockets are important for the binding of drugs, inhibitors and other small molecule ligands. We have shown that the distance of the clefts from protein centroid and sequence entropy of

the lining residues, when used in conjunction with the volume, are valuable descriptors for predicting the catalytic site. We have applied the SVM approach for recognizing and ranking the active site clefts and tested its performance using different combinations of attributes.

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.

Depicting the evolutionary pathways of bacterial oxygenases : *Dr. Tapan K. Dutta*

Bacterial aromatic ring-hydroxylating oxygenases (RHOs) are the key enzymes in degradation of aromatic compounds. They are also useful in synthesis of industrially important stereo isomers and drug intermediates. Various structural and functional analyses have been undertaken to elucidate the pathway leading to the evolution of the catalytic domain of the oxygenase in specific and the multi-component enzyme system in general. Whole genome analyses and phylogenetic studies have been carried out ultimately reaching to the derivation of a mathematical model to justify the evolution of the enzyme family towards a wide range substrate.

Insight into Structural dynamics of biomolecules, leading to drug deign : *Dr. Shubhra Ghosh Dastidar*

The general interest of our 'Structural Dynamics' group is to gain novel mechanistic insight into biology from computational modeling and simulations of molecular structures. The research projects aim for the fundamental understanding of the mechanisms of molecular recognition processes and to use that knowledge for designing novel therapeutic molecules. The more specific interest is to understand the role of protein flexibility to determine the protein-protein and protein-ligand associations. p53-pathway, and Bcl2 family are two primary areas of focus, where both are promising areas of cancer therapeutics. We use high performance computing (HPC) technology to perform our scientific investigations. We work in a truly interdisciplinary manner with active collaborations with experimentalists.

Evolutionary Bioinformatics : *Dr. Tapash C Ghosh*

Different proteins evolve at different rates. Elucidation of the determinants of the rate of protein sequence evolution is one of the great challenges in evolutionary biology. The main theme of his research goal is to identify and understand the different evolutionary forces by

analyzing the genomic and functional data of various organisms. Very briefly, the major results of the last one year (2010-11) are as follows:

- The role of for the differential evolutionary rates between the disease and non disease genes have been explained by protein connectivity, protein disorder, expression level, functionality and stable/transient interaction pattern and these results might be helpful in understanding the disease process and prediction of candidate disease genes in future.
- The importance of protein-complex forming propensity of the proteins in addition to their connectivity in the protein-protein interaction network and protein secondary structures have been established to be a key factor in guiding the evolutionary rates of proteins.

Non-coding RNA and stem cell biology : ***Dr. Zhumur Ghosh***

Pluripotent stem cells, both human embryonic stem cells (hESCs) and human-induced pluripotent stem cells (hiPSCs), can be differentiated to multiple cell types and hence have tremendous potential for regenerative therapies. Our main aim is to investigate the extent to which these differentiated stem cell derivatives are truly devoid of oncogenic potential. As a preliminary part of this work, we used embryoid body method to differentiate hiPSCs and hESCs into endothelial cells (ECs) and $CD31^{+}$ cells were sorted. Very briefly, the major results of the above work carried out during last year (2010-11) are as follows:

- A rigorous bioinformatic analysis was performed to compare the gene profiles of hiPSCs, hESCs, hiPSC-ECs, hESC-ECs, and human umbilical vein endothelial cells (HUVECs) using whole genome microarray. Our analysis demonstrates that gene expression variation of hiPSC-ECs and hESC-ECs contributes significantly to biological differences between hiPSC-ECs and hESC-ECs as well as to the "distances" among hiPSCs, hESCs, hiPSC-ECs, hESC-ECs, and HUVECs. We further conclude that hiPSCs can differentiate into functional endothelial cells, but with limited expansion potential compared with hESC-ECs.

Comparative molecular dynamics simulations of Ca^{++} dependent and Ca^{++} independent Type II antifreeze proteins : ***Dr. Debjani Roy***

Molecular dynamics simulations of Ca^{++} dependent and Ca^{++} independent Type II antifreeze proteins have been carried out in order to compare the dynamic conformations of these two proteins. We have also investigated the role of Ca^{++} in Ca^{++} dependent AFP.

A systems level analysis of transcriptional changes in Parkinson's Disease : ***Dr. Debjani Roy***

Parkinson's disease (PD) is the second most common neurodegenerative disorder after Alzheimer's disease. Overall, the pathology of PD is complex and is most likely a consequence of an unspecified combination of genetic and environmental factors, which induce a common

pathogenic cascade of molecular events. Here, we used a series of systems-based computational analyses to build weighted gene co-expression network, identify functional modules and associated transcription factors to analyze microarray gene expression data from normal and PD affected individuals. This knowledge will help to identify network biomarkers for the diagnosis and treatment of PD.

A combined *in silico* genomics and proteomics approach for the development of antiparasitic drugs : ***Dr. Debjani Roy***

Availability of complete genomic sequences of many human pathogens has provided a tremendous amount of information that can be useful in drug target and vaccine target identification. We have used a subtractive genomic approach in order to find a set of genes that are likely to be essential to the pathogen but absent in the human. The structural information about the protein products of these essential genes has been obtained using various protein-modeling methodologies. This information has opened the efforts for virtual screening initiatives. Finally molecular dynamics simulations have provided detailed information on the dynamics of the selected protein-inhibitor complexes.

Sir J. C. Bose at Mayapuri, Darjeeling

IV. Molecular Medicine

Understanding mechanism of carcinogenesis : Role of tumor derived glycosphingolipids in mediating tumor growth, progression and metastasis : ***Dr. Kaushik Biswas***

Although a number of reports exist on the deleterious effects of tumor derived glycosphingolipids, particularly gangliosides in suppressing anti-tumor immunity in tumor bearing host, the role of gangliosides in carcinogenesis has not been studied with any great detail. Based on this lacunae in this area of research, we aim to define the role of gangliosides in tumor cell motility, migration, invasiveness and metastatic potential. Preliminary studies have demonstrated differential ganglioside expression in at least two different tumor types by different techniques. We plan to undertake a systematic approach to delineate which signaling pathways gangliosides interact with in order to modulate tumor cell growth and progression, by not only looking at the protein level but also elucidate the changes in expression of genes regulating vital cellular processes involved in tumor growth and progression in response to either ganglioside treatment or knockdown of specific gangliosides. These studies will not only help to establish the role, gangliosides play in mediating tumor growth and progression and identify its mechanism, but also to understand the complex process of tumor development, growth, progression and metastasis eventually leading to development of novel and effective therapeutic strategies and block tumorigenesis.

Preliminary cell culture studies with different human as well as mouse tumor lines have been initiated during the past few months. Further studies are under way to characterize ganglioside expression in different tumor lines and how that correlates with motility and migration as well as the metastatic potential of the different tumors, as the very first step in understanding the functional role of these glycolipids in carcinogenesis.

Deciphering the codes of metastasis: Role of tumor suppressor p53 : ***Dr. Tanya Das***

Distant metastasis is a major factor that sabotages the successful management of cancer. The prevalence of K-Ras mutations in various cancers suggests that it is a dominant signaling pathway critical for oncogenic transformation of cells. Our results demonstrated that cancer cells with mutant K-ras undergo epithelial-mesenchymal transition (EMT) in collaboration of p53 which under the influence of mutant K-ras leads to inhibition of E-cadherin transcription, a process that has already been implicated in mediating EMT and transformation. Interstingly, in wild-type Ras-expressing cancer cells, p53-transactivated Smar1, a matrix attachment region binding protein, was found in one hand to increase E-cadherin expression *via* transcriptional repression of slug and to rescue E-cadherin from MDM2-mediated degradation. In addition, such cross-talk between p53 and Smar1 also regulates tumor angiogenesis by amending major pro-angiogenic factors, VEGF and HIF-1α, and thereby further adding to metastasis regulation. These results indicate that p53 acts as a molecular switch in deciding the metastatic behavior of cancer cells depending on the status of Ras.

Restoration of p53 by differentially regulating pro- and anti-p53 networks in virus-infected cervical cancer cells : ***Dr. Tanya Das***

Abrogation of functional p53 is responsible for malignant cell transformation and maintenance of human papilloma virus (HPV)-infected cancer cells. Restoration of p53 has, therefore, been regarded as an important strategy for molecular intervention of HPV-associated malignancies. Here we report that differential regulation of pro- and anti-p53 set-ups not only up-regulates p53 transcription but also stabilizes and activates p53 protein to ensure p53-induced apoptosis in HPV-18-infected cervical cancer. Functional restoration of p53 can be achieved by non-steroidal anti-inflammatory drug celecoxib *via* multiple molecular mechanisms: (i) inhibition of p53 degradation by suppressing viral oncoprotein E6 expression, (ii) promoting p53 transcription by down-modulating Cox-2 and simultaneously retrieving p53 from Cox-2 association, and (iii) activation of p53 *via* ATM-/p38MAPK-mediated phosphorylations at serine-15/-46 residues. That restored p53 is functional has been confirmed by its ability of transactivating Bax and PUMA, which in turn switch on the apoptotic machinery in these cells. Studies undertaken in biopsy samples of cervical carcinoma further validated celecoxib effect. Our approaches involving gene manipulation and pharmacological interference finally highlight that celecoxib alters pro- and anti-p53 networks, not in isolation but in concert, to rejuvenate p53-dependent apoptotic program in HPV-infected cervical cancer cells.

Germ cell apoptosis by benzo(a)pyrene and its prevention by natural aryl hydrocarbon receptor antagonist : ***Dr. Kuladip Jana***

Benzo(a)pyrene (BaP), an aryl hydrocarbon receptor (AhR) ligand present in cigarette smoke and car exhaust, is thought to have negative effects on male reproduction. We studied that BaP damages sperm through AhR activation, phase 1 enzyme induction, DNA adduct formation, and increased germ cell death in the testis. Exposure of mice to the BaP resulted in a toxic effect on spermatogenesis, and a decrease in sperm concentration. Early events in apoptosis was detected in live sperm by using annexin V labelling. Resveratrol, a naturally occurring AhR antagonist found in some red wines, was able to significantly decrease the sperm cell apoptosis, suggesting a possible therapeutic application in prevention of adverse AhR toxicant effects on reproductive function.

Ageing associated oxidative stress & testicular gametogenic and steroidogenic disorders: Ameliorating potential of alpha lipoic acid and acetyl L- carnitine : ***Dr. Kuladip Jana***

In aged Leydig cell, ROS produced by endogenous cellular processes either physically disrupts membrane lipids or inappropriately activates the cellular desensitization machinery, resulting in attenuation of LH receptor signalling to adenylyl cyclase with concomitant decreases in maximal levels of cAMP. This attenuation of cAMP production has short-term effects on the intracellular transfer of cholesterol to the mitochondria and long-term effects on the

metabolism of cholesterol to testosterone. Moreover, inhibition of steroidogenic processes is reinforced by activation of stress-response signalling by ROS through the p38 MAPK cascade and increased expression of the COX-2 enzyme that ultimately leads to germ cell and Leydig cell apoptosis. Ultimately, there is a reduction in steroid and sperm output by aging testis. Thus, alpha lipoic acid and acetyl L- carnitine acts as potent antioxidants and protects steroidogenesis and spermatogenesis in aged testis.

Resveratrol induced apoptosis in cervical cancer cell line (Hela): Role of β- catenin : ***Dr. Kuladip Jana, in collaboration with Prof. Sanghamitra Raha, Crytallography & Molecular Biology Division, Saha Institute of Nuclear Physics, Kolkata***

Resveratrol is a phytoalexin, which is present in several natural sources like red grapes, barries etc., caused apoptosis in human cervical cancer cell line in a dose and time dependent manner. Resveratrol treatment decreased the levels of β-catenin, a major signalling protein of the Wnt pathway, in both nucleus and cytoplasm. Besides this resveratrol rapidly abolished the Ser473 phosphorylation of Akt and reduce its kinase activity even after 1 hr. of treatment. Inactivation of the Akt pathway, in turn, blocks the Ser9 phosphorylation of GSK- 3β. Thus phospho-Akt and phospho-GSK-3β have shown a decrease in their levels with time. Levels of Cycline-D1, a downstream target of β-catenin, was also reduced by resveratrol treatment. Moreover, our research focussing to understand the molecular signalling involved in the apoptotic effect of resveratrol on Cervical cancer cell line.

Distribution of p14, a sperm protein, during maturation, capacitation, and acrosome reaction of caprine spermatozoa : ***Dr. Kuladip Jana, in collaboration with Dr. Parimal C. Sen***

p14 is a 14 kda molecular mass protein previously purified from goat testis cytosol. The pI value of the protein is 6.2.The protein acted as potent stimulator of Ca-ATPase. p14 was shown to decrease the forward motility of goat spermatozoa. With this previous knowledge, in the present, we have localized the protein in goat spermatozoa as well as in epididymal tissue and have explored the changes in the distribution pattern of p14 during epididymal maturation, capacitation, and acrosome reaction. We have also examined the changes in the phosphorylation pattern of different sperm proteins including p14 under above mentioned condition.

Immunomodulatory role of Arabinosylated Lipoarabinomannan against Visceral Leishmaniasis : ***Dr. Subrata Majumdar, Santanu Kar Mahapatra and Bidisha Pal Chowdhuty***

Visceral leishmaniasis is a potentially lethal, vector-borne protozoal infection caused by *Leishmania donovani*. Our lab has been recently focused on the application of novel TLR2-using molecule, Arabinosylated Lipoarabinomannan (Ara-LAM) to combat agaisinst visceral

leishmaniasis. Recently, we have demonstrated that Ara-LAM pre-treatment induces TLR2 expression in *L. donovani*infected BALB/c mice in a dose-dependent manner, thereby triggering significant release of proinflammatory cytokines, and nitric oxide. In vivo experiments suggest that Ara-LAM playing a long-term protective role with effective dose at 30μg and we have seen the significant reduction of liver and spleen parasitemia along with induction of specific CD4+ T cells proliferation which may involve in controlling chronic infection. Thus, these findings might provide crucial cues in understanding the immunoprophylactic role of Ara-LAM in conferring protection against visceral leishmaniasis.

Arabinosylated Lipoarabinomannan skews Th2 phenotype towards Th1 during Leishmania infection by chromatin modification: Involvement of MAPK signaling : ***Dr. Subrata Majumdar and Parna Bhattacharya***

In this study we have evaluated the potential of Arabinosylated Lipoarabinomannan (Ara-LAM), a cell wall glycolipid isolated from non pathogenic *Mycobacterium smegmatis*, in regulating the host effector response via effective regulation of mitogen-activated protein kinases (MAPK) signaling cascades in *Leishmania donovani* infected macrophages isolated from BALB/C mice. Ara-LAM, a TLR2 specific ligand, was found to activate p38 MAPK signaling along with subsequent abrogation of extracellular signalregulated kinase (ERKs) signaling. Molecular characterization of this regulation of IL-10 and IL-12 was revealed by chromatin immunoprecipitation assay which showed that in Ara-LAM pretreated parasitized murine macrophages there was a significant induction of IL-12 by selective phosphorylation and acetylation of histone H3 residues at its promoter region. While, IL-10 production was attenuated by Ara-LAM pretreatment via abrogation of histone H3 phosphorylation and acetylation at its promoter region. These results demonstrate the crucial role played by Ara-LAM in regulating the MAPK signaling pathway which might provide crucial clues in understanding the Ara-LAM mediated protection during *Leishmania* induced pathogenesis.

Antigen pulsed CpG-ODN stimulated dendritic cells exhibit host protective immune responses in Experimental Visceral Leishmaniasis : ***Dr. Subrata Majumdar and Saikat Majumder***

The potential of soluble leishmanial antigen (SLA) pulsed CpG-ODN (oligodeoxynucleotides) stimulated dendritic cells (SLA-CpG-DCs) in restricting *Leishmania donovani* infection via the generation of proinflammatory mediators was studied in an *in vivo* model. SLA-CpG-DCs-mediated leishmanicidal activity was found to be dependent on the efficient suppression of T regulatory cells (Treg) coupled with elevated lymphoproliferation in the treated parasitized mice. Further SLA-CpG-DCs was also able to abrogate the survival of *Leishmania* by restoration of impaired cytotoxic T lymphocyte (CTL) activity observed in parasitized mice. Thus, this study strongly demonstrates that SLA-CpG-DCs unlike SLA pulsed-control-ODN-stimulated DCs, is involved in rendering a protective response in experimental VL via the up-regulation of proinflammatory, cytotoxic mediators and suppression of Treg cell functioning.

IP-10 induces host protective immune response by changing the T regulatory cell functioning in *Leishmania donovani* infected mice : ***Dr. Subrata Majumdar and Gaurav Gupta***

Recently, our group has shown that interferon-γ-inducible protein (IP)-10, a CXC chemokine, renders protection against visceral leishmaniasis. In the present study, we have elucidated the mechanism by which IP-10 renders protection in *in vivo L. donovani* infection. We observed that IP-10treated parasitized BALB/c mice showed a strong Th1 immune response along with marked decrease in immunosuppressive cytokines, TGF-β and IL-10 secreting $CD4^+$ T cells. This IP-10-mediated decrease in immunosuppressive cytokines was correlated with the reduction in the elevated frequency of $CD4^+CD25^+$ T regulatory (Treg) cells along with the reduced TFG-β production from these Treg cells in *Leishmania*-infected mice. This reduction in TGF-β production was due to effective modulation of TGF-β signaling by IP-10.

Function of molecular chaperone heat shock protein 70 (Hsp70) in quality control of protein kinases : ***Dr. Atin Kumar Mandal***

Protein quality control is an essential cellular process that maintains protein homeostasis. Maintaining proper balance between folding and degradation of misfolded proteins is critical for cell survival. This quality control system plays a central role in many pathophysiological conditions including cancer, diabetes and late onset neurodegenerative diseases. Molecular chaperone Hsp70 functions in the early stages of protein folding by interacting with the newly synthesized polypeptide chains cotranslationally or immediately after translation and protects misfolded proteins against aggregation. This function is integrated with its intrinsic ATPase activity. Cochaperones such as Hsp40 and Hsp110 modulate the activity of Hsp70. Hsp40 catalyze ATP hydrolysis of Hsp70 and stabilize substrate binding to Hsp70. On the other hand, Hsp110 catalyzes nucleotide exchange of Hsp70 and facilitates substrate release. Hsp70 also targets misfolded proteins for degradation. But how Hsp70 partitions between folding and degradation of substrates is not known.

We have initiated to understand the mechanism how Hsp70 decides for productive folding of proteins or triage of misfolded proteins using protein kinase as a bonafide substrate and also how cochaperones of Hsp70 modulate the triage decision. Preliminary studies such as cloning and expression of protein kinases in yeast system have been successfully done. Further studies defining the role of Hsp70 are underway.

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

The giant black tiger marine shrimp, *Penaeus monodon*, is one of the most economically important captured and cultured shrimp species for the aquaculture industry all over the world. However, white spot disease due to white spot syndrome virus (WSSV) is one of the most life-threatening diseases, resulting in huge economic losses in shrimp industry around

the globe. Losses have been estimated to several billion dollars till date all over the world and despite of serious efforts it is a failure in most cases to control the disease.

We have collected the samples from captured and cultured populations of *Penaeus monodon* and it was found that among the captured populations that were collected from four distinct geographic location of India (Digha-West Bengal, Chilika-Orissa, Vishakhapatnam-Andhra Pradesh and Chennai-Tamilnadu), Chennai population has the highest WSSV prevalence (56.25%) and Chilika population has the lowest WSSV prevalence (0.00%). Among the cultured populations of thirty five different highly virus infected ponds, 42% WSSV prevalence was found in the survived individuals, depicting the existence of the disease resistant population. We have performed the virus test in gill tissues of Black Tiger Shrimp followed by nested PCR and Gel Electrophoresis.

Genomic DNA isolated from pleopod tissues were subjected to disease resistant microsatellite DNA marker analysis. On the basis of our earlier reported DNA marker, captured and cultured populations of Black Tiger Shrimps were tested and result indicates that the average disease resistant prevalence of the captured population was 30.18% and 23.78% for the cultured population. As we know that *Penaeus monodon* is a marine species so culturing them in a different condition may alters their genetic characteristics which also reflects in the result i.e. captured population are more resistant to WSSV infection than the cultured population.

We have also performed the quantitative real time PCR to see the actual WSSV load in the disease resistant and susceptible groups based on our developed markers. The result indicates that the resistant shrimps has the 50 fold lower viral load as compared to the susceptible shrimps and this observation is statistically significant also ($P<0.001$). We are also working on the development of more DNA based marker in this species and we found few has the potentiality to be a genetic marker that can be used to select the disease resistant *Penaeus monodon*.

We have started the WSSV challenge experiment for further validation of these markers in the laboratory condition and the results are found to be positive i.e. the percent of WSSV propagation in the susceptible samples is much higher than the resistant samples. This information will be very useful for the generation of disease resistant brood-stock for MAS program for shrimp hatcheries and the disease resistant post larvae will be supplied to rural areas for culturing. As a result this will prevent the huge economic loss due to the virus outbreak and this will cause species preservation, socio-economic upliftment and rural and urban development.

Development of biomarkers to predict Acute myocardial infarction (AMI) : ***Dr. Nripendranath Mandal***

Acute myocardial infarction (AMI) is a complex multifactorial and polygenic disease. AMI is one of the leading worldwide causes of morbidity and death. Rates are rising in India, and by 2015 it has been predicted to rank first among the causes of death in the Indian population. There is growing evidence that inflammation plays a central role in the pathogenesis of atherosclerosis,

which is in turn widely considered to be related to an inflammatory process. AMI is the sequela of rupture or erosion on unstable plaque of epicardial coronary artery, in which the inflammatory process has the central role. We have been studied based on the assumption that the reciprocal interaction of the IL-6 -174G>C, TNF-α -308G>A and IL-10 -592C>A gene promoter polymorphism and have a measurable influence on atherosclerotic mechanisms and contribute to or reduce the occurrence of AMI. We observed significant interactions between IL-6, TNF-α and IL-10 gene promoter SNPs. Three loci combination of genotypes: [GC/CC (IL-6)+ GA/AA (TNF-α)+ CA/AA (IL-10)] was associated with increased risk of AMI as compared to the risk conferred by individual wild type genotypes, suggesting a synergistic interaction between these genes towards disease susceptibility.

Importance of medicinal plants to combat various human diseases:

Earlier we have characterized various medicinal plant extracts as a source of potential natural antioxidants. Among these *Spondias pinnata* has been tested for active components using various solvent fractionation methods. Water and ethyl acetate extracts have shown potent antioxidant activity. These extracts could be a source for developing a potent anticancer drug.

The introduction of new iron chelating drugs may ultimately improve iron-chelation therapy for patients with iron overload diseases such as thalassemia and other disorder. Some of the medicinal plants are also tested for iron chelating activity *in vitro* and *in vivo* condition. Some plant extracts significantly inhibit iron overload induced lipid peroxidation and protein oxidation of liver, decrease hepatic iron and hepatic collagen content and reduce serum ferritin level. *In vitro* study also demonstrates that these extracts could release iron from ferritin. These plant extracts could be a source for developing a better and safer drug to treat thalassemia and other iron overload disorders.

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

(a) Our research group is actively involved in the synthesis of 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.

(b) Our laboratory has 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. In the current scenario, glycoconjugates have emerged as successful synthetic vaccine candidates to control microbial infections. In collaboration with biologists, immunochemical studies of the glycoconjugates could lead to the effective antibacterial agents in due course.

Molecular mechanisms of signal specific induction of heat shock genes : ***Dr. Mahadeb Pal***

Inducible forms of heat shock genes encoding different protein chaperones play critical roles

in various forms of cancer. HSF1 (heat shock factor 1) activates HSP genes, by facilitating transcription elongation of HSP genes that are as such wrapped up in nucleosomes in the coding region. Although HSF1 has been already considered as a good drug target, the mechanism of action of HSF1 especially how it mediates transcription elongation through a cellular chromatinised hsps is not well understood. We aim at studying native human hsp70 to understand what are the chromatin modifying activities involved, and how HSF1 might be recruiting those activities with a systematic approach. A detail understanding of these processes may open up new opportunities for small molecule interventions of heat shock response in addition to providing important mechanistic insights into gene regulation.

Curcumin enhances the efficacy of chemotherapy by tailoring p65NFκB-p300 cross-talk in favor of p53-p300 in breast cancer : ***Dr. Gaurisankar Sa***

The major obstacle in cancer treatment is the resistance of cancer cells to therapies. Recently, p65NFκB has emerged as an important contributor to chemoresistance. High constitutive expression of NFκB has been found in different cancers, creating an environment conducive for cancer cell survival. Here we report the role of curcumin in sensitizing drug-resistant breast tumors to doxorubicin by inhibiting NFκB-mediated defense pathway. In drug-resistant murine breast cancer model, curcumin prevented doxorubicin-induced phosphorylation and degradation of IκBα thereby inhibiting p65NFκB activation. Consequently, expression of NFκB-downstream gene, Bcl-2, was reduced and NFκB-dependent protective response was suppressed. In such anti-survival environment, cancer cells underwent p53-dependent apoptosis involving Bax and caspase-cascade. Transfection of IκBα-SR-cDNA/p65NFκB-siRNA induced significant apoptosis following doxorubicin treatment confirming that curcumin-mediated sensitization to doxorubicin is NFB-dependent. An in depth study revealed that curcumin rescued p300 from p65NFκB thereby establishing p53-p300 collaboration to induce p53-dependent Bax-transactivation and instigation of downstream pro-apoptotic cascade in drug-resistant cells. Simultaneous decrease in drug-induced systemic toxicity might also have enhanced the efficacy of doxorubicin by improving the intrinsic defense machineries of the tumor-bearer. Overall, the findings of this preclinical study clearly demonstrate the effectiveness of curcumin as a potent chemo-sensitizer to improve the therapeutic index of anti-cancer drugs. Taken together, these results suggest that curcumin can be developed into an adjuvant-chemotherapeutic drug.

Eicosapentaenoic and docosahexaenoic acids enriched polyunsaturated fatty acids from the coastal marine fish of Bay of Bengal and their therapeutic value : ***Dr. Parimal C. Sen***

Eicosapentaenoic acid (EPA)/docosahexaenoic acid (DHA) enriched polyunsaturated fatty acids (PUFA) having high availability in marine fish oil emerge as preventive agents for combating many health problems specially in chronic or metabolic disorders. The fish in the

coastal area of Bay of Bengal has remained unexplored with respect to EPA/DHA enriched PUFA content in its oils, though it may be a potential source in harnessing the health benefit. In this study seven varieties of the coastal fish were analysed for the content of EPA/DHA enriched PUFA. The one locally known as lotte, (Harpadon nehereus) though has low content of total lipids, was found to have high EPA/DHA in its oil. The phospholipids rich fraction extracted from the total fish oil. The EPA/DHA enriched PUFA was isolated to investigate the potential use for health benefits in cell culture and animal model. EPA/DHA enriched PUFA of lotte is found to act as protective agent against mercury poisoning studied in cell culture as well as in animal mode. It was found to be highly preventive in diabetes and very effective in the enhancement of sperm motility. The lotte is available in the coastal area of Bay of Bengal adjoining West Bengal, India in large scale and it is the first report showing EPA/DHA enriched PUFA in these fish oil that can be availed for exploitation to harness in important health benefits.

Efficient synthesis of (6-deoxy-glycopyranosid-6-yl) sulfone derivatives and their effect on Ca^{2+}-ATPase : ***Dr. Parimal C. Sen in collaboration with Dr. Anup Kumar Misra***

Synthesis of a series of novel (6-deoxy-glycopyranosid-6-yl) sulfone derivatives has been achieved using a general synthetic strategy. Yields were excellent in every case. The synthetic compounds were evaluated for their biological potential against Ca^{2+}-ATPase, an important enzyme involves in tranporting Ca^{2+} across the cell membranes.

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

Research in our laboratory encompasses several major areas of organ pathophysiology:

hepatotoxicity, cardiotoxicity, neurotoxicity, reproductive toxicity and nephrotoxicity. However, special emphasis is placed upon:

- Drug and chemical-induced mechanisms of cell injury and cell death in multiple vital target organs both in vivo and in vitro.
- Studies on the signal transduction mechanism of cell death and survival in organ pathophysiology.
- Unraveling the mechanisms and exploring the antitoxic/antioxidant potentials of phytochemicals (natural and man-made antioxidants).

Diabetes induced organ dysfunction and its reversal by nature derived bioactive molecules

In modern civilization diabetic mellitus is one of the most common endocrine metabolic disorders. Worldwide, the number of diabetic patients is rapidly increasing in the general population especially in obese and aged ones. A large body of earlier investigations has examined the role of oxidative stress and insulin resistance type I and type II diabetes and its

associated complications. In addition, nonenzymatic glycation of protein and glucose autoxidation are also closely associated with the development of hyperglycaemic condition. Antioxidants protect against glycation-derived free radicals and may have therapeutic potential. In addition, recent studies have shown that compounds with combined antioxidant and antiglycation properties are more effective in treating diabetes mellitus. Thus, the screening and development of new compounds with combined antioxidant and antiglycation properties would be beneficial in the treatment of diabetes mellitus. Our aim is to find out easily available, inexpensive therapeutics, having minimum side effects for the better treatment of these diabetic patients.

Role of nanostructures in organ pathophysiology

In the last decade new directions of modern research, broadly defined as "nano scale science and technology" have emerged. Nanotechnology involves the creation and manipulation of materials at nanoscale levels. Nano materials have unique physicochemical properties (like ultra small size, large surface area to mass ratio and extremely high chemical reactivity) which make them different from bulk materials of the same composition. These properties can be used to overcome some of the limitations found in traditional therapeutic and diagnostic agents. The application of nanotechnology to medicine, known as nanomedicine, concerns the use of nanomaterials to develop novel therapeutic and diagnostic tool. The difference between nanomedicine and conventional drugs is that nanomedicine is entirely based on small molecule chemistry. They not only act as therapeutic agents but also deliver themselves to specific regions or tissues in the body. While benefits of nanotechnology are widely expected, however both academic and public concerns begin to emerge on the potentially adverse effects of these manufactured nanomaterials. Thus, nanotoxicology is emerging as an important sub-discipline of nanotechnology. Exposure to nanostructures occurs in a variety of manners, such as researchers of the manufacturing nanoparticles, patients injected with nanostructures, or people using products containing nanostructures. After exposure and absorption, they enter into the cells of different organs, interact with the macromolecules like protein, DNA etc., and cause organ pathophysiology.

Studies on the protective role of an antioxidant protein molecule from the herb, *Phyllanthus niruri* in pathophysiology: Signal transduction mechanism

The herbal plant, *Phyllanthus niruri*, has been known to be useful in folklore medicine for long period of time, especially for the treatment of jaundice. Earlier studies from various groups reported that aqueous extracts of this herb possesses protective activity in hepatic and other organ disorders, but the nature of the responsible active principle(s) in its beneficial role has not been well defined. Experimental evidence from our laboratory showed that the soluble protein fraction of this herb possessed more hepatoprotective activity than the non-proteinous fraction against various toxicants and drugs. Recently we also observed that in addition to the hepatoprotective activity, the protein isolate of this herb also possessed free radical scavenging acitivity in cell free system as well as in hepatocytes.

To achieve this goal, we aim to address the following questions:

i) What role does the protein (PNP) play in mitochondrial dysfunction?

ii) Does it release specific second messenger(s) and open a cascade of signaling path ways for its mechanism of action to protect cell death?

iii) Do the factors like MAP kinases, TNFα, NF-kB, STAT 1, STAT 3, Bcl2 family proteins, Akt, caspases etc. are involved in the pathophysiological states of our interest, and if so, what role does PNP play on these factors?

iv) Is the co-existence of apoptosis with necrosis an underlying mechanism of action in cell death under the pathophysiological states of our interest? and if so, does the application of PNP reverse or reduce the phenomenon of death?

Further characterization of the CI-protein from *Cajanus indicus L*: Mechanism of protective action in organ pathophysiology

A 43 kDa protein (the CI protein) molecule was isolated and purified in our laboratory from the leaves of *Cajanus indicus* L, a popular herbal plant found in several tropical countries. In India, the traditional uses of this herb are believed to be in treatment for liver disorders, jaundice, hepatomegaly diabetes, hypoglycemia and cardiovascular disease. It has been found to be effective in reducing hepatotoxicity induced by toxins such as fluoride, cadmium chloride, chloroform, thioacetamide, etc., both *in vivo* and *in vitro*.

Lecture Hall Main Door – with motif of "*Bajra*", "*Desmodium gyrans*" and "*Mimosa pudica*"

V. Microbial Genomics and Infection Biology :

The OppABCD peptide transporter of *Mycobacterium tuberculosis* and its role in host-pathogen interaction : ***Dr. Joyoti Basu in collaboration with Dr. Manikuntala Kundu and Prof. Brigitte Gicquel, Institut Pasteur, Paris***

The genome sequence of *M. tuberculosis* H37Rv reveals two peptide permease operons encoded by *Rv3665c-Rv3662c* and *Rv1280c-1283c*(OppABCD). In order to understand the biological roles of the putative peptide importers of mycobacteria, we have cloned, expressed and studied the substrate-binding properties of OppA of *M. tuberculosis*($OppA_{MTB}$). OppA shows a broad substrate specificity and the transporter imports glutathione. Glutathione is a cofactor in the glyoxalase I and II-catalyzed conversion of methylglyoxal (MG) to lactate. We observed that MG levels are lower in macrophages infected with an OppDA knock out (OppDA-KO) of *M. tuberculosis* compared to the wild type. Apoptosis of macrophages in granulomas in TB patients, is induced by an environment rich in MG. In keeping with this, we observed decreased apoptosis of macrophages infected with OppDA-KO compared with the wild type.

The mycobacterial protein SepF interacts with FtsZ : ***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. Our aim is to delineate the interactions among divisomal proteins and elucidate the functions of some of these proteins. Rv2147c forms part of the dcw cluster of *Mycobacterium tuberculosis*, and is similar to the *Bacillus subtilis* SepF protein. We demonstrate that it interacts with the cell division protein FtsZ. The functional consequences of this interaction are under investigation.

DnaK dependent activation of the Mycobacterial Heat Shock Response regulator, HspR : ***Dr. Sujoy K. Das Gupta***

Stress response plays a key role in establishing the persistent state of *Mycobacterium tuberculosis* - the causative agent of TB. Induction of stress response in Mycobacterium involves a panoply of transcriptional regulators, one of which being the heat shock response regulator HspR. It represses, in a DnaK dependent manner, expression from several heat shock responsive virulence related operons including *dnaKJE-hspR* which harbors its own gene. The molecular basis for the observed DnaK dependence of HspR activity was investigated. The results indicate that DnaK is necessary, primarily for efficient refolding of HspR. If allowed to refold under controlled conditions, an active protein can be obtained even without using DnaK. The inability of HspR to refold by itself is due to the presence of a hydrophobic C-terminal tail, conserved in Actinomycetels. If it is deleted, HspR can function in a DnaK independent manner. The hydrophobic C-terminal tail of HspR like repressors may thus have evolved to ensure that they function in a DnaK dependent manner, thereby ensuring better regulation of the heat shock response. The present study unravels a novel regulatory

mechanism where the activity of a repressor is controlled by the efficiency with which it refolds.

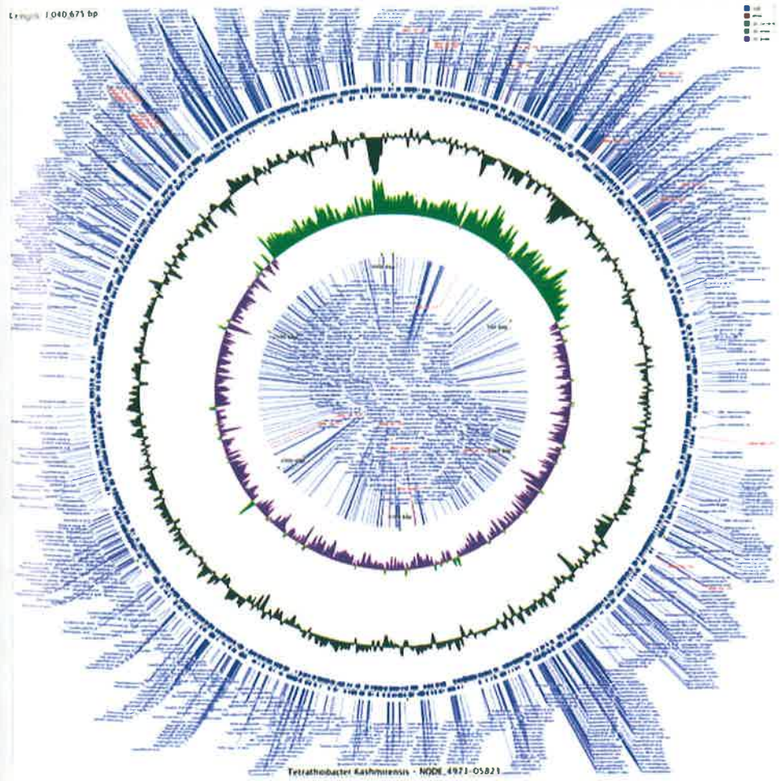
Exploring microbial potential for remediation of toxic environmental pollutants : ***Dr. Tapan K. Dutta***

Pollution due to recalcitrant aromatic pollutants is one of the major issues of environmental concern. Our group focuses on exploring unique catabolic pathways involved in degradation of such compounds (mainly those of endocrine disrupters and polycyclic aromatic hydrocarbons). In doing so, we have isolated and characterized several bacterial species (belonging to the genus *Pseudomonas*, *Sphingobium*, *Burkholderia*, *Ochrobactrum*, *Stenotrophomonas* etc.) from various environmental samples. This has provided insights into certain unique mechanisms of degradation as well as involvement of novel degradative enzymes. Genes encoding the multi-component naphthalene dioxygenase enzyme system have been cloned and sequenced from a naphthalene-degrading *Pseudomonas stutzeri* strain NJ. Structure of the catalytic subunit has been modeled and docked with different substrates followed by experimental validation, leading to understanding of a broad substrate preference of the enzyme. On the other side, different catabolic genes have been cloned and identified from a *Sphingobium* sp. strain PNB which confers degradation of a wide spectrum of aromatic pollutants via a complex regulatory mechanism. A novel pathway regulation has also been observed in *Burkholderia* sp. strain BC1 capable of utilizing 2-hydroxy-1-naphthoic acid. Understanding the regulation mechanisms is underway.

Project I : Phylogenomics of chemolithotrophic sulfur oxidation : ***Dr. Wriddhiman Ghosh***

Lithotrophic sulfur oxidation is an ancient metabolic process central to our understanding of the nutritional strategies of early Life. Over billions of years of evolution, numerous ecologically and taxonomically diverged prokaryotes have developed equally diversified pathways of utilizing different reduced sulfur compounds as lithotrophic substrates. Through tandem use of phylogenomics and global proteomics I am trying to delineate the origin(s), evolution and interactions of the Sox multienzyme complex-mediated mechanism of sulfur compounds oxidation (epitomized in facultatively lithotrophic alphaproteobacteria) in correlation with the so-called Tetrathionate Intermediate (S_4I) Pathway (reported from several beta- and gammaproteobacteria). Towards this end I have determined the whole genome shotgun sequence of *Tetrathiobacter kashmirensis*, a model S_4I-forming organism, while the gapped genome of *Pseudaminobacter salicylatoxidans*, a prototype of the Sox system, has also been sequenced. The *T. kashmirensis* genome has been registered with the NCBI Entrez Genome Projects Database (Project ID: 67337; URL: http://www.ncbi.nlm.nih.gov/genomes/mpfsubmission.cgi?show= C4999DF2-0E1A-40E3-B435-AA3858A19B38) and an accession number is expected within a month. I am now trying to translate the genomics-derived knowledge into proteomic (and metabolomic) understanding of the evolution and interactions of the two aforesaid pathways of sulfur oxidation.

General importance of the *T. kashmirensis* genome in bacterial evolution. The family *Alcaligenaceae* to which *T. kashmirensis* belongs is a phylogenetically coherent assemblage of environmentally as well as physiologically distinctive betaproteobacteria. Its members range from soil-dwelling xenobiotic-degraders (e.g., *Achromobacter xylosoxidans*, which notably is also an opportunistic pathogen) and sulfur-oxidizing chemoautotrophs (such as *T. kashmirensis*) to pathogens of various animals groups (e.g., species of *Bordetella*, *Taylorella* etc.). Crucial effects of DNA acquisition, genome reduction and genome optimization (rearrangements and mutations) in the differential evolution of pathogenic and non-pathogenic variants within bacterial families and genera have been demonstrated in several groups of *Bacteria*. In this complex scenario of extensive environmental and physiological diversification within such a consistent monophyletic group as *Alcaligenaceae* (where different genera have ~96% 16S rRNA gene sequence similarity), it is imperative to comprehensively understand the dynamics of genome evolution within the group and assess the importance of



Circular view of the largest 3.04 MB (NODE_4973-0.5823) scaffold of the *Tetrathiobacter kashmirensis* whole genome shotgun sequence showing all the predicted protein-encoding genes, G+C % distribution and GC skew plot over a sliding window of 10,000 base pairs.

reductive evolution and genome optimization in the adaptive specialization of the different members. Complete genome sequences of the respiratory tract parasites belonging to the genus *Bordetella* were long available. Of late, the genome of the haloaromatic acid-degrading soil isolate *A. xylosoxidans* has been published, paving the way for an objective genomic comparison between the pathogenic and non-pathogenic variants of this group. The present shotgun sequencing of the 4,410,066 base pair genome of *T. kashmirensis* now provides an excellent opportunity to comprehensively elucidate the evolutionary dynamics of non-pathogenic soil bacteria vis-à-vis their closely-related pathogenic relatives.

Project II. Paleobiology and Geobiology of ancient ecosystems : ***Dr. Wriddhiman Ghosh***

Silica and travertine deposits, the two most common surface manifestations of terrestrial hot springs, have so far been the only markers universally helpful in locating and interpreting geothermal systems and past lifeforms potentially associated with them. We have, for the first time, identified microbial fossils from a third type of geothermal sinter, viz., the boron mineral deposits, which are characteristic of the relatively uncommon silicate-poor hot springs. Our organic biomarker analyses of the boratic sinters framing the hot springs of Puga valley, Ladakh have identified molecular fossils (viz. respiratory and photosynthetic isoprenoid quinones and photosynthetic pigments) of a mat-like microbial community putatively comprised of algae, fungi, cyanobacteria and other photosynthetic bacteria, some of which may be proteobacteria. So far as microfossil preservation is concerned, mineralized mat-like biofabrics with diverse cellular morphotypes could be identified in scanning electron microscopy of sub-recent sediments as well as hard and consolidated old sinters. Though this putative past community is quite unusual in volcanic niches, its ubiquitous and enduring presence in the Puga geothermal area is highlighted by the discovery of its biosignatures along all the three dimensions of the explored boratic deposits. These findings usher a new paradigm of looking at past or present geothermal Life in as well as outside the Earth.

Functional analysis of mycobacterial response regulators : ***Dr. Manikuntala Kundu in collaboration with Dr. Joyoti Basu***

Two-component systems (TCSs) form essential components of the mycobacterial machinery that senses environmental signals and responds to these signals. We are focusing our efforts on understanding the regulation of gene expression by some of these TCSs, and on characterizing some of the response regulators in detail. Towards this end, we have cloned, expressed and purified the response regulators MprA and RegX3. The structure-function relationships of these are being investigated. The possible cross-talk between different TCSs is also under investigation.

Regulation of the polyphosphate kinase 1 (*ppk1*) of *Mycobacterium tuberculosis* under stress : ***Dr. Manikuntala Kundu in collaboration with Dr. Joyoti Basu***

PPK1 is an important regulator of the stress response in mycobacteria. In our attempt to characterize the promoter of the *ppk1* gene of *Mycobacterium tuberculosis*, a 450 bp region

upstream of the start site of *ppk1* has been cloned upstream of *gfp* in a promoter-less vector. Using *M. smegmatis* as a surrogate host, the *ppk1* promoter was observed to be expressed under conditions of phosphate starvation.

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

The current projects in the lab are focused on three aspects of cell cycle regulation-a) identifying proteins that interact with novel kinesins; b) discovering the mechanism of EhCaBP6 in microtubular assembly and c) functional analysis of EhFormin5. A) We have discovered that EhKlp2-4 are multi-functional kinesins that associate with F-actin in addition to microtubules. Structural analysis showed that these proteins do not contain actin binding domains. Using yeast two hybrid analysis we have shown that EhKlp3 and 4 bind to specific actin binding proteins. This explains the association of EhKlp3,4 with actin. B) Serendipitously, we have discovered that the Ca binding protein EhCaBP6 (discovered in Alok Bhattacharyya's lab, JNU) is a microtubule end associated protein. This protein likely regulates chromosome segregation and MT assembly in response to Ca signaling. C) EhFormin5 is unique since it lacks the conserved Formin Homology domain (FH1). In order to determine its role in actin polymerization we have carried out functional studies showing its association both with MT and actin. We have discovered that EhFormin5 is regulated by the p21rap1 protein in E. histolytica. This result is important since all known Formins are regulated by Rho/Rac proteins and not Ras/Rap. All these studies have identified hitherto unidentified regulators of chromosome segregation and cell division in amoeba.

Studies on *E. coli* HflKC, a host factor that influences the lysys/ lysogeny decision of bacteriophage lambda : ***Dr. Pradeep Parrack***

The HflKC proteins from *E. coli* have been implicated in the lysis/lysogeny switch of coliphage lambda. HflKC antagonizes the action of HflB towards the membrane associated substrates of the latter. The behavior of HflKC with respect to the cytosolic substrates of HflB (such as λCII), however, remains unclear. Likewise, the role of HflKC in the lysis-lysogeny decision of λ is not well understood. They always copurify as a complex and their individual activities were unknown. We have purified HflK and HflC individually and have shown that each can bind to HflB and inhibit the proteolysis of CII. Deletion of *hflKC* has no effect on the stability of CII. However, when λ infects Δ*hflKC* cells, turbid plaques are produced, indicating stabilization of CII under these conditions. We found that CII is stabilized in Δ*hflKC* cells even without infection by λ, if CIII is present. Nonetheless, we also obtained turbid plaques when a Δ*hflKC* host was infected by a *cIII*-defective phage, λ*cIII*^{67}. These results suggest that a yet unidentified phage factor may influence the lysis-lysogeny decision in Δ*hflKC* cells

Investigations into the GTPase and related activities of the protein HflX from *Escherichia coli* : ***Dr. Pradeep Parrack***

The proein HflX from *E. coli* is an ATPase as well as GTPase, but its cellular function is unknown. The protein also exhibits ribosome binding and autophosphorylation activities. We have

initiated various studies to characterize the autophosphorylation property of HflX, and to find out its function in the cell. Specifically, a C-terminal part of HflX has been purified and tested for GTPase and autophosphorylation activities. Experiments are also under way for a comparative study of the growth of wild type *E. coli* with those lacking HflX and those overexpressing HflX, under a variety of different conditions.

Studies on the gene regulators and drug discovery tools : ***Dr. Subrata Sau***

Repressor of mycobacteriophage L1 unconventionally binds to multiple operator DNAs with no dyad symmetry. Our footprinting data indicate that two adjacent major grooves in the operator DNA helix participate in the repressor binding. In addition, interaction between the repressor and operator DNA was found to occur primarily through one face of the DNA helix. Interestingly, repressor that weakly induced bending in the operator DNA interacted with the operator as a monomer.

Bacteriophage ϕ11 that utilizes *Staphylococcus aureus* as the host encodes two repressors, namely, CI and Cro. While CI showed binding to two 15 bp operator sites (*O1* and *O2*), Cro bound to the homologous *O3* site in the ϕ11 *cI-cro* intergenic region. Recent investigations revealed that CI interacts with several 4-5 bp regions in and around the *O1* and *O2* sites. Binding of RNA polymerase to the promoter of *cI* / *cro* appears to be affected by CI.

A reporter *S. aureus* strain was constructed (by inserting the *drp35* promoter - *lacZ* transcriptional fusion into *S. aureus* RN4220 genome) and employed to develop various assay systems for studying the expression of β-galactosidase in the presence of different antibiotics. Our microtiter plate assay system exhibited the induced synthesis of β-galactosidase, specifically in the presence of sublethal concentrations of the cell wall affecting antibiotics, indicating that it could be potentially utilized for the high-throughput screening of new cell wall inhibitors.

High fidelity replication and segregation of chromosomes in eukaryotes using the yeast *S. cerevisiae* as the model system : ***Dr. Pratima Sinha***

1. The Chl1 protein was previously characterized by others and us as required for the establishment of sister chromatid cohesion in S-phase, for the repair of DNA damage, for transcriptional silencing, to prevent unequal sister chromatid cohesion and premature aging. We have now shown that the absence of Chl1p leads to depletion in the association of cohesin complex with chromatin and for the maintenance of cohesion in G2 phase, after its establishment in S-phase. (manuscript under revision)
2. In earlier work we have shown that Sum1p, a transcriptional repressor that binds to promoters and recruits histone deacetylase Hst1 to chromatin, is also a dosage suppressor of mutations in the alpha-tubulin gene. We have extended this observation and shown that dosage suppression by Sum1p extends to wild-type microtubules as well, in that higher dosage of Sum1p protects wild-type microtubule structure against depolymerization by anti-mitotic drugs like benomyl and nocodazole.

VI. Development of Systems Biology :

Mathematical model of differential gene expression in *Bordetella pertussis* : ***Dr. Suman K Banik***

Based on the phosphorelay kinetics operative within BvgAS two-component system we proposed a mathematical model for signal transduction and differential gene regulation in *Bordetella pertussis*. To understand the system behavior under elevated temperature, the developed model has been studied in two different ways. First, a quasi-steady state analysis has been carried out for the two-component system, comprising of sensor BvgS and response regulator BvgA. The quasi-steady state analysis reveals a positive feedback and temperature induced molecular switch, leading to graded response and amplification in the output of BvgA. Accumulation of large pool of BvgA thus results into differential regulation of the downstream genes, including the gene encoding toxin. Furthermore, numerical integration of the full network kinetics has been carried out to explore time dependent behavior of different system components, that qualitatively capture the essential features of experimental results performed *in vivo*.

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

miRNAs play an important role in the immune response including the development and differentiation of immune cells, antibody production, and innate immunity regulation. Our efforts to understand the global regulation of miRNAs in *M. tuberculosis* infected murine macrophages reveals that miR-155, one of the early innate immune response regulated miRNAs, is upregulated. The secretory antigen ESAT-6, individually triggers miR-155 expression. The implications of miR-155 upregulation are under investigatnion. A host of other miRNAs, many of unknown function have also been identified as being regulated by *M. tuberculosis*. These are being analyzed further.

Network analysis of *M. tuberculosis*-triggered gene expression in murine macrophages: ***Dr. Joyoti Basu in collaboration with Dr. Manikuntala Kundu and Dr. Soumen Roy***

Global gene expression profiling has been carried out in a temporal manner in *M. tuberculosis*-infected murine macrophages. Two networks of downregulated and upregulated genes have been constructed from the data available. Nodes of high connectivity have been identified, and efforts are under way to under way to understand the significance of these nodes in the immune response to infection.

Interdisciplinary Physics/Systems Biology : ***Dr. Indrani Bose***

Bistability, i.e., the coexistence of two stable steady states constitutes a universal theme in cell biology. It is, in general, an outcome of dynamics involving positive feedback and sufficient nonlinearity. One way of achieving the latter condition is when cooperative binding of

regulatory molecules occurs at the promoter region of the gene or when the regulatory proteins form multimers which then bind the specific regions of the DNA. Recently, a new mechanism of bistability, termed emergent bistability, has been proposed and demonstrated in a synthetic gene circuit. In this case, the protein product X of a gene promotes its own synthesis in a noncooperative manner (positive feedback but not sufficient nonlinearity) and has a retarding effect on the growth of the host cell. The experimental signature of bistability lies in the coexistence of two distinct subpopulations with low and high protein levels. Noise-induced transitions between the expression states are responsible for the generation of the phenotypic heterogeneity. The origin of noise lies in the stochastic nature of the gene expression. We have investigated the effects of additive and multiplicative noise on emergent bistability using stochastic theories based on the Langevin and Fokker-Planck equations. We have computed the steady state probability distribution of the protein levels in an ensemble of cells as well as the mean first passage times for escape over the potential barrier.

The *Mycobacterium tuberculosis* response to surface stress : ***Dr. Manikuntala Kundu in collaboration with Dr. Suman Banik and Dr. Joyoti Basu***

An approach combining experiments with mathematical modeling has been initiated to understand aspects of the stress response of *M. tuberculosis*. *M. tuberculosis* has been subjected to surface stress and the time- and concentration-dependent expression patterns of *mprAB* (a two-component system) and *sigE* (an extracytoplasmic function sigma factor) have been analyzed.

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

We have developed *in vitro* transcription assays with recombinant *M. tuberculosis* RNA polymerase and have purified each of the 13 sigma factors of *M. tuberculosis*. We have initiated efforts to identify the genes regulated by each sigma factor. The method involves two complementary sets of experiments. 1) Genomic SELEX approach to identify promoters for each sigma factor. 2) Microarray analysis of mRNA from *in vitro* transcription assay with each sigma factor, RNA polymerase and *M. tuberculosis* genomic DNA.

Topological metrics in Biological networks : ***Dr. Soumen Roy***

While some particular topological metrics could be a good index of the state of things in a specific biological network it may not yield much meaningful information in another biological network. In recent past, new measures like synthetic accessibility have shed valuable insight into the working of biological systems. We are working on measures that can shed insight into the understanding of complex biological networks in specific and general contexts.

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

Nonlocal quantum information and entanglement : ***Dr. Somshubhro Bandyopadhyay***

One of the central goals in Quantum Information Theory is to understand the nonlocal nature of quantum information and its relationship with quantum entanglement. We are addressing this problem via two approaches outlined below.

A. Local discrimination of orthogonal quantum states: (with G. Kar, ISI, Kolkata and S. Ghosh, IMSc, Chennai)

We are studying the relationship between entanglement and nonlocality associated with quantum information within the set up of local discrimination of orthogonal quantum states. In this setting it is assumed that a composite quantum system is prepared in one of many orthogonal quantum states and is distributed amongst several spatially separated observers whose task is to determine, without error, in which state the system was prepared. Recently we have obtained a necessary and sufficient condition to discriminate a set of orthogonal maximally entangled states under one way LOCC

B. Local discrimination of orthogonal quantum states with many copies:

In the standard set up it is assumed that the observers are given only a single copy of the unknown state. We have relaxed this assumption and have been able to show that even with potentially unlimited supply of copies of the unknown state it may not be possible to completely determine the state of the quantum system if the states are mixed. On the other hand if the system was prepared in one of many orthogonal pure states, it is always possible to completely determine the state with a finite number of copies.

Besides contributing to our understanding of nonlocality and entanglement within the LOCC paradigm, the above results have applications in developing quantum cryptography primitives like quantum data hiding and quantum secret sharing.

Hybrid quantum algorithms : ***Dr. Somshubhro Bandyopadhyay*** (***with G. Brassard, University of Montreal and K. Chakrabarti, J. U.***)

Another research area that we have been pursuing is to develop hybrid quantum algorithms. In particular we have developed two algorithms combining both Grover search and Deutsh-Jozsa algorithms in a novel way. The algorithms address the problems of function evaluation and Boolean satisfiability.

Quantum Optics Laboratory : ***Dr. Somshubhro Bandyopadhyay and Dr. Achintya Singha***

The setting up of a quantum optics laboratory at CAPSS is now under progress. Single photon

experiments pertaining to the field of quantum information will be carried out in this lab. Few basic experiments demonstrating the particle nature of light as well as quantum interference will be part of our M.Sc program. The basic set up is expected to be functional by the end of this year.

Quantum spin systems : *Dr. Indrani Bose*

Quantum discord (QD) is a general measure of bipartite quantum correlations with a potential role in quantum information processing tasks. Spin clusters representing molecular magnets serve as ideal candidates for the implementation of some of the associated protocols. We have computed the QD in the ground and thermal states of a spin trimer and a tetramer as a function of an anisotropy parameter, magnetic field and temperature. We have obtained a number of interesting results such as a finite value of the QD in the trimer ground state for which the pairwise entanglement is known to be zero and the complete vanishing of the QD in the asymptotic limit of temperature $T \rightarrow \infty$. We have further studied the dynamics of the QD at $T = 0$ under the effect of a dephasing channel describing the interaction of the reduced spin cluster state with independent local environments. The QD is found to vanish asymptotically as time $t \rightarrow \infty$ in contrast to the 'sudden death' of pairwise entanglement.

The transverse Ising model (TIM) is the simplest spin Hamiltonian with a quantum character and serves as the prototypical model for the study of quantum phase transitions (QPTs). We have studied the dynamics of the QD and classical correlations when the TIM is coupled to an environment. We have established that the QD has two distinct decay rates as a function of time, this is most prominent close to the quantum critical point. The decoherence rate further provides a signature of the QPT.

A direct synthetic approach to pyrroloindoles and pyrroloindazoles : *Dr. Manas Chakrabarty*

We have developed a new, general synthesis of pyrrolo[3,2-*e*]indole, which constitutes the core of the potent antitumour agent CC-1065, starting from 5-nitroindole and through the successive intermediacies of 5-aminoindole and 5-alkynylaminoindole. Several *N*(1)-substituted derivatives have also been prepared. We have successfully extended this protocol for a similar new, general synthesis of pyrrolo[3,2-*e*]indazoles starting from 5-nitro-indazole and its *N*(1)-substituted derivatives. The generalisation of the protocol for both types of nuclei is being pursued. Throughout, the synthesised novel products were characterised by IR, ^{1}H and ^{13}C NMR (both 1D and 2D), EI-MS and elemental analysis. This work is being carried out in collaboration with Dr. Gandhi K. Kar of Presidency University, Kolkata.

Additionally, at the request of the Chief Editor of "Advances in Heterocycles," I am preparing, in collaboration with Dr. Mrs. Ajanta Mukherjee of Krishnanagar Govt. College, a review on a particular class of condensed nitrogen heterocycles.

Physical and Chemical Characterization of Aerosols over Darjeeling, North-Eastern Himalaya : *Dr. Abhijit Chatterjee, Anandamay Adak, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha*

Atmospheric aerosol and trace gases are linked to visibility reduction, adverse health effects and heat balance of the Earth. To determine the relative contribution of natural and anthropogenic components on the total aerosol loading continuous monitoring of aerosols is being carried out. A strong seasonal variation in aerosol chemistry was observed over Darjeeling. During premonsoon and summer months, enhanced convection, and the steep pressure gradient across the Himalayan-Gangetic region steer aerosols aloft. The main source region is Thar and Arabian Deserts. With the onset of rainy season (the Arabian Sea and Bay of Bengal branches of the South West summer monsoon), the loading of sea salt aerosols and marine based SO_2 is enhanced to a significant level. During winter and postmonsoon, northeasterly winds from the subcontinent bring anthropogenic aerosols over the Himalayan region. In addition to that, massive biomass burning during winter also plays a role in the loading of anthropogenic aerosols and CO over northeastern Himalayas.

The meteorological parameters along with the respirable suspended particulate matter (RSPM) concentration were measured to understand the annual behavior of RSPM and to estimate source strength and dispersion parameters. Annual distribution shows the highest RSPM concentration during winter months when the meteorological conditions were unfavorable for atmospheric dispersion and, also during the seasons when tourist influx was high (March-May and September-October). The method used for deriving source strength and dispersion parameter from the observations of RSPM concentration and meteorological variables, done in this study. Source strength estimation is indicative of the possible corrections to the global inventory of different anthropogenic sources from this region.

We investigated the atmospheric dry deposition flux of total aerosol and water insoluble trace elements during dry season both in day and night time at Darjeeling. The average flux of total aerosol in day time was found to be three times than in night time. Fe, Al and Zn were found to be the most abundant trace elements.

The aerosol dust monitor (GRIMM) was used for the measurement of number-size distribution of aerosols in different size spectrum. The seasonal variation of ultrafine aerosol particles shows that the nucleation (diameter less than 1 microns) and accumulation mode (diameter between 1 and 2 microns) particles show higher concentrations during winter months and in general nucleation mode particles remained higher in concentrations compared to accumulation mode particles. But during premonsoon the loading of accumulation mode particles were found to be enhanced which could be attributed to the ultrafine dust particles transported from distant arid and semiarid regions. The diurnal variation of ultrafine aerosols clearly shows a strong dependence on the thermodynamic conditions within the boundary layer.

Study on black carbon (soot) in the atmosphere of Darjeeling : *Dr. Abhijit Chatterjee, Anandamay Adak, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha*

The monthly variation of black carbon shows higher concentration during winter followed by summer, postmonsoon and premonsoon with the minimum during monsoon. The winter shows ~1.5 times higher in concentration than premonsoon and postmonsoon while it was ~10 times higher than monsoon. Black carbon shows higher concentrations during 0900 hrs - 1300 hrs LT). During evening (1700 hrs LT) it shows another peak in the dry season. The evening peaks during summer and postmonsoon were found to be dominant compared to morning peaks due to massive influx of tourists during evening. In winter, Black carbon shows much higher concentrations during late evening (1900 hrs LT) to night (2100 hrs) which could be attributed to massive biomass burning by the local people to get warmth against cold.

Aerosol - Solar Radiation Interaction over Darjeeling : *Dr. Abhijit Chatterjee, Anandamay Adak, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha*

An extensive effort has been taken to understand the seasonal variations in aerosol components along with the simultaneous measurements of aerosol optical depth (total vertical columnar solar radiation attenuation by aerosol) on clear sky days over Darjeeling. We observed a heavy loading of fine dust component (Ca^{2+}) during premonsoon (Apr May) and the loading of anthropogenic aerosol components mainly from biomass burning (SO_4^{2-} and black carbon) during winter. These high increases in dust aerosols during premonsoon and anthropogenic aerosols during winter enhanced the attenuation of solar radiation 25 and 40 %, respectively. We observed that for every 1 % increase in anthropogenic aerosols, attenuation increased by 0.55 % during winter whereas for every 1 % increase in dust aerosols, that increased by 0.46 % during premonsoon. This shoul]d be taken into account in proper modeling of the airspace environment over eastern Himalayas.

Aerosol Removal by Rain: Effect on Climate Forcing over Darjeeling : *Dr. Abhijit Chatterjee, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha*

We investigated the removal and the building-up of several natural and anthropogenic aerosol components during and after the rains respectively and its impact on Radiative Forcing, the measure of warming (or cooling) of the atmosphere over Darjeeling. We observed that the rain with lower rate (1-2 mm per hour) i.e. drizzle type of rain washed out fine mode (smaller) aerosols more efficiently. Whereas the rain with higher rate (> 5 mm per hour) i.e. heavy rain washed out larger aerosol particles from the atmosphere than smaller aerosols. Black Carbon, the most important atmospheric species responsible for global warming was found to be removed or washed out by the drizzle type of rain for longer duration. This type of rain has been found to be useful in lowering the radiative forcing (warming to cooling) of the atmosphere by efficiently washing out black carbon from the atmosphere.

Studies on Tropospheric Ozone over Darjeeling : *Dr. Abhijit Chatterjee, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha*

Characteristics of surface ozone at Darjeeling show large seasonal variation from 20 ppbv (monsoon) to 70 ppbv (summer and premonsoon). Such high surface ozone is rarely observed in India. However, presence of low carbon monoxide as well as non-availability of sunlight during monsoon may explain the low value of surface ozone during monsoon period. On the other hand, NOx emission associated with massive influx of tourist vehicles and its consequent dissociation by high solar radiative flux to produce ozone is the main reason for the high loading of surface ozone during premonsoon.

Studying the physics of superheated liquids using superheated drop detectors : *Dr. Barun K. Chatterjee and Dr. Rupa Sarkar*

Droplets in the superheated emulsion detector (SED) exist in multiple metastable states, hence it deviates from a proportional counter. Following the interstate transition rates which predict the absence of the second state above 30 °C (R-12 SED) we are studying the nucleation in superheated droplets at high pressure (upto 22 atmospheres) and high temperatures. This gas manifold has also been used to regenerate the nucleated SED.

The acoustic emission due to spontaneous and induced nucleation (AmBe neutron; 59.54, 662 keV gamma) of R-12 SED at 41, 45 and 48 °C have been studied for their difference in spectral characteristics.

Dicholesteryl Carbonate as the Determinant of the Thermodynamic Stability of the LC States of Cholesteryl Oleyl Carbonate : *Dr. Pradip Das*

Differential Scanning Calorimetry, X-ray Diffraction and Infrared Spectroscopy studies were undertaken to reveal the role of dicholesteryl carbonate in determining the thermodynamic stability of the liquid crystal phases of cholesteryl oleyl carbonate. Like the structurally similar, unsaturated fatty chain cholesteryl ester, cholesteryl oleate, it undergoes a melting transition, e.g., crystal to the thermodynamically stable cholesteric phase. This is unlike in cholesteryl stearate, which is the saturated fatty chain version of cholesteryl oleate, and which melts into the isotropic phase, thereby making all the LC states metastable. Besides this structural aspect of saturation and unsaturation of fatty chains, dicholesteryl carbonate present as an impurity influences the thermodynamic stability of the LC states in COC.

Active Detector Array for Cosmic Ray studies : *Dr. Supriya Das*

We are in the process of building an extended air shower array at Darjeeling, using plastic scintillators coupled with WLS fiber and fast PMTs. This will allow us to study the energy spectrum of the primary cosmic rays at the knee region, the possible sources and compositions of the primary cosmic rays causing the air showers. We will start with seven detectors, each with 1 m^2 of area. This 7 detector array will have hexagonal configuration with one detector each at the vertices and one at the center. All components required for this array have been procured and the sight has also been finalized.

Remote Monitoring of Detectors at GRAPES-3 Array at CRL, Ooty : *Dr. Supriya Das and Ms. Sumana Das*

We have taken part in the remote monitoring of the detectors at the GRAPES-3 experiment at Cosmic Ray Laboratory (CRL), Ooty. This involves the monitoring of several parameters of the detectors and data and preparation of report for the Engineer on Duty (EOD) on sight. The EOD takes action on the basis of the report. This helps to maintain the continuity in data and solve problems with detectors as well as the data acquisition system.

Study of Quark-Hadron Phase Transition and other aspects related to QGP : *Dr. Supriya Das, Dr. Sanjay K. Ghosh, Dr. Sibaji Raha and Dr. Rajarshi Ray*

- A Large Ion Collision Experiment (ALICE) involving collision of Lead (Pb) ions at relativistic energies, is being carried out at Large Hadron Collider (LHC), CERN, Geneva to study the properties of matter created in these collisions. It has been reported from earlier such experiments elsewhere in the world that a new state of matter has indeed been created in such collisions. It has also been predicted that the lifetime of the matter created at LHC energies will be longer than earlier. So ALICE will have greater opportunities to study the matter in more detail and will be able to answer the hitherto open questions. We have joined the international collaboration to work on this experiment and proposed to build an electromagnetic calorimeter, along with other collaborating Indian institutes, for the forward region of ALICE. This calorimeter will be integrated with ALICE in the upgraded version of it. This sub-detector will allow us to detect and characterize the high energy γ and π^0 coming out from the collisions. This in turn will tell us about the initial conditions such as the Parton Distribution Functions (PDF) which are crucial elements to understand the particle production following perturbative QCD. We have started the simulation studies on the configuration and performance for this detector.
- Another experiment called the Compressed Baryonic Matter (CBM) has been proposed to start in 5-6 six years from now at the Facility for Anti-Proton and Ion Research (FAIR), which is under construction at Darmstadt, Germany. This will be a fixed target experiment involving Gold (Au) ions to study the matter created in such collisions when the temperature is moderate but the density is high. This will look for the critical point on the quark-hadron phase diagram, where the first order phase transition ends. Bose Institute acts as the nodal institution for the Indian participation at FAIR. We will build a di-muon spectrometer in collaboration with other Indian institutes working in CBM experiment. This detector will detect the muons from the decay of short lived vector mesons such as ρ,ω,ϕ as well as Ψ and Ψ'. This information will help us to characterize the matter at high density.

Multiparticle production in high energy heavy ion collisions : *Dr. Supriya Das, Dr. Sanjay K. Ghosh, Dr. Sibaji Raha and Dr. Rajarshi Ray*

The recent LHC data have once more brought the issue of the formation of thermalized state of matter in hadron-hadron collisions into the forefront. We have shown that the scaling of the information entropy of the chaotically produced particles is valid up to recently available data from p+p collisions at center of mass energy of 2.36 TeV obtained by ALICE experiment. We predict that at the highest energies projected for LHC, almost all the particles will be produced chaotically, indicating that a collective behavior should be observed in hadronic collisions. This picture of multiparticle production scenario was proposed quite some time ago by some of us. The present study is showing a definitive proof of that scenario.

Neutron Star Physics : *Dr. Sanjay K. Ghosh and Dr. Sibaji Raha (External Collaborators : Dr. Ritam Mullick, IISC, Bangalore)*

Phase transition, from normal nuclear matter to quark matter, can take place inside a neutron star (NS) whose central density is of the order of 5-10 times normal nuclear matter saturation density. The transition is conjectured to occur via a conversion front, converting the neutron star to strange star. In this paper, we solve the relativistic hydrodynamic equations in presence of high magnetic field, usually present in NSs, for the conversion front. We have included the Lorentz force due to magnetic field in the energy momentum tensor by averaging over the polar angles. We find that for a initial dipolar field configuration of the magnetic field with a sufficiently high value at the surface, velocity of the front increases considerably.

Effective Model studies in the Physics and Astrophysics of strongly interacting matter : *Dr. Sanjay K. Ghosh, Dr. Rajarshi Ray, Anirban Lahiri and Sarbani Majumder (External Collaborators : Dr. Abhijit Bhattacharya, Paramita Deb, University of Calcutta)*

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. Lattice QCD data seem to agree reasonably with both the Lagrangians.

In order to study the quark matter in neutron star scenario one must consider the condition of beta equilibrium among the species and the electrical neutrality. The QCD phase diagram of 2+1 flavour qurak matter in beta equilibrium is studied within the frame work of PNJL model. We study the charge neutral trajectories along with the phase diagram. The isentropic trajectories for different values of electron chemical potential is obtained. It is useful for analyzing the thermodynamic evolution of the system and we have plotted the pressure along these trajectories.

Heavy Ion collision at LHC energies : ***Dr. Sanjay K. Ghosh, Dr. Rajarshi Ray and Sarbani Majumder (External Collobrators : Dr. Jan-e-Alam, Dr. Bedangadas Mohanty, VECC, Kolkata)***

Tau leptons are heavy leptons which are expected to be produced in high energy collision environment of LHC. Due to their larges mass compared to electron and muons, production of tau leptons will have much larger partonic contribution compared to the hadronic ones. So, if produced, the detection of these leptons may be a clean signature of the formation of quark-gluon plasma. Our study indicates the possibility of detecting tau lepton pairs from quark gluon plasma (QGP) in the mass window 4 to 6 GeV.

Nuclear Physics with Rare Isotope Beams : ***Dr. Dhruba Gupta***

Light exotic nuclei having Borromean structure (bound three-body systems with unbound two-body subsystems) such as ^{6,8}He, ^{11}Li provide an arena to study pairing correlations. These nuclei have large spatial extent (halo) of the valence nucleon(s) and have dominant breakup and transfer channels. The present studies show that the valence nucleon correlations manifest in favoring transfer reactions over others including even projectile breakup.

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

Using measurements pertaining to a suitable Mach-Zehnder type setup, a novel quantum mechanical effect of interdependence between the path and the polarization degrees of freedom of a polarized photon has been demonstrated, without using any notion of hidden variablesan effect that holds good for the product as well as the entangled states. This form of experimental context-dependence is manifested in a way such that the empirically verifiable *subensemble* statistical properties revealed by an arbitrary polarization measurement depend upon the choice of a commuting (comeasurable) path observable, while this effect disappears for the *whole ensemble* of photons emerging from the two exit channels of the experimental setup.

The extent to which the nonuniqueness that is inherent in the standard quantum mechanical calculation of arrival/transit time distribution can be exploited to enable an empirical scrutiny of any causal trajectory model such as the Bohmian scheme has been studied by considering the example of spin-1/2 neutral particles corresponding to a wave packet which pass through a spin rotator (SR) that contains constant magnetic field confined within a region. In such a case, the transit time distribution can be measured in terms of the spin distribution of particles emerging from the SR. In particular, the way one can compare the Bohmian predictions obtained for this example with that using the quantum approach based on the probability current density has been investigated.

In terms of a suitable variant of the EPR-Bohm example, it has been argued that the quantum mechanically predicted and the experimentally verified violation of a Bell-type path-spin noncontextual realist inequality for an 'intraparticle' path-spin entanglement involving single neutrons can be used to infer a curious form of nonlocality, distinct from Bell-type nonlocality. Implications of this type of quantum nonlocality with respect to information theoretic protocols call for further probing.

Cosmic Ray Simulation Studies : ***Dr. Partha S. Joarder, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha***

Effect of particle interaction models on the atmospheric antiproton component has been studied along with the comparison of the BESS observations of atmospheric antiproton spectra with those obtained by means of a full three dimensional Monte Carlo simulation program.Comparison of the atmospheric antiproton fluxes predicted by a few popular microscopic models of particle interaction with each other has also been performed to get an idea about the influence of such models at energies beyond the BESS upper cutoff up to an energy of about 100 GeV. We find that the simulated atmospheric antiproton flux has strong dependence on the choice of particle interaction models. The present analysis seems to further indicate that the theoretical prediction of galactic antiproton spectrum may be uncertain by a reasonable amount due to our limited knowledge of particle interaction characteristics.

Project IRHPA activity (under radiometry programme) :

Studies on correlation of radio signal at microwaves in earth-space satellite link during rain at Darjeeling [27°05N, 88°26'E] : ***Soumendra Singh, Dr. Amitabha Mitra, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha***

The signal propagation in earth-space satellite link is dependent on the radio propagation characteristics of the transmission media, the troposphere. The atmospheric gases, clouds, fog and precipitation etc. play a dominant role in the losses for the signal during such transmission depending on the signal frequency which reduces the quality & reliability of the transmitted signal.

Rain Attenuation is a subject of concern for those frequencies which are operating above 10 GHz. It degrades the SNR and thereby the bit-error ratio (BER) of the ground receiving system. To estimate signal attenuation due to rain, rain drop-size distribution (DSD) is important together with rain rate (mm/hr). Rain events were recorded through a Micro-rain radar(MRR), which gives vertical profile of rain rates and DSD derived from Z-R relationship at discrete pre-selected heights(up to 6 km). A statistical analysis of two-year(2009-10) rainfall rate with the parametric changes of DSD over Darjeeling has been carried out as it experiences very high rain rate in shorter duration during April to November unlike of typical tropical location of plains. The analysis of MRR data shows that even for a constant rain rate throughout the altitude, the DSD is not unique during a particular season of a year. Moreover, it also shows that for a particular rain rate at a certain height the DSD is not found to be similar at different time of the year. The study of such variation is important in view of the inadequacy of the existing rain attenuation models particularly at higher rain rates. Also, the percentage of occurrence of time corresponding to each rain rate has been calculated from surface rain record obtained from optical rain gauge. Thus, in order to find out the total signal path attenuation during rain, the product of path averaged specific attenuation value with effective path length ignoring the height and temporal dependence of DSD will not give the correct estimation for the total

attenuation, instead, profile dependent specific attenuation may lead to better estimation for the same. Our aim is to evolve a suitable rain model based on the cumulative percentage of occurrence of time for various rain rates at Darjeeling which could be correlated with signal variation in earth-space line-of-sight satellite link in order to obtain better correlation of signal attenuation during rain.

Project SMS activity :

Study of High Resolution Radar Imaging under outdoor clutter environment at microwaves & millimetewaves through system development with related code : ***Dr. Amitabha Mitra, Soumendra Singh, Vineet Surana, Ayona Chakravarty, Dr. Sanjay K Ghosh and Dr. Sibaji Raha***

In view of experimental determination of scattering cross section of rain drop ensemble at microwaves and millimeterwaves, suitable instrumentation radar hardware with suitable code was developed to determine radar cross section of few canonical structures at outdoor noisy environment. Clutter rejection employing suitable data processing with appropriate hardware and software gating in experimental set up *is achieved* for few low reflectivity canonical targets. Exploiting the *radio reflectivity* property of material, in microwaves and millimeterwaves frequencies, radio image of arbitrary combination of canonical structures were obtained at outdoor environment in *Two* as well as in *Three-dimensional* formats through the development of suitable radar system with appropriate development of automated data acquisition algorithm & processing codes using different techniques of digital signal processing.

Project MWS-Phase III activity :

Development of Radar Reflectivity Measurement & Diagnostic Imaging at W band : ***Dr. Amitabha Mitra, Vineet Surana, Soumendra Singh and Dr. Sibaji Raha***

A three dimension code has been developed for creating 3-D radio image in millimeter wave band(W-band:75-110GHz) through indigenously developed instrumentation radar hardware with state-of-the-art-components at indoor environment for arbitrary shaped metal objects.

Calibration of the polyethylene terephthalate (PET) passive detector at CERN : ***Dr. Swapan K. Saha, Dr. Dhruba Gupta and Dr. Sibaji Raha***

Systematic studies were carried out to determine the charge response of the polyethylene terephthalate (PET) detector at CERN, Switzerland. This is essential before any new material can be used as a Solid State Nuclear Track Detector (SSNTD). Beams from the REX-ISOLDE facility at CERN were utilized to measure the charge response of PET to 2.82 MeV/u 129Xe, 78Kr and 49Ti ions. Along with our previous investigations, this data firmly establishes the calibration curve for PET, and consequently PET as an SSNTD particularly suited for rare event search in cosmic rays.

Electron correlation effects in nanofabricated quantum structures : ***Dr. Achintya Singha***

Semiconductor quantum structures are artificial systems in which electrons are confined by a potential that can be finely controlled by nanofabrication approaches. In the low electron density limit the artificial structure is of particular interest because of the strong Coulomb force among the electrons. The interactions between the electrons can create novel emergent states of matter with remarkable properties. Understanding of this novel, highly-correlated electronic states represents an important aspect of nanoscience. We construct tailored artificial atoms and lattice systems in the two-dimensional electron gas and manipulate their quantum mechanical properties through external magnetic and electric fields. By means of inelastic light scattering measurements we identified collective modes that emerge from the Coulomb interaction in the artificial atom and lattice. The work has been done in collaboration with Dr. V. Pellegrini and Dr. M. Polini in NEST , SNS, Pisa, Italy and Prof. A. Pinczuk, Col. Univ. NY and Prof. G. Vignale, Univ. of Missouri,USA.

Study of one dimensional semiconductor nanostructures by Raman spectroscopy : ***Dr. Achintya Singha***

Semiconductor nanowires offer a versatile playground to explore mesoscopic and quantum physics due to their small diameters and large surface to volume ratio. Here, we investigates the physics of InAs nanowires of different shapes and sizes grown by chemical beam epitaxy using low temperature polarization dependent near-and off-resonance micro-Raman measurements. The highly anisotropic shape of the nanowires shows Raman antenna effect. The anharmonic decay of phonon due to defect states has been detected. This work is being carried out in collaboration with Prof. A. Roy in IIT Kharagpue and Prof. L. Sorba in NEST, SNS, Pisa, Italy.

Studying the interactions of nanoparticles and proteins : ***Dr. Achintya Singha***

Nanoparticles offer real and radically new opportunities in the field of biomedicine because they are small enough to enter almost all areas of the body including cells and organs. For understanding the effect of nanoparticles on biomolecules requires knowledge of how various molecules bind with nanostructures. This project aims to understanding the processes behind the protein-metal nanoparticle interactions. We are synthesizing metal nanoparticles of different shapes and sizes. The biological aspect of this work will be carried out in collaboration with other Departments at Bose Institute.

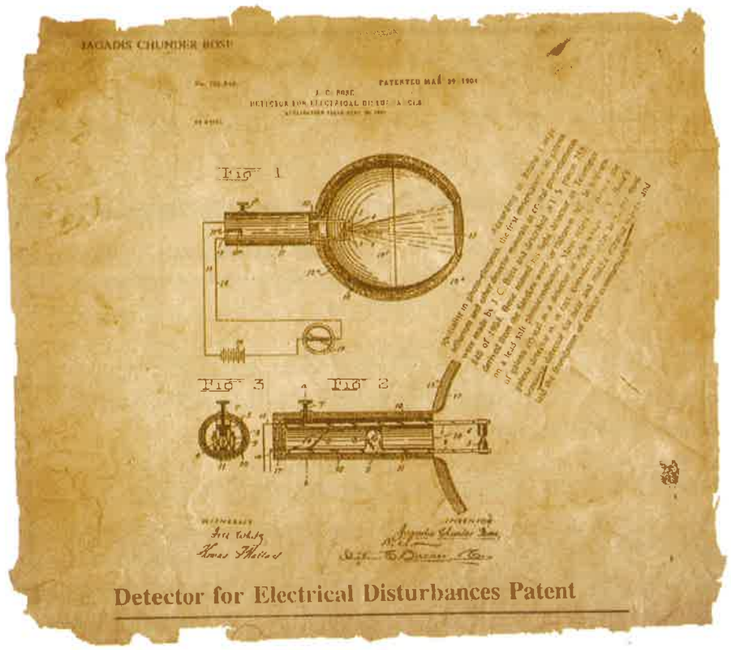
Transport properties of complex perovskite oxides : ***Dr. T. P. Sinha***

The temperature and frequency dependent of various complex perovskite oxides (such as Sr_2CeSbO_6, yttrium-doped $Ba(Zr_{0.25}Ti_{0.75})O_3$, $Sm(Ni_{1/2}Zr_{1/2})O_3$ etc.) have been investigated by alternating current impedance spectroscopy. The Cole-Cole, Davidson-Cole and Havriliak-Negami models are used to study the conduction process in these oxides. The scaling

behaviour of imaginary parts of various dielectric parameters indicates that the relaxation describes the same mechanism at different temperatures. The Jonscher's power law is used to study the frequency dependent conductivity spectra of these oxides.

Electronic structure calculation of strongly correlated systems : *Dr. T. P. Sinha*

The optical and magnetic properties of strongly correlated system such as $BaTiO_3$, Ca_3MWO_6, Sr_2AlNbO_6, etc. are investigated by band structure calculation using density function theory in its generalized gradient approximation. The calculated density of states is compared with the X-ray photoemission spectroscopy data.


JAGADIS CHUNDER BOSE

PATENTED MAY 29 1901

FIG 1

FIG 3

FIG 2

Detector for Electrical Disturbances Patent

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Microbiology Department

1. Dutta T K, Chakraborty J, Roy M, Ghosal D, Khara P, and Gunzales I C (2010) Cloning and characterization of a three-component p-cymene methyl hydroxylase from *Pseudomonas chlororaphis* subsp. *aureofaciens*. *Res. Microbiol.* 161(10): 876-882.

2. Ghosal D, Chakraborty J, Khara P, and Dutta T K (2010) Degradation of phenanthrene via meta-cleavage of 2-hydroxy-1-naphthoic acid by Ochrobactrum sp. strain PWTJD. *FEMS Microbiol. Lett.* 313(2): 103-110.

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Physics Department

1. Agrawal L, Dutta A, Shannigrahi S, Singh B P and Sinha T P (2011) Impedance spectroscopy study and ground state electronic properties of $In(Mg_{1/2}Ti_{1/2})O_3$, *Physica B*, 406, 1081-1087.

2. Agrawal L, Singh B P and Sinha T P (2010) Dielectric Relaxation in Complex Perovskite Oxide $In(Co_{1/2}Ti_{1/2})O_3$, *Integrated Ferroelectrics*, 118, 696-705.

3. Badapanda T, Rout S K, Cavalcante L S, Sczancoski J C, Panigrahi S, Sinha T P and Longo E (2010) Structural and dielectric relaxor properties of yttrium-doped $Ba(Zr_{0.25}Ti_{0.75})O_3$ ceramics, *Materials Chemistry and Physics*, 121, 147-153.

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8. Bharti C and Sinha T P (2011) Structural and ac electrical properties of a newly synthesized single phase rare earth double perovskite oxide: Ba_2CeNbO_6, *Physica B*, 406, 1827-1832.

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10. Bhattacharyya Abhijit, Deb Paramita, Lahiri Anirban and Ray Rajarshi (2010) Susceptibilities with multi-quark interactions in PNJL model, *Physical Review*, D82, 114028.

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15. Choudhary B K, Singh S N, Himanshu A K, Bandyopadhayay S K, Chakraborty K R and Sinha T P (2010) Effects of Substitution of Titanium by Iron and Niobium on the Structure and Dielectric Properties in $BaTi_{1-x}(Fe_{0.5}Nb_{0.5})_xO_3$, *Integrated Ferroelectrics*, 117, 530-535.

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20. Dutta A and Sinha T P (2010) Magnetic structure of double perovskites Ca_2MWO_6 (M = Co, Ni): a first principles study, *Journal of Magnetism and Magnetic Materials*, 322, L25-L27.

21. Dutta A and Sinha T P (2011) Dielectric relaxation and conduction mechanism in $LaNi_{1/4}M_{1/4}O_3$ (M=Mo, W) at low temperature, *Journal of Alloys and Compounds*, 509, 1705-1710.

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33. Johnsen Rainer and Chatterjee Barun K (2011) Flow of binary gas mixtures through small sampling orifices, *J. Vac. Sci. Technol. A.* 29, 011002-1.

34. Kumar N, Dutta A, Prasad S and Sinha T P (2010) Dielectric relaxation of complex perovskite $Sm(Ni_{1/2}Zr_{1/2})O_3$, *Physica B*, 405, 4413-4417.

35. Kumar P, Singh B P, Sinha T P and Singh N K (2011) AC conductivity and dielectric relaxation in $Ba(Sm_{1/2}Nb_{1/2})O_3$ ceramic, *Physica B*, 406, 139-146.

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38. Mahto D K, Dutta A and Sinha T P (2010) Impedance spectroscopy analysis of double perovskite Ho_2NiTiO_6, *Journal of Materials Science*, 45, 6757-6762.

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41. Pal A K and Bose I (2010) Motion of bound domain walls in a spin ladder, *Eur. Phys. J.* B, 77, 139 146.

42. Pal A K and Bose I (2011) Quantum discord in the ground and thermal states of spin clusters, *J. Phys. B: At. Mol. Opt. Phys.* 44, 045101, 9.

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46. Sarkar R, Chatterjee B K and Roy S C (2010) Energy dependence of gamma detection efficiency for SED R-12, *Nucl. Instr. and Meth. A* 619, 203-206.

47. Sharma H, Brajesh K, Kumari K, Himanshu A K, Bandyopadhayay S K and Sinha T P (2010) Dielectric Relaxation and Phase Transition in $[Pb_{0.94}Sr_{0.6}][(Mn_{1/3}Sb_{2/3})_{0.05}\ (Zr_{0.55}Ti_{0.45})_{0.95}]O_3$ Ceramics, *Integrated Ferroelectrics*, 117, 507-523.

48. Shekhar, Brajesh K, Himanshu A K, Bandyopadhayay S K and Sinha T P (2010) Dielectric Studies of Ba Substitution in Lead Zinc Niobate-lead Zirconium Titanate Ceramics by Precipitation Method, *Integrated Ferroelectrics*, 116, 445-453.

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50. Singha A, Gibertini M, Karmakar B, Yuan S, Polini M, Vignale G, Katsnelson M. I, Pinczuk A, Pfeiffer L. N, West K.W, and Pellegrini V (2011) Two-dimensional Mott-Hubbard electrons in an artificial honeycomb lattice, *Science* 332, 1176.

51. Singha A, Pellegrini V, Pinczuk A, Pfeiffer L. N, West K. W, and Rontani M, (2010) Correlated Electrons in Optically Tunable Quantum Dots: Building an Electron Dimer Molecule, *Phys. Rev. Lett.*, 104, 246802.

Symposium Publication

1. Kundu S, Bhattacharya C, Rana T K, Banerjee K, Ghosh T K, Mukherjee G, Dey A, Bhattacharya S, Meena J K, Mukhopadyay S, Gupta D, Kumar S, Pandit S K, Santra S, Mahata K, Chatterjee A, Ramachandran K (2010) Fragment emission studies in 12C + 12C reaction, DAE-BRNS Symposium on Nuclear Physics 55, 326

2. Singh S, Surana V, Chakroborty A, Ghosh S K, Raha S and Mitra A (2010) *RCS Measurement scenario at outdoor environment at Kolkata,* presented at ICMARS-10, ICRS, Jodhpur, Rajasthan.
3. Surana V, Chakraborty A, Singh S, Ghosh S K, Raha S and Mitra A (2010) *Development of Low Cost Microwave Absorber at X-band,* presented at *ICM*ARS-10, ICRS, Jodhpur, Rajasthan.

Library

1. Chakraborty A K (2010) Developing Sustainable Digital Libraries: Socio-Technical Perspectives. (Edited Book) Web2.0 and Social Web Applications. *IGI Global, USA. ISBN13: 9781615207671*, Chapter : 108-32.
2. Chakraborty A K (2010) Digital library system : with reference to consortia; *In INDEST-AICTE workshop and seventh annual meet*, 2010, 6-18.
3. Chakraborty A K (2010) Library Consortia : Some Issues; *Rabindra Bharati University : Journal of Library and Information Science*, 13.

Editor:

1. One of the Editors IASLIC Special Publication No. 50. IASLIC Seminar Conference Volume 2010 --- Theme: (1.) "Reading habits in changing scenario; (2) LIS Education : Emerging paradigm, challenges and vision" held at Deen Dayal Upadhaya University, Gorakhpur during 18-21 December, 2010.

X RAY / IMAGE PLATE READER

Students Awarded with Ph.D. Degree

Name of the Student (University/Year)	Title of thesis	Supervisor
Acharya J.C. Bose Biotechnology Innovation Centre		
Mr. Bejoysekhar Datta (CU, 2010)	Microbiology Department/ Phylogeny of a bacterium isolated from nodule-like organ on the root of *Cicer arietinum* L. and genetics of its siderophore biosynthesis.	Dr. P.K. Chakrabartty
Biochemistry Department		
Mr. Shrihari Sonavane (JU, 2010)	Analysis of cavities and packing in macromolecules, and prediction of enzyme active sites	Dr. P. Chakrabarti
Mr. Kaustav Bandyopadhyay (JU, 2010)	Functional studies on *Escherichia coli hflKC* and their effects on the lambda lysis-lysogeny switch.	Dr. P. Parrack
Bioinformatics Centre		
Ms. Pamela Mukhopadhyay (J.U., 2010)	Studies on evolutionary forces in shaping genetic organization of plant and animal genomes having heterogeneous base composition.	Dr. T. C. Ghosh
Chemistry Department		
Ms. Sulakshana Karmakar (J.U. 2010)	Studies on reactions and synthesis of aromatic heterocycles	Dr. M. Chakrabarty
Ms. Ratna Mukherjee (J.U. 2010)	On the synthesis and reactions of useful small molecules	Dr. M. Chakrabarty
Ms. Ajanta Mukherji (J.U. 2010)	Synthetic approaches to heterocycles and studies on their reactions	Dr. M. Chakrabarty

Division of Molecular Medicine

Mr. Surajit Bhattacharya (J.U., 2010)	Anti-leishmanial immunotherapeutic approaches: Involvement of herbal and other compounds	Dr. Subrata Majumdar
Mr. Santanu Biswas (J.U., 2011)	Association studies of different biochemical and genetic markers in coronary heart disease (CHD) among Asian Indian populations in the Eastern part of India	Dr. N. Mandal
Mr. Tushar K. Bera (J.U., 2010)	Functional Characterization of Arylsulphatase A in a Protein isolated from Goat Spermatozoa having Na+,K+ -ATPase Inhibitory Activity	Dr. P. C. Sen

Division of Plant Biology

Ms. Shubhodipa Sengupta (J.U., 2010)	Development of marker free insect resistant transgenic rice plant type: A clean gene approach.	Dr. Sampa Das

Microbiology Department

Mr. Joydeep Chakraborty (J.U., 2010)	Studies on the bacterial metabolism of aromatic pollutants and evolution of aromatic ring-hydroxylating dioxygenases	Dr. Tapan K. Dutta

Physics Department

Mr. Subhasis Banerjee (C.U., 2011)	Self-organization in complex evolving systems	Dr. I. Bose

Grants-in-aid Schemes

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Schemes funded by Aeronautical Development Agency(ADA), Ministry of Defence		
Dr. S. Raha *Principal Coordinator*	Millimeterwave Scattering(MWS-Phase-III)- Development of Radar Reflectivity	CAPSS/ Physics
Dr. A. Mitra *Investigator-in-Charge*	Measurement & Diagnostic Imaging Facility at Multifrequency Band June 2006- November 2011	
Schemes funded by CSIR		
Dr. P. K. Chakrabartty	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. Subrata Sau	Isolation of the conditional lethal mutants of mycobacteriophage L1 repressor possessing high operator binding affinities and development of an expression vector for mycobacterial systems (started 01-06-2011)	Biochemistry
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. M. Chakrabarty	Solution-phase and green synthesis of condensed heterocycles and preparation of a review	Chemistry
Dr. N. Mandal	Isolation and Identification of natural antioxidant and anticancer product in *Spondias pinnata*	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	Division of Molecular Medicine

Dr. P. C. Sen	Structural and Functional Characterization of a Bi-Functional Protein from Goat Spermatozoa	Division of Molecular Medicine
Dr. Shubho Chaudhuri (PI)	Investigating the role of ARID/HMG a novel high mobility group protein in modulation of chromatin structure in plants.	Division of Plant Biology
Dr. D. N. Sengupta (PI)	Upstream Analysis of the gene for Expression of Sucrose Phosphate Synthase (SPS) in Banana Fruit : Analysis of CIS-acting elements to findout the trans-acting factor. (February,2008 to 2011)	Division of Plant Biology
Dr. S. R. Sikdar	Towards identification of aphid resistance gene(s) from wild crucifer *Rorippa indica* through differential transcriptomic approach.	Division of Plant Biology
Dr. Sujoy K. Das Gupta	Investigating DNA Trajectories in DNA-protein complexes of Prokaryotic origin.	Microbiology

Scheme funded by CSIR NMITLI

Dr. Sampa Das	Novel approaches for production of hybrid seeds with characterization of improved insect resistance and higher yield.	Division of Plant Biology

Schemes funded by CCRH

Dr. T. Das Dr. G. Sa	Protective role of homeopathic medicine in cancer carcinogenesis and immunosuppression: A mechanistic study	Division of Molecular Medicine

Scheme funded by DAE

Dr. Subrata Sau (PI) Dr. T. K. Dutta (Co-PI)	Studies on the repressor and its cognate operators/promoters of temperate *Staphylococcus aureus* phage ϕ 11 and development of a high expression vector for staphylococcal systems (started on 22.02.08)	Biochemistry / Microbiology
Dr. S. Majumdar Dr. Nisith Pal	Signal Transduction mechanism during host-pathogen interaction: special emphasis on the changes in Th1-Th2cytokine response in macrophagesfrom different age groups infected with M.tuberculosis. 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. A. Lohia	Regulation of phagocytosis, cell division and motility in *Entamoeba histolytica*	Biochemistry
Dr. T. C. Ghosh	Evolutionary studies of duplicated genes in protein-protein interaction network of different organisms	Bioinformatic Centre
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. Jayanta Mukhopadhyay	Role of alternative sigma factors in gene regulation of *M. tuberculosis*	Chemistry
Dr. S. Majumdar	Immunomodulatory role of Arabinosylated Lipoarabinomannan Against Visceral Leishmaniasis	Division of Molecular Medicine
Dr. N. Mandal	Disease resistance in giant black tiger shrimp, *Penaeus monodon*	Division of Molecular Medicine
Dr. N. Mandal	Purification and characterization of bioactive natural antioxidant, immunomodulator and anticancer products from *Dioscorea alata* L., of North Eastern region of India (funded by DBT-NER Twinning)	Division of Molecular Medicine
Dr. Sampa Das (Coordinator & PI) Dr. S. R. Sikdar (Co-PI)	Programme Support on 'Biotic stress in Plants: A concerted approach based on functional genomic, proteomic and transgenic techniques".	Division of Plant Biology
Dr. Sampa Das (PI) Dr. S. R. Sikdar (Co-PI)	A transgenic approach to develop aphid resistant *Brassica juncea* plant types and their field evaluation.	Division of Plant Biology

Dr. Sampa Das	Study of the interaction between the receptor protein(s) isolated from *Helicoverpa armigera* and the CrylAc toxin coded by *Bacillus thuringiensis* through biochemical and bioinformatic approach.	Division of Plant Biology
Dr. Sampa Das	A transgenic approach to develop aphid resistant *Brassica juncea* plant types and their field evaluation	Division of Plant Biology
Dr. P. Kundu (PI) Dr. Sampa Das (Co-PI)	Regulation of microRNA transcription and biogenesis by fungal-stress in tomato	Division of Plant Biology
Dr. D. N. Sengupta (PI) Dr. P. C. Sil (Co-PI)	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	Division of Plant Biology / Division of Molecular Medicine
Prof. A. N. Lahiri Majumder (Co-ordinator and PI) Prof. D. N. Sengupta (Co-PI) Dr. Shubho Chaudhuri (Co-PI)	Generation of salt-tolerant rice plants: A translational approach.	Division of Plant Biology
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 *Porteresia coarctata:* Introgression into cultivated rice.	Division of Plant Biology
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.	Division of Plant Biology / Chemistry
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. T. K. Dutta (PI)	Identification of amino acid residues involved in substrate specificity of bacterial ring- hydroxylating dioxygenases using bioinformatics approach	Microbiology

Scheme funded by DRDO, Ministry of Defence

Dr. S. Raha *Principal Coordinator* Dr. A. Mitra *Investigator-in-Charge* Dr. S. K. Ghosh *Co-Investigator*	Studies on Microwave Scattering(SMS) (Feb 2007- Feb 2012)	CAPSS / Physics

Dr. T. P. Sinha	Transport Properties of Double Perovskite Oxides	Physics

Scheme funded by DST

Dr. P. Chakrabarti	J.C. Bose National Fellowship	Biochemistry
Dr. A. Lohia	Identifying proteins that determine the function of novel kinesins from *Entamoeba histolytica*	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 *Mycobacterium tuberculosis* (03.12.2009-02.12.2012)	Chemistry
Dr. T. Das (PI) Dr. G. Sa (Co-PI)	Evaluation of p53-dependent and independent signalings in theaflavin induced human breast cancer cells apoptosis	Division of Molecular Medicine
Dr. A. Pal (PI) Dr. K. P. Das (Co-PI)	A proteomic approach to identify the proteins involved in *in vitro* differentiation of *Vigna radiata*	Division of Plant Biology/ 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/ Division of Plant Biology
Dr. Sujoy K. Das Gupta	Investigating the mechanism by which chaperons activate DNA binding activity of the mycobacterial heat shock response regulator HspR. Date of commencement: 11.01.2011	Microbiology
Dr. T. P. Sinha	Dielectric relaxation in complex perovskite oxides	Physics

Project funded by DST under IRHPA, Govt. of India

Dr. S. Raha *Principal Investigator* Dr. S. K. Ghosh *Co-Principal Investigators* Dr. A. Mitra *Co-Principal Investigator*	Studies on atmospheric water vapour and cloud liquid water using dual frequency radiometer and related rain/fog environment at the high altitude station at Darjeeling under *Centre for Astroparticle Physics and Space Science - a National Facility* (Sept. 2005-Oct. 2011)	CAPSS / Physics

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 Sp1and modulation of Sp1 regulated genes by the gastric pathogen *Helicobacter pylori* (1.1.2007-31.12.2010)	Chemistry

Scheme funded by Indo-French Centre for the Promotion of Advanced Research

Dr. P. Chakrabarti	Analysis of protein flexibility in biological recognition	Biochemistry

Scheme funded by Indo Swiss Collaboration in Biotechnology

Dr. Sampa Das (PI)	Evaluation of ASAL expressing chickpea transgenic plants for the inheritance of aphid resistance	Division of Plant Biology

Scheme funded by Ministry of Earth Science (MoES)

Dr. N. Mandal	Study on white spot syndrome virus (WSSV) prevalence and diversity of disease resistant population among wild giant black tiger shrimp (*Penaeus monodon*) of the entire coastal area of India	Division of Molecular Medicine
Dr. N. Mandal	Study of shrimp Genome: Disease resistant DNA markers of *Penaeus monodon*	Division of Molecular Medicine

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

Scheme funded by Rashtriya Krishi Vikas Yojana

Dr. T. K. Ghose (Co-PI)	Promotion of Bengal Aromatic Rice through improved production and processing system	Division of Plant Biology

Scheme funded by NAIP/ NFBSFARA (ICAR)

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	Division of Plant Biology
Prof. Sampa Das (P.I.) Dr. D. Basu (Co PI)	Development of pod borer resistant transgenic pigeonpea and chickpea	Division of Plant Biology

Project guide for the Department of Library & Information Science, Kolkata

Dr. A. K. Chakraborty	"Library Consortia : Trends and Development" -- M.Phil.	Library

PROTEOMICS WORKSTATION

Participation in Conferences/Symposia/Workshops & Invited Talks Delivered at Various Organizations

Dr. S.K. Datta (Acharya J.C. Bose Biotechnology Innovation Centre) attended (i) 'National Symposium on Floricultural Scenario in the Changing Global Perspective', held by the Department of Floriculture and Landscaping, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya in collaboration with All India Co-Ordinated Research Project on Floriculture (AICRP), Society for the Advancement of Horticulture and Department of Food Processing Industries and Horticulture (Govt. of West Bengal), during 16th to 18th April, 2010, at Farmers' Training Centre, Kalyani, Nadia, West Bengal. Following two Invited papers were presented : (ii) Plant Chimera Origin and their management for development of new ornamental varieties; (iii) Datta, S.K. and Roy, Supriya. Employment generation utilizing unutilized flora for preparation of value added products using dehydration technique.(iv) Dr. Datta attended 'NAARRI International Conference 2010 (NIC-2010), Isotope Technologies and Applications New Horizones', December 13-15, 2010, Mumbai, Organized by National Association for Applications of Radioisotopes & Radiation in Industry (NAARRI), Mumbai, Sponsored by Department of Atomic Energy, Government of India and presented one Invited Talks : 227-230; (v) Induced mutagenesis for development of new varieties in vegetatively propagated ornamentals.

Dr. P. Chakrabarti (Biochemistry) Presented papers/talked at (i) The 1st User Group Meeting of East India Bioinformatics Centres, North Bengal University, Siliguri, April 23-24, 2010; (ii) National Workshop on PCR based Advanced DNA Fingerprinting, Assam University, Silchar, April 21-May 5, 2010; (iii) International Conference on Recent Advances in Bioinformatics, KIIT University, Bhubaneswar, September 3-5, 2010; (iv) Workshop on Bioinformatics in Genomics, Proteomics and Metabolomics, IIT, Kharagpur, September 24-25, 2010; (v) Meeting of the International Network of Protein Engineering Centres (INPEC 2010), Uppsala, Sweden, October 6-9, 2010; (vi) Indo-Swiss Bioinformatics Meeting, IIT, Delhi, October 26-27, 2010; (vii) Annual Meeting of the Asian Crystallographic Association, Busan, Korea, October 31 November 3, 2010; (viii) Meeting of the North-East Coordinators of BIF Centres, Imphal, November 11-12, 2010; (ix) Workshop on Proteins: Structure, Function and Folding, IISc, Bangalore, December 20-24, 2010; (x) International Conference on Emerging Areas of Chemistry, Tripura University, Agartala, January 12-14, 2011; (xi) 25 Years of Bioinformatics in India: A Symposium, Pondicherry University, February 2, 2011; (xii) Modern Trends in Macromolecular Structures, IIT, Bombay, February 21-23, 2011; (xiii) National Symposium on Frontiers in Modern Biology, IISER, Kolkata, February 26-27, 2011.

He was also invited to deliver talk at (i) Bioinformatics Centre, Tripura University, Agartala, September 27, 2010; (ii) CDRI Diamond Jubilee Lecture, Lucknow, November 16, 2010; (iii)

Participation of conferences by Prof. P. Chakrabarti's group member. (Biochemistry) Dr. T. Chatterjee, Arumay Pal, S. Chakraborty, Sucharita Dey, Devlina Chakravarty and Aritrika Pal

attended the Annual Meeting of the Asian Biophysical Society (ABA-IBS-2011), Delhi, January 30 February 2, 2011. Sucharita Dey and Devlina Chakravarty attended ESF-EMBO Symposium on Molecular Perspectives on Protein-Protein Interactions, San Feliu, Spain, November 14-19, 2010.

Dr. P. Parrack (Biochemistry) delivered a invited talk "Separation of Biomolecules" at the UGC National Seminar on "Recent Trends in Separation of Biomolecules" at Prabhat Kumar College, Contai (September 24th, 2010); participated in the Guha Research Conference held at Aurangabad, Maharashtra, (Dec 16-24, 2010); attended the 14th Transcription Asssembly Meeting at Hyderabad (January 19-22, 2011) and delivered an invited talk entitled "The Role of host factors in the λ lysis-lysogeny decision: The mystery of the E. Coli HflKC proteins".

Dr. P. Sinha (Biochemistry) talk delivered (i) 'Cell division cycle, genome instability and cancer'. Talk delivered at the DST-INSPIRE programme held at MPVM School, Allahabad, during August 31 - September 3, 2010; (ii) Colloquium: ' Transmission of Genetic Information During Cell Division' delivered at Harish-Chandra Research Institute on September 3, 2010; (iii) 'Regulation of microtubule stability by a transcriptional repressor in the budding yeast' Invited talk at the 'International Symposium on Modern Biology in 21st Century: Teaching and Research', at Calcutta University, Dec. 7-8, 2010 (iv) 'Faithful Transmission of Genetic Information During Cell Division' talk delivered at the symposium 'Present Scenario & Future Prospects of Microbiology and Plant Biotechnology' organized by Asutosh College, 9-10 March 2011.

Dr. T. C. Ghosh (Bioinformatics) delivered a invited talk in 14th Evolutionary Biology Meeting at Marseilles, France during September 2010.

Dr. Shubhra Ghosh Dastidar (Bioinformatics) participated a lecture and sessions at the workshop "To Predict and Model Biological Molecules and System" at B.I.F. Kalyani University, held during 16th -18th March, 2011

Dr. G. Basu (Biophysics) delivered invited talk on May 28, 2010, Ins Institut de Biologie Physico Chimique (Paris, France) Discovering new sequence motifs that stabilize the cis peptide bond in proteins: NMR spectroscopy and MD simulations.

Dr. J. Basu (Chemistry) delivered an invited lecture in the Keystone symposium on "Tuberculosis: Immunology, cell biology and novel vaccine strategies" held in Vancouver, Canada from January 15 to 20, 2011; she also delivered an invited lecture in the DAE-BRNS Life Sciences Symposium (LSS-2010) on "Current Trends in Biology and Medicine" organized at Bhaba Atomic Research Centre, Mumbai during December 22 to 24, 2010; presented a paper in the 14th International Congress of Immunology held in Kobe, Japan from August 22 to 27, 2010.

Dr. Manas Chakrabarty (Chemistry) delivered invited talks entitled (i) "Green and Non-green Synthesis of (Potentially) Bioactive Condensed Heterocycles" in the Seminar Lecture arranged by the Royal Society of Chemistry (U.K.), Kolkata Chapter and held at the Departments of Chemistry, University of North Bengal, Darjeeling on November 21, 2010 and at Sikkim Govt.

College, Gangtok on November 22, 2010; (ii) "Green Chemistry' in the Department of Chemistry, Krishnagar Govt. College, Krishnagar, Nadia on the 11th march, 2011.

Dr. K. P. Das (Chemistry) delivered invited talk (i) "Stabilization of oligomeric structure of a-crystallin by Zn^{+2} through intersubunit bridging", at the National Conference on Membranes, Microemulsions and Self Assembled Systems, held at Sikkim Manipal Institute of Technology during September 28-30, 2010. He also chaired a session at the conference; (ii) "Protein protein recognition a structural study using biophysical and molecular biological tools", at the National Conference on Trends in Surface Science and Related Areas held on November 19, 2010 at the Institute of Chemical Engineers, Jadavpur University, Kolkata; (iii) "Techniques for studying biomolecular conformation and interactions – use of FT-IR and SPR" at the refreshers course at the Chemistry Department of Jadavpur University, on January 15, 2011; (iv) "Structure of substrates bound to molecular chaperone α-crystallin studied by biophysical and molecular biological tools" at the Chemistry Department of Sambalpur University, Orissa, on 13th November 2010.

Dr. M. Kundu (Chemistry) delivered an invited lecture in the "International Conference on Emerging Areas of Chemistry" held in Tripura University, Agartala from January 12 to 14, 2011; she also delivered an invited lecture in the DAE-BRNS Life Sciences Symposium (LSS-2010) on "Current Trends in Biology and Medicine" organized at Bhaba Atomic Research Centre, Mumbai during December 22 to 24, 2010.

Dr. Jayanta Mukhopadhyay (Chemistry) Presented a talk at 14th Transcription Assembly, 20-22nd January 2011; Hyderabad; he also presented a talk at Workshop: Structural Bioinformatics and Drug Designing from 4th - 6th March 2011, Presidency College, Kolkata

Dr. Soumen Roy (Chemistry) delivered a talk, titled "Networks and metrics" at IISER Kolkata on 30'th March 2011; participated in Statphys Kolkata VII at Saha Institute of Nuclear Physics, Kolkata during November 26-30'th March 2010, and presented a poster.

Dr. Tanya Das (Division of Molecular Medicine) delivered a special lecture on 'Aiming towards a multi-targeted signal modulation therapy by theaflavins: A journey from cancer to cancer stem cells' in the symposium on *Medicinal Plants in Health and Disease* of CAST at Ballygunge Science College, Kolkata and a plenary lecture on 'Cancer chemoprevention and its mechanisms' at Kalyani University, Kalyani, in *International Conference on Cell Signaling* in 2010. She was invited to chair a session and to deliver an invited lecture on 'A Journey from Cancer to Cancer Stem Cells: An Approach towards a Multifocal Signal Modulation Therapy' at the scientific session in the *Medical Science and Physiology section* of the 98th Indian Science Congress, at Chennai, in January 2011. Dr. Das was invited to deliver Special Guest Lecture on 'Cancer Chemoprevention: A Journey towards Molecular Imaging' in the International Symposium on Molecular Imaging at IIT, Kharagpore in 2011. She delivered a special lecture on 'A Journey from Cancer to Cancer Stem Cells: One Bullet, Multiple Targets' in the DST-sponsored Workshop at Vidyasagar University in 2011. Dr. Das also presented her work in an

invited lecture on 'A Journey from cancer to cancer stem cells: An approach towards 'resistance to apoptosis' switchover' in the *National Cancer Congress* at Kolkata in 2011.

Dr. Kuladip Jana (Molecular Medicine) attended the 4th International Symposium on "Nonsurgical Contraceptive methods of Pet Population Control" held on April 8-10, 2010 in Dallas, Texas, U.S.A., having received scholarship from Alliance for Contraception in Cats and Dogs (ACC&D), Portland, OR, U.S.A. and presented research work on "Non-surgical sterilization of pet animals with a new drug Chemisterisol™, and also attended and represented the research works on animals of Bose Institute in the workshop of "Committee for the Purpose of Control & Supervision of Experiments on Animals (CPCSEA)", Ministry of Environment & Forest, Govt. of India, held on 19th April, 2010 at Central Glass & Ceramic Research Institute, Kolkata.

Dr. S. Majumdar (Division of Molecular Medicine) presented an invited talk at the Mapping Of Health Products R&D Landscape For Infectious Tropical Diseases In India organized by WHO-TDR at NII, New Delhi in April 15-16, 2010.

Dr. Nripendranath Mandal (Division of Molecular Medicine) participated in National Symposium on "Sir J. C. Bose memorial National Symposium on Recent Trends in Animal Science Research and the challenges of the day", March 23-25, 2011, organized by Department of Zoology, Presidency University , Kolkata; he delivered Plenary Lecture on "Importance of Biotechnology to control various diseases in human as well as in aquatic animal" at National Symposium on "Sir J. C. Bose memorial National Symposium on Recent Trends in Animal Science Research and the challenges of the day", March 23-25, 2011, organized by Department of Zoology, Presidency University , Kolkata; also delivered an invited Lecture on "Biotechnology for disease management in human and aquatic organism" at the Department of Zoology, University of North Bengal, Siliguri - 734013, West Bengal, 26th February, 2011.

Dr. Anup Kumar Misra (Division of Molecular Medicine) delivered lecture in the *XXV th Carbohydrate Conference* held at Himachal Pradesh University, Simla, Himachal Pradesh, during 11-13th November, 2010; he delivered invited talk in the workshop on Green Chemistry: Necessity for Sustainable development held at H. N. B. Garhwal University (Srinagar) during March 22-23, 2011.

Dr. Mahadeb Pal (Division of Molecular Medicine) delivered an invited talk entitled "Mechanism of action of an anti-cancer drug curaxin on cellular transcription" at the SBC local chapter seminar series held at the Department of Biochemistry, Calcutta University, August 6, 2010.

Dr. P. C. Sen (Division of Molecular Medicine) delivered invited talk (i) Annual Conference of the Physiological Society of India at Bangalore in December 2010; (ii) Refresher Course on "Pharmacy : A fulcrum of knowledge of drug and drug research" in Jadavpur University, February 2011; (iii) DST-INSPIRE Internship Science Camp "Explore the Ecstasy of Science" at JBNSTS, February 2011; (iv) DST-JBNSTS Sponsored Science Camp at Digha in January 2011

and Burdwan, in November 2011; (v) chaired a Session in the 18Th WB State Science Congress at Narendrapur Ramakrishna Mission College, March 2011.

Ms Swatilekah Ghosh and Ms Pinki Nandi (Division of Molecular Medicine) attended and presented a paper in the 18Th WB State Science Congress at Narendrapur Ramakrishna Mission College, February 28-March 1, 2011

Dr. G. Sa (Division of Molecular Medicine) delivered plenary lecture in International Conference on *International Conference on Cell Signaling* at Kalyani University in 2010. Prof. Sa delivered special lecture in the symposium on *Medicinal Plants in Health and Disease* of CAST at Ballygunge Science College, Kolkata. Prof. Sa was invited to deliver invited lecture at the scientific session in the Medical Science and Physiology section of the 98th Indian Science Congress, at Chennai, in January 2011. Prof. Sa delivered special Lecture in the DST-sponsored Workshop at Vidyasagar University in 2011. Prof. Sa was invited to deliver Special Guest Lecture in the International Symposium on Molecular Imaging at IIT, Kharagpore in 2011. Prof. Sa was invited to chair a scientific session in the National Cancer Congress at Kolkata in 2011. Prof. Sa was invited to give lecture in the Molecular Immunology Forum-2011 at New Delhi in 2011.

Dr. Debabrata Basu (Division of Plant Biology) has delivered an invited talk in a UGC sponsored seminar on "Present Scenario and future prospect of Microbiology and Plant Biotechnology" held at Asutosh College on 9th and 10th March, 2011.

Dr. S. Bhattacharya (Division of Plant Biology) presented one poster at the 'Botanicals in integrated health care' held during 26-28 December, 2010 at the Agri Horticultural Society of India, Alipur, Kolkata.

Shri. Himadri Shekhar Chakrabarti (Division of Plant Biology) presented a paper on "Changing scenario of fungal aerosol load and respiratory allergy symptoms in Kolkata" in the '16th National Conference on Aerobiology ,2010', held at Bapuji Institute of Eng. & Tech., Karnataka, India on 19th–21st November, 2010.

Dr. Shubho Chaudhuri (Division of Plant Biology) has participated in the XXXIV All India Cell Biology Conference and Symposium on "Quantitative Biology: From Molecules to Cell", held on 4th -6th December, 2010, Bose Institute, Kolkata.

Dr. Sampa Das (Division of Plant Biology) presented a paper at Asilomer, USA in the International Conference on Legume Genomics and Genetics organised by UC Davis during July 2nd to 7th , 2010. She delivered an invited talk at Bangladesh Agriculture Research Institute in a conference for the promotion of pulse research in Bangladesh during 19-20th September, 2010. Prof. Das and her two scholars had participated and presented paper in 2nd International symposium of ISCB at New Delhi during 10-11th March, 2011. She has delivered a talk on "Role of Plant Biotechnology in global food security" on 2nd March, 2011 in a short term course in Botany for professional development of senior faculty of different Universities and colleges organized by Academic staff college in collaboration with Calcutta University.

Dr. Gaurab Gangopadhyay (Division of Plant Biology) presented poster entitled "Identification of genotype specific PCR based marker in Sesame (*Sesamum indicum* L.)" in the XXXIV All India Cell Biology Conference and Symposium on Quantitative Biology: From Molecules to Cells, held at Bose Institute, Kolkata during December 4 – 6 2010; acted as the coordinator of Plant Science program in the North-Eastern States Teachers' Training on Basic Science 2011 (NESTT-BASE - 2011) at Bose Institute on 28th January 2011 (Theme: Plant diversity with special reference to North Eastern States of India); also delivered presentation to the participants on "Analysis of diversity data". Dr. Gangopadhyay also invited and acted as an expert in the Directorate of Distance Education Programme of Vidyasagar University at Jogomaya Devi College P. G. Study Centre during July – Agust 2010 (delivered three lectures in the Personal Contact Programme).

Dr. Pallob Kundu (Division of Plant Biology) has presented a paper on "Analyzing molecular networks influencing a plants defense response against a biotic stress having prior exposure to an abiotic stress" in the XXXIV All India Cell Biology Conference and Symposium on "Quantitative Biology: From Molecules to Cell", held on 4th – 6th December, 2010, Bose Institute, Kolkata.

Dr. A. N. Lahiri Majumder (Division of Plant Biology) delivered the"6th Debidas Bhattacharya Memorial Lecture" at Visva Bharati University on December 9th, 2010; delivered the Key-Note Address in the International Conference on "Plant Science in Post Genomic Era " held at Sambalpur University during February 17-19, 2011. He also delivered invited lecture in the National Conference on " Plant Genomics and Biotechnology" on March 21, 2011 at the Department of Botany, Calcutta University

Dr. Amita Pal (Division of Plant Biology) participated in the 'TWOWS Fourth General Assembly and International Conference: Women Scientists in a Changing World', held at Beijing, China from 27th to 30th June, 2010. She has delivered an invited talk on 'Bamboo genetic diversity study: Applications of Molecular Markers' and also Chaired a Scientific Session in the National Seminar on "Banana & Bamboo: Diversity Management of at risk commercially valuable crops through community-technology integration" held on 29th and 30th November, 2010 at the Lady Brabourne College, Kolkata. She has delivered an invited talk on "Bamboo identification: A molecular approach" on 22nd January, 2011 at the Ram Mohan College, Kolkata. She served as a Resource person in the North East Teachers Training on Basic Sciences and delivered a talk on "Genetic diversity and molecular phylogeny of tropical bamboo species" on 28th January, 2011. Prof. Pal has delivered a talk on "Progress in understanding molecular basis of differential regeneration response in two cotyledons of *Vigna radiata*" and another paper of her group entitled "Differential response of MYMIV-susceptible- and tolerant genotypes of *Vigna mungo* upon salicylic acid treatment: Oxidative stress related enzymes and proteomic analyses" was presented by Dr. D. Chakraborty during the National Symposium on "Recent advances on Plant Tissue Culture and Biotechnological Researches in India" and she has also chaired a technical session, attended the 32nd Annual Meeting of PTCA(I) held at the M. N. Institute of Applied

Sciences, Bikaner on 4th to 6th February, 2011. She has served as a Resource person in the short term-course on "Integrative Biology- A New Paradigm' organized by the UGC-Academic Staff College, University of Calcutta during March 01 to 04, 2011 on "Molecular mechanism of plant pathogen interactions: Current understanding through genomic and proteomic approaches" for professional development of Senior Faculty of different Universities and Colleges.

Dr. P. K. Saha (Division of Plant Biology) attended ISTA Seed Symposium 2010 held in Cologne, Germany during June 16-20, 2010 and presented a poster. Dr. Saha was also invited to participate in the 2010 World emerging Industries Summit held at Changchun City, China during 31st. August to 2nd September, 2010. He also represented Bose Institute in the World Emerging Industries Cooperation Conference held in Jincheng City, China during September 3-6, 2010.

Dr. S. Sen Mandi (Division of Plant Biology) delivered invited lead lecture on " Molecular Documentation and Evaluation of Plant Genetic Resource for use in herbal medicine (in the session on Bio-Diversity & Conservation of Medicinal Plants):Botanicals in Integrated Health Care Convention organized by The Agri- Horticultural Society of India, Kolkata on 26-28th December, 2010; an invited paper on "Species specific DNA Markers for *Digitalis purpurea* L. (Scrophulariaceae) and *Zanthoxylum acanthopodium* DC.(Rutaceae) was delivered at the IXth International Conference of International Organization of Plant Biosystematics (IOPB), organized by Babasaheb Ambedkar Marathawada University, Aurangabad, Maharashtra, India on 2nd-4th September, 2010.

Dr Abhijit Chatterjee (Environment Section) attended a workshop "Asia Flux Work shop 2010" held in Guanzhou, China during 1-4 December, 2010.

Dr. Sujoy K. Das Gupta (Microbiology) delivered a lecture on DNA trajectory in a Mycobacterial plasmid replication origin complex, at a symposium organized by the SCHOLAR UNITED FORUM of NICED (National Institute of Cholera and Enteric Diseases). Date 23 rd April 2010; deliverd a lecture on TB Genomics and Drug Development at the National workshop on TB GENOMICS, DRUG DEVELOPMENT AND RECENT MOLECULAR DIAGNOSIS, organized by Department of Biotechnology, Assam University and Silchar Medical College & Hospital, in connection with the World TB Day, Silchar. Date 24th March 2011.

Dr. S. Bandyopadhyay (Physics/CAPSS) (i) Served in the Local Organizing Committee of the International Symposium on 75 years of Quantum Entanglement organized by S. N. Bose National Center for Basic Sciences., January 6-10, 2011; (ii) participated in the International Symposium on 75 years of Quantum Entanglement organized by S. N. Bose National Center for Basic Sciences, January 6-10, 2011; (iii) delivered an invited talk in ICQOQC-11, March 24- 26, 2011 at JIIT, Noida, "Local distinguishability of unilaterally transformable orthogonal quantum states"; (iv) acted as a resource person in NESST-BASE 2010.

Dr. I. Bose (Physics) delivered on invitation a set of four lectures at the Workshop on Modeling Infectious Diseases at the Institute of Mathematical Sciences, Chennai (September 13-18, 2010),

a talk on Confinement of spinons in spin ladders at the K. S. Krishnan Symposium on Recent Trends in Condensed Matter Physics at IACS, Kolkata on 3/12/10, a talk on Quantum discord properties of molecular magnets at the International Conference on 75 years of quantum entanglement organized by the S. N. Bose Centre (January 6-10, 2011), two talks on Spin disordered states: an overview and Molecular magnets, quantum discord and decoherence at the International School and Conference on Quantum Information Processing and Applications at HRI, Allahabad (February 14-20, 2011), a talk on Stochastic gene expression: a computational perspective at the meeting on Computational Biology: Challenges and Prospects at Orange County, Bangalore (27/ 2 /11-2 /3 /11), a talk on How microorganisms cope with stress at the National Seminar on Mathematical Modelling of Natural Phenomena at Bethune College, Kolkata on 11/3/11. She also delivered on invitation a special lecture on How microorganisms cope with stress: A search for physical principles at the Science Education Programme on Foundations of Physics organized by BESU, Shibpur on 25/5/10, convened a course for undergraduate students on Interdisciplinary physics: some basic aspects at Ramananda College, Bishnupur (funded by the three Science Academies of India) during January 6-7, 2011 and gave a talk on Biological Physics, participated in the Statphys- Kolkata 10 Conference on Statistical Physics during November 26-30, 2010 and a one-day meeting on Graphenes at IACS on 1/11/10.

Dr. B. K. Chatterjee (Physics) delivered an invited talk entitled "The liquid state-some aspects" at Lady Brabourne College on the occasion of the Professor C.K. Majumdar Summer Program organized by Indian Association of Physics Teachers, on June 5, 2010.

Dr. Rupa Sarkar (Physics) attended the workshop on "Workshop on Dark Matter in the LHC Era: Direct and Indirect Searches" held at the Saha Institute of Nuclear Physics during January 4 - 8, 2011.

Shri Prasanna K. Mondal (Physics) attended the workshop on "Workshop on Dark Matter in the LHC Era: Direct and Indirect Searches" held at the Saha Institute of Nuclear Physics during January 4-8, 2011.

Dr. Supriya Das (Physics/CAPSS) participated in the CORSIKA School at CRL, Ooty in December, 2010; participated in the 5th. Winter Workshop in Astroparticle Physics at CRL, Ooty in December 2010; delivered contributed oral presentation on "Entropy Scaling for Chaotically produced Particles in p+p Collisions at LHC Energies" in the 6th International Conference on Physics and Astrophysics of Quark Gluon Plasma (ICPA-QGP-2010), held at Goa, India, in December 2010; took part in the discussion meeting on "India and CERN: Vision for Future Collaboration" held at BARC, Mumbai in March 2011.

Dr. Supriya Das and Ms. Sumana Das (CAPSS) was involved in organizing a workshop on Digital Pulse Processor, organized by CAEN, Italy & Bose Institute, at Bose Institute, February 23-24, 2011.

Dr. Sanjay K. Ghosh (Physics) (i) Served as resource person in the WAPP 2010 program held at Cosmic Ray Laboratory, TIFR, Ooty, India, in December 2010; (ii) served as an organizing

committee member of International Conference on Physics and Astrophysics of Quark-Gluon Plasma (ICPA-QGP 2010); (iii) delivered an invited talk in International Symposium on "75 Years of Quantum Entanglement: Foundations and Information theoretic applications", held in Kolkata during January 6th to 10th, 2011

Dr. Dipankar Home (Physics/CAPSS) Co-convener and gave a talk at the International Symposium titled *"75 Years of Quantum Entanglement: Foundations and Information Theoretic Applications"* that was held on 6 10 January, 2011 organized by S. N. Bose National Centre for Basic Sciences, Kolkata.

Dr. Amitabha Mitra (Physics/CAPSS) invited talk in The Role of Troposphere on Passive and Active Sensing at Microwaves and Millimeterwaves & related Measurement Constraints at ITR, DRDO, Balasore on 7th July 2011.

Dr. Rajarshi Ray (Physics/CAPSS) (i) delivered *plenary* talk on "Models in strong interaction" in the 6th International Conference on Physics and Astrophysics of Quark Gluon Plasma, held at Goa, India, in December 2010; (ii) served as resource person in the WAPP 2010 program held at Cosmic Ray Laboratory, TIFR, Ooty, India, in December 2010; (iii) delivered a talk on "QCD at finite density" in the physics day of CBM & STAR meeting held at VECC, Kolkata, India, in April 2011.

Dr. Swapan K. Saha (Physics/CAPSS) attended and delivered an invited talk at Workshop on Astroparticle Physics (WAPP 2010) held at CRL, TIFR, Ooty in December 2010.

Dr. Achintya Singha (Physics) (i) Visiting Scientist: National Enterprise for nanoScience and nanoTechnology, Scuola Normale Superiore, Pisa, Italy (06/09/2010 to 03/10/2010); (ii) delivered invited talk on "Spectroscopic properties of nanomaterials" at Jagadis Bose National Science Talent Search (JBNSTS), Kolkata, 26th March, 2011; (iii) delivered invited talk on "Engineering Electron States in Nanopatterned GaAs: Towards Artificial Graphene" at one-day discussion meeting on graphene and its derivatives, 1st November, 2010 in Indian Association for the Cultivation of Science, Jadavpur, Kolkata, India (iv) attended conference and oral presentation on "Electron Dimer Molecules in Optically Tunable Semiconductor Quantum Dots" at International conference on Current Trends in Condensed Matter Physics (CTCMP-2010), National Institute of Science Education and Research (NISER), IOP Campus, Bhubaneswar, India. December 15-19, 2010

Dr. T. P. Sinha (Physics) delivered a talk on "First principles study of magnetic structure of double perovskite oxide" in the International Conference on Advanced Materials Modeling held at University of Nantes, France during July 5-10, 2010. Dr. Sinha presented a paper in the International Conference on Magnetic Materials held at Saha Institute of Nuclear Physics, Kolkata during October 25-29, 2010. Dr. Sinha presented a paper in International Conference on Fundamental and Applications of Nano science and Technology held at Jadavpur University, Kolkata during December 9-11, 2010. Dr. Sinha delivered an invited talk on

"Electronic structure and optical properties of perovskite oxides" in National Seminar on Ferroelectrics and Dielectrics held at Guru Ghasidas University, Bilaspur during December 2-4, 2010.

Dr. Arun Kumar Chakraborty (Library) (i) Participated as one of the member of the Advisory Committee for identifying E-Journals / E-Newspapers both National and International held on March 16-17, 2011 at RRRLF, Kolkata; (ii) Invited to deliver talk in the National Seminar on 25th February, 2011 on "Promoting E-resources in Colleges" under the UGC-INFONET Programme sponsored by INFLIBNET-UGC and organized by Salesian College, Siliguri, West Bengal also acted as a Chairperson in the Technical Session; (iii) Invited to act as one of the Panelist in MDI Gurgaon in an International Conference on "**Digital Libraries and Knowledge Organization".** Panel discussion was on the topic "Knowledge Sharing through Digital Library Collaboration and Networking: role of Digital Library Consortia" on 15th February, 2011. The International Conference was organised by IASLIC, INDEST and MDI Gurgaon, during 14-17 February, 2011; (iv) Presented a paper in MDI Gurgaon in an International Conference on "**Digital Libraries and Knowledge Organization" on 15th February, 2011.** (v) Invited to Chair the Session in a tutorial session on "Managing a Virtual Reference Service" in MDI Gurgaon in an International Conference on "**Digital Libraries and Knowledge Organization"** on 14th February, 2011. (vi) Organized first KOHA meeting at Bose Institute, Kolkata on 7th February, 2011. The programme is to implement KOHA in all College Libraries in India which is being funded by MHRD, Govt. of India; (vii) Invited to participate in the inaugural programme panel as well as in the seminar organized by the DLIS, Jadavpur University and Bengal Library Association, Kolkata held at the Jadavpur University, Kolakta during 4-6 February, 2011; (viii) Invited to participate as one of the member of Organizing committee in the International Conference on Digital Library Management (ICDLM) held at Science City, Kolkata during 11-13 January, 2011 organized by TERI and RRRLF, Ministry of Culture on "Expending benefits of modern technology to public, academic and special libraries; (ix) Invited to participate in an interactive International workshop to plan a "Digital Archiving and Database of Early Bengali Books" to be developed by the National Library, Kolkata and British Library, London. The workshop was held during 6-7 January, 2011 in the National Library, Kolkata; (x) Invited to **deliver talk** on 30th December, 2010 in the "National Seminar on Challenges and Opportunities of Library and Information Science in Digital Era during 29 30 Dec 2010 sponsored By the **National Library, Kolkata** and Jointly Organised by National **Institute of Virology (NIV)**, Pune and Gokhale Institute of Political and Economics (GIPE), **Pune** Venue Kale Hall, Gokhale Institute of Political and Economics (GIPE) B M C C Road, Pune 411004; (xi) Invited to deliver talk and also acted as a Chairperson in the 24th National Seminar of IASLIC on the session SIG on Industrial Information on 18th December, 2010 held at Deen Dayal University, Gorakhpur; (xii) Bose Institute organized jointly "27th National Seminar of Society for Information Science (SIS), New Delhi on "Open Access, Open Innovation" with IICB which was held at Bose Institute, Kolkata during 24-27th November, 2010. More than 250 participants participated from India and abroad; (xiii) Invited to deliver talk and present an invited paper on 18th November, 2010 in the

Seminar on "E-Resource Management and North Zone User Convention of INDEST-AICTE Consortium" during 18-19th November, 2010; (xiv) Invited as a Chief Guest for the National workshop on "KOHA : Open source software for Library Automation on 4th-5th June, 2010 at Birla Institute of Technology (BIT), Mesra, Ranchi; (xv) Guest faculty in the Rabindra Bharati University, Kolkata for MLISc. and BLISc., Guest faculty for Calcutta University for M.Phil Course and guest faculty for Kalyani University and external examiner of different universities in Kolkata.

Sri Pradip Kumar Sarkar (Library) (i) Participated in the workshop on "Library Automaton using KOHA : Open source software and D-space Digital Library Software during 29th September to 1st October 2010 organized by Bose Institute, Kolkata; (ii) Participated in the "International Conference on Digital Library Management (ICDLM)" at the Science City, Kolkata, organized by TERI, New Delhi, in collaboration with RRRLF, Kolkata during 11-13 January, 2011; (iii) Participated in the workshop on " Digitization workflow : Tools and Techniques jointly organized by the IASLIC, Kolkata and Goethe-Institute , Max Mueller Bhavan, Indian on 24.02.2011 at Department of Library & Information Science, University of Calcutta, Kolkata; (iv) Worked as an expert for Physical Verification Committee of the Indian Science Congress Association (ISCA), Kolkata for 2009-2010 to verify library books, journals and priced publications of ISCA for 2009-2010. The Physical verification work had been done at ISCA, Kolkata on 21-07-2010.

Dr. (Mrs.) Banhi Sikha Chaudhuri (Library) (i) Participated in the workshop on "Library Automaton using KOHA : Open source software and D-space Digital Library Software during 29th September to 1st October 2010 organized by Bose Institute, Kolkata; (ii) Attended the "International Conference in Digital Library Management (ICDLM)" at the Science City, Kolkata, organized by TERI, New Delhi, in collaboration with RRRLF, Kolkata during 11-13 January, 2011.

Honour Received

Dr. A. Lohia (Biochemistry) (i) Adjunct Scientist- CDFD Hyderabad (2009); (ii) Member of Research Advisory Council of Hyderabad Eye Research Foundation, LVPEI; (iii) Member of Council of Indian Academy of Sciences, 2010-2012.

Dr. T. C. Ghosh (Bioinformatic) Member of Editorial board: BMC Genomics (From 2010)

Dr. Zhumur Ghosh (Bioinformatic) Member of Editorial board: KBM Journal of Biology, USA

Dr. Manas Chakrabarty (Chemistry) acted as a Member of the Advisory Committee attached to the SAP-DRS Programme of the Department of Chemistry, University of North Bengal, Darjeeling in its Meeting with the Vice-Chancellor held on March 14, 2011.

Dr. N. Mandal (Division of Molecular Medicine) Delivered plenary lecture, felicitated and presided over as Co-chairman of a session at Sir J.C. Bose Memorial National Symposium on Modern Trends in Animal Science Research and Challenges of the Day on March 23, 2011 organized by Department of Zoology and Molecular Biology & Genetics, Presidency University, Kolkata.

Dr. Gaurisankar Sa (Division of Molecular Medicine) elected as the member of Molecular Immunology Forum.

Dr. Parimal C. Sen (Division of Molecular Medicine) (i) elected "Fellow of the West Bengal Academy of Science and Technology" (F.A.Sc.T.); (ii) awarded Prof. P.B. Sen Oration from the Physiological Society of India, December, 2010;

Shri Himadri Shekhar Chakrabarti (Division of Plant Biology) awarded P H Gregory Memorial Award 2010" by 'Indian Aerobiological Society' for his presented research work at '16th National Conference on Aerobiology 2010', held at Bapuji Institute of Eng. & Tech., Karnataka, India on 19th 21st November, 2010.

Dr. Tapan K. Dutta (Microbiology) has received the DBT-CREST Award 2010-11 from Department of Biotechnology, Government of India.

Dr. A. K. chakraborty (Library) Elected as Honorary Librarian, Indian Association of Special Libraries & Information Centre (IASLIC), Kolkata, a National Library-Professional Association for 2011-2013.

Sri Pradip Kumar Sarkar (Library) Elected as Honorary Convenor, Serial Division of Indian Association of Special Libraries & Information Centre (IASLIC), Kolkata, a National Library Professional Association for 2011-2013.

Patents

Dr. S. Sen Mandi (Division of Plant Biology)

A Patent application filed jointly by DBT and BI on "a process for enhancing flavour in tea using UV radiation" (inventor: Swati Sen Mandi) has been granted by Kenya Industrial Property Institute (#KE392, dt. 23.06.2010).

Acharya J. C. Bose – with scholars of Bose Institute.

Symposia and Seminar Organized

Dr. Joyoti Basu and Dr. Manikuntala Kundu (Chemistry) organized the XXXIV All India Cell Biology Conference from December 4 to 6, 2010.

Dr. Mahadeb Pal (Division of Molecular Medicine) Dr. Cheng-Ming Chiang, Professor at the University of Texas Southwestern at Dallas, USA, gave an invited talk at Bose Institute entitled "Epigenetic Control of Chromatin-Dependent Transcription" on December 9, 2010.

Colloquia organized by the Department of Physics

Joint Conveners : Dr. B. K. Chatterjee and Dr. A. Singha

Colloquium 2010

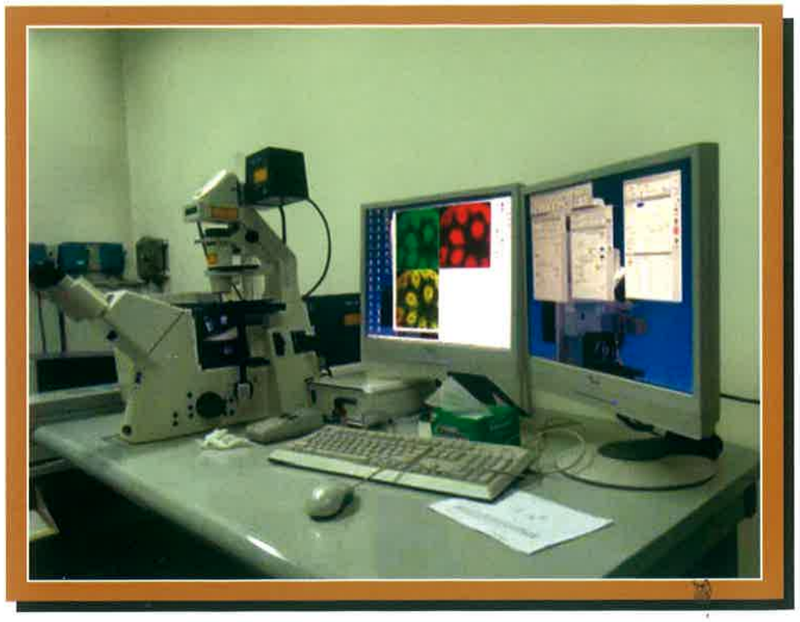
Speaker	Date	Topic
Prof. Gautam Basu	April 20, 2010	Computer simulation of protein evolution
Dr. Surajit Ghosh	June 25, 2010	Biomimetic assembly of intracellular motility with minimum components
Prof. Atal Chaudhuri	July 20, 2010	Visual Cryptography
Prof. Sarbarish Chakravarty	August 4, 2010	Waves in shallow water, the KP line-solitons and chord diagrams
Prof. Jayanta Bhattacharjee	September 2, 2010	Turbulence
Prof. Krishnendu Sengupta	October 29, 2010	Graphene: From Dirac physics to nano-devices

Colloquium 2011

Speaker	Date	Topic
Dr. Jaydeb Chakrabarti	February 23, 2011	Hydrophobic versus Electrostatic Interactions: Stable Macromolecular Clusters

Dr. Arun Kumar Chakraborty (Library) (i) Organized Seminar on "Vistas of Bose Institute Library e-Resources" on 29th September, 2010. More than 150 faculty / research scholars of

Bose Institute participated. (ii) Organized workshop on "KOHA : Library Automation Software and D-space : Digital Library software" from 29th September, 2010 to 1st October, 2010 to provide training to library professionals to automate the libraries by using open source digital library software. (iii) Organized 27th Annual Convention of Society for Information Science and Conference on "Open Access ; Gateway to open Innovation" from 24th November, 2010 to 26th November, 2010 in association with IICB, Kolkata.



CONFOCAL MICROSCOPE

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 laboratorybased 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. Pran K. Chakrabartty)

Bacterial wilt caused by *Ralstonia solanacearum* is a severe disease of field grown tomatoes and of many other crops throughout the world. In our effort to isolate plant growth promoting rhizobacteria (PGPR) to biocontrol the disease, initially we isolated the pathogenic strain Tom5 from a diseased tomato stem and identified it as *Ralstonia solanacearum* biovar IIIA. From the rhizosphere of plants growing in the local fields five PGPR isolates (T1, BH25, AM12, AM13 and R6) were selected based on their efficacy of antagonism to *R. solanacearum* Tom5 and were characterized as *Pseudomonas aeruginosa* T1, *Pseudomonas* sp. BH25, *Pseudomonas* sp. AM12, *Pseudomonas* sp. AM13 and *Pseudomonas putida* R6, respectively. The isolates were assessed for their potential to biocontrol the disease in tomato seedlings. Among them *Pseudomonas* sp. BH25 was found to be most promising to reduce the pathogenic effect of *R. solanacearum* Tom5.

Dehydration of flowers and foliage and floral craft & their commercialization
(Dr. S. K. Datta)

Objectives :

- Market survey [present status of dry flower market; raw materials used; source of raw materials; processing of raw materials; preparation of dry flower salable items;

domestic market and export data; man power engaged in the present dry flower business etc.]

- Collection of cultivated seasonal flowers and standardization of dehydration of flowers and foliage [temperature, media, time of exposure etc.] :
  - By press drying
  - In hot air oven and micro wave oven
- Development of different distinctive and artistic designs [greeting cards, get well cards, wall plates, landscapes, scenery, table tops, lamp shades, coasters, table mats, and many other products] with dry flowers and leaves for sale
- Collection of literature and market data and compilation
- Development of complete protocol for dehydration of flowers and foliage and floral craft

Work done

Collection of local seasonal flowers/leaves :

A good number of naturally growing seasonal wild flowers and leaves were collected from in and around Madhyamgram Experimental Farm (MEF) , Bose Institute , Kolkata 700 129, West Bengal, Maslandapur (Dist. Habra), Badu(Dist. 24-Parganas), Hasnabad (Dist. 24 Pgs), Duttapukur(Dist. 24 Pgs), Kalyani, Kamarpukur, Bankura, Bishnupur and Kakdwip. Different types of leaves with decorative colours, shapes and borders were collected from these areas. All naturally available materials were dehydrated by press drying. All the materials were identified from Taxonomy Section, Department of Botany, Kalyani University, Kalyani, West Bengal. Following are the materials collected and identified and used in dehydration during the work period :

Press Drying :

All the collected leaves and flowers were kept between blotting sheets and one type of leaves/flowers were always pressed in one sheet. All blotting sheets containing leaves/flowers were kept between two ply boards and tightened with nut and bolt. The materials were kept in room temperature for dehydration. The time required for dehydration were recorded for every material. Blotting sheets were changed every 3rd and 5th day to avoid fungal effect/contamination. This helps maintenance of original colour of flowers and leaves.

Press drying at room temperature

Sl	Plant	Family	Locality	Time required for drying in days
1	Croton		MEF	4
2	Laportea interrupta	Urticaceae	Badu	8
3	Senecio contorta	compositeae	Masslandpur	8
4	Eragrostis sp	Gramineae	MEF	4
5	Cassia occidentalis	Caeselpiniaceae	MEF	4
6	Ailanthus excelsa	Simarubiaceae	Badu	6
7	Breynia vitis-idaea	Euphorbiaceae	Duttapukur	5
8	Bauhinia comentosa	Caeselpiniaceae	MEF	6
9	Triumfetta rhombidea	Tiliaceae	MEF	6
10	Sapium sebiferum	Euphorbiaceae	Masslandpur	6
11	Boerhavia repens	Nyctaginaceae	MEF	8
12	Phlox	Nyctaginaceae	MEF	7
13	Cosmos leaves		MEF	8
14	Marigold leaves		MEF	8

Flower petals of Bougainvillea, Ixora, Lagerostromia, Peltophorum, Phlox, Cosmos, Rose, Tithonia, Chrysanthemum, Marigold, Canna, Mussanda, Brassica (inflorescence) etc. were also pressed and dried.

For quick drying the leaves as well as petals were pressed and treated in hot air oven at 60° C.

Table showing time of exposure for petals and leaves of different materials in hot air oven at 60°C for quick drying and large scale production.

Sl.No	Material	Time of exposure in hrs
1	Wedilia leaves	4
2	Duranta leaves	4
3	Cleome viscosa leaves	4
4	Delonix regia petals	5
5	Lagerostomia petals	5
6	Peltophorum petals	5
7	Samania saman leaves	4

Sl.No	Material	Time of exposure in hrs
8	Mussanda petals	4,5
9	Dryopteris	3,4,5
10	Thuja	5
11	Summer Cosmos flowers	5
12	Summer Cosmos leaves	3,4
13	Croton	5
14	Morus alba	3
15	Neem leaves	3,4
16	Scoparia leaves	4
17	Marigold leaves	3 followed by room temperature
18	Caeselpinia petals	3,4 but best colour retains at RT
19	Tithonia petals	3
20	Panicum leaves	3
21	Amrul	4
22	Desmodium leaves	$4^1/_2$
23	Red flower leaves	6
24	Acylapha leaves	3 followed by RT
25	Sida leaves	3,4
26	Balsam petals	4
27	Cletoris	$1^1/_2$ followed by room temperature
28	Mussanda leaves	1 followed by room temperature
29	Money plant leaves	3 hrs at high pressure →1,2 followed by room temperature At 80°C for 1,2 followed by RT But all leaves turned black
30	Canna petals	3 hrs at high pressure ?1,2 at 60°C followed by room temperature At 80°C for 1,2 followed by RT But all leaves turned purple
31	Brassica inflorescence	6
32	Chrysanthemum petals	3 followed by RT

The press dried leaves and petals were used for making greeting cards, Table mats, Coasters, Landscapes, page markers etc.

Embedding:

Flowers of Marigold , Rose, Nymphea(Blue), Chrysanthemum, Dahlia etc were selected for embedding and drying. For embedding river sand and silica gel were used as medium. Most of the flowers were dehydrated in hot air oven at a temperature of 60° c for 48 hours. Flowers with thick disc need exposure of 72 hours at 60°C.

An attempt was made for comparative assessment of quality of dehydrated materials using sand and silica gel. Repeat experiments were conducted with Chrysanthemum, Dahlia and Marigold (Yellow and Orange). It was observed that materials dried using river sand were of slight dull look in comparison to those dried in Silica gel were bright and original fresh look.

Microwave Oven drying

Attempts were made to standardize the dehydration technique using microwave oven.

Different flowers were embedded in sand/silica gel in glass container and dehydrated in micro wave oven and the time taken for dehydration was standardized for few materials :

Micro at 100°C

Material	1min	2min	3min	4min	5min
Red Rose	+	+++ Good	+++ over	+++ Brittle	⊕
Small Chrysanthemum	–	⊕ over	⊕ Slightly over	⊕ Charred	⊕ Charred
Dahlia	+	+++	⊕	⊕	⊕
Marigold	+	++	+++	+++	⊕
Nymphea blue	+	++	+++	⊕	⊕

Micro at 80°C

Materials	1min	2min	3min	4min	5min
Red Rose	+	++	+++	⊕	⊕
Small Chrysanthemum	++	+++	+++ Colour change	⊕	⊕
Dahlia	+	+	+++	⊕	⊕
Marigold	+	+	++	++	+++
Nymphea blue	+	+	++	+++	+++

Micro at 60°C

Materials	1min	2min	3min	4min	5min
Red Rose	+	++	++	+++	+++
Small Chrysanthemum	+	++	++	++	++
Dahlia	+	+	++	++	++
Marigold	+	+	+	+	+
Nymphea blue	+	++	++	++	++

+ Under; ++ Half dried; +++ Full dried; ⊕ Over dried

All the materials were left undisturbed for 2 hours [setting time] after taking out from micro wave oven.

It has been observed that the best results obtained in the above material are as follows:-

Red Rose- 3 min at 80 ° C
Small Chrysanthemum- 6 and 7 min at 60 ° C
Dahlia- 6 min at 60 ° C
Nymphea- 4 and 5 min at 80 ° C
Marigold- 3 min 20 sec at 100 ° C

Post Dehydration Care :

The pressed dried materials were preserved either in blotting sheets or in cellophane bags and the embedded dried flowers were preserved in glass desiccators for future use. The dried materials were used for making three dimensional floral crafts.

Employment Generation Utilizing Unutilized Rural Flora for Preparation of Value Added Products Using Dehydration Technique *(Dr. S. K. Datta)*

Survey and collection of materials :

Surveyed different villages of North 24-Parganas District, South 24-Parganas District, Nadia District, Hooghly District, Bankura District, and Darjeeling and Sikkim hills for selection/collection of naturally growing seasonal wild flowers and leaves suitable for dehydration. Approx. 55 types of plant materials (including foliage and flowers) were collected. All the materials were dehydrated by specially designed plant press. Leaves and flowers were kept between blotting sheets and sheets containing leaves/flowers were kept between two ply boards and tightened with nut and bolt. The materials were kept in room temperature for dehydration. The time required for dehydration were recorded for every material. Time required for dehydration varied from 9 to 15 days in room temperature. Blotting sheets were changed every 3rd and 5th day to avoid fungal effect/contamination. Attempts were also made for quick drying keeping the pressed materials in hot air oven. From the pilot experiment it was

observed that the leaves of *Alysicarpus bupleurifolius* dried within 8 days in room temperature and dried within 3 days after pre-treatment for 1 hour in hot air oven at 60° C. Similarly leaves of *Euphorbia hirta* dried within 2 days following similar method which otherwise takes 6 days to dehydrate in room temperature.

Embedding of flowers is pre-requisite for maintaining original colour and shape after dehydration. Gomphrena, Cosmos and Ixora flowers were embedded in sand. The embedding was done in earthen pots, plastic pots and tray. The embedded materials took 30-32 hours to dehydrate in hot air oven at 60°C.

The pressed dried materials were **preserved** either in blotting sheets or in cellophane bags and the embedded dried flowers were preserved in glass desiccators for future use.

The press dried leaves and petals were used for making **floral crafts** like greeting cards, Table mats, Coasters, Landscapes, page markers etc.

Following trainings were organized for awareness development and employment generation on 'Dehydration of flowers and foliage and floral craft'**:**

Training 1 : 6 7th April, 2010.

523, M.G. Road, Purbasan, Thakurpukur, Kolkata- 700063. The training was sponsored by All India Clench Foundation, Kolkata . Total Candidate : 25

Training for SHG in association with All India Clench Foundation, 6-7 April 2010

Training 2 : 18 - 19 May 2010

Thakurpukur, Kolkata 700 063. The training was sponsored by Thakurpukur Helpless Development Home, Kolkata. Total Candidate : 5 men and 18 women

Training for SHG in Association with Thakurpukur Helpless Development Home, 18-19 May 2010

Training 3 : 4 – 6th August, 2010

KVK, Chopra, Uttar Dinajpur. The training was sponsored by Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar. Total Candidate 15

KVK, Chopra, Uttar Banga Krishi Viswavidyalaya, Pundibari, Uttar Dinajpur, Cooch Behar, 4-6 August 2010

Training 4 : 25 to 26 August, 2010

Baishnabchak Gram Panchayat, Kolaghat Block, Kolaghat, Purba Medinipur, West Bengal. The training was sponsored by Prayas Foundation. Total Candidate 25.

Baishnabchak Gram Panchayat, Kolaghat Block, Kolaghat, Purba Medinipur, West Bengal, 25-26, August. 2010

Total candidate trained during April 2010 to March 2011 :

25 + 23 + 15 + 25 = 88

(March-May and September-October). When meteorological conditions favor mixing in the lower troposphere, concentration levels of RSPM was low. During pre-monsoon months (March-May), additional contribution was provided by long range transport of pollutants caused by intense convective activity over Northern India.

- **Radiative properties of aerosols over Darjeeling have been studied.** The monthly mean columnar Aerosol optical depths (AOD) at five different wavelengths over Darjeeling shows two distinctly contrasting features in AOD spectra between dry (October May) and wet (June September) seasons. During dry season, AOD is found to decrease rapidly with wavelength whereas during wet season, there is a slow decrease of AOD with wavelength. Also, there is a weak increase in AOD at higher wavelength during wet season compared to dry season. The high loading of dust aerosol from distant source regions during premonsoon and massive biomass burning during winter months significantly affected aerosol optical depth. It was found that aerosol loading increased by about 45 % during premonsoon which in turn enhanced AOD at 500 nm by 30 % from the respective annual mean values whereas massive biomass burning enhanced aerosol loading by about 50 % during winter which in turn increased AOD at 500 nm by about 35 % from the respective annual mean values.

Central Instruments facility

The **Central Instruments Facility** of Bose Institute has been used extensively for almost two decades, not only by researchers of this Institute, but also many other neighboring Institutes. In the initial stages the equipments housed in this facility were mainly meant for Biochemical and Biophysical research, but with the creation of the **I**ntensification of **R**esearch in **H**igh **P**riority **A**rea (IRHPA) center for Genomics and Proteomics in 2005, facilities for performing genome based research were included. Through the creation of these facilities it has been possible to cut down on outsourcing thereby resulting in significant savings both in terms of money and time. More importantly the in house facilities created have stimulated cross disciplinary research, sharing of expertise and generation of new ideas. The facility is run by highly trained and dedicated Technicians, who not only maintain the hardware, but are also capable of performing various experiments such as DNA sequencing Ribotyping, Image analysis, 2D Gel Electrophoresis etc independently. Some of the facilities that are extensively used by both in-house as well as guest users are a) DNA Sequencing, b) MALDI TOF mass spectrometer c) Proteomics work station d) GC mass spectrometer e) FACS f) Confocal Micrscope g) Real time PCR and h) CD Spectrometer. Apart from Scientists, students from various Universities visit the facility as part of Educational tours. They are briefed by the technicians about the various applications of the sophisticated instruments.

Centre for Astroparticle Physics & Space Science

A national facility for the observational studies on Cosmic Ray and atmospheric phenomena has been developed at Darjeeling campus of Bose Institute under the IRHPA scheme of Department of Science & Technology, Govt. of India.

Atmospheric Science – Changing airspace environment in eastern Himalayas

- **Seasonal and diurnal variation of aerosols of different sizes has been studied at Darjeeling**. Aerosol shows higher concentrations during winter months and minimum concentrations during monsoon both in fine and coarse mode. Different formation pathways of the formation of the secondary aerosol components have also been found out. Strong evidence has been established towards the long range transport of dust aerosol from arid regions of western India and even from Arabian deserts during premonsoon. Principal component analysis (PCA), a multivariate analysis technique and a trajectory model HYSPLIT_4 were used to identify possible source types and regions of aerosols in Darjeeling. It was found that, 80 % of the ionic species originated from the local and other continental sources and 20 % was from the marine
- The **meteorological parameters along with the respirable suspended particulate matter (RSPM)** concentration were measured during October 2004 - September 2005 to understand the annual behavior of RSPM and to estimate source strength and dispersion parameters. Annual distribution shows the highest RSPM concentration during winter months when the meteorological conditions were unfavorable for atmospheric dispersion and, also during the seasons when tourist influx was high

- The columnar ozone over Darjeeling was found to vary between 275 and 320 DU with an annual average of 290 DU. The seasonal variation of columnar ozone shows higher values during premonsoon whereas it shows lower values during postmonsoon and winter months. The high ozone column during premonsoon could be due to the combined effect of surface ozone and transported ozone from other continental regions.

Cosmic Ray studies at high altitude

- **Observation of rare events in cosmic rays at high altitude :**

  PET films were exposed for long duration in our Darjeeling campus at an altitude of 2200 Meters. After the films were chemically etched, they were scanned under the microscope. For a single projected image frame, there was generally only one track, for only 2% of the total scanned area. The projected image frame for the rest 98% of the scanned area had no track at all. However, in one such single image frame (out of 8000) we found six almost identical nuclear tracks very close to each other. It is found that the diameter 10.5±0.26 μm and cone length 10± 2 μm of each of the six etch cones are comparable with the corresponding figures of diameter 8.5±0.26 μm and cone length 8.5± 2 μm for the fission fragments from ^{252}Cf which were earlier detected in the same kind of OHP detector, as we have reported earlier So, they are likely to be heavy ions with Z/β comparable to that of fission fragments, viz. Z/β = 900 to 1600. The measured flux of this unusual event is ≈ 1.1 X 10^{-6} /m^2sr sec which is much different compared to the flux of the primary cosmic rays of Fe-group (E > 1GeV/n 10^{-52} / m^2 sr sec.) or the flux of Ultra-Heavy group (Z > 50) at Darjeeling altitude. 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. We will start with 7 plastic scintillator detectors, each with 1 m^2 of area and coupled with WLS fibers and PMT. All components for this 7 detector array have been procured. The sight for this array has also been finalized.

- **Numerical modeling of available data on cosmic ray flux and other phenomenological work :**

  There is a lack of consensus about the origin and composition of the primary cosmic rays. Moreover, Cosmic ray energy spectrum has revealed new fine structures. Although enormous amount of data has been obtained both through direct measurements by means of satellite or balloon borne experiments as well as indirect such as Extended Air Shower (EAS) experiments, there exist still a number of open questions on the above mentioned points. One of the reasons for this is the lack of understanding of the hadronic interaction mechanisms during the course of primary cosmic rays through the atmosphere. A number of different interaction models such as FLUKA, GHEISHA, UrQMD have been developed by different groups to study and explain the existing data. We have carried out a comparative study of different interaction models in view of the available proton and antiproton spectra from BESS experiment using the cosmic ray air shower simulation program CORSIKA.

- We have performed **extensive studies on black carbon aerosol over Darjeeling.** The monthly variation of black carbon shows higher concentration during winter followed by summer, postmonsoon and premonsoon with the minimum during monsoon. The winter shows ~1.5 times higher in concentration than premonsoon and postmonsoon while it was ~10 times higher than monsoon. The diurnal variation of BC shows that, the concentrations of BC peaked up during morning (0900 hrs LT) hours and remained higher till early afternoon (1300 hrs LT). During evening (1700 hrs LT) it shows another peak in the dry season. The evening peaks during summer and postmonsoon were found to be dominant compared to morning peaks due to massive influx of tourists during evening. In winter, BC shows much higher concentrations during late evening (1900 hrs LT) to night (2100 hrs). Monsoon shows much lower concentrations compared to dry seasons.

- **Studies on atmospheric surface and columnar ozone over Darjeeling.** Characteristics of surface ozone at Darjeeling show large seasonal variation from 20 ppbv (monsoon) to 70 ppbv (summer and premonsoon). Such high surface ozone is rarely observed in India. However, presence of low carbon monoxide as well as non-availability of sunlight during monsoon may explain the low value of surface ozone during monsoon period. On the other hand, NOx emission associated with massive influx of tourist vehicles and its consequent dissociation by high solar radiative flux to produce ozone is the main reason for the high loading of surface ozone during premonsoon.

Single Photon Experiments in Quantum Information :

- The setting up of a quantum optics laboratory is now under progress at CAPSS. The purpose is to carry out single photon experiments in the field of Quantum Information. The laboratory will also be a part of our M.Sc. course in Physics to demonstrate quantum interference experiments. We expect to demonstrate the basic set up by the end of this year.

Experimental Facility for Plasma Physics :

- A plasma physics laboratory is under progress at CAPSS in collaboration with Plasma Division of SINP. This laboratory will primarily used for the M.Sc. course. The equipments have been procured and presently the plasma discharge tube is being tested at SINP.

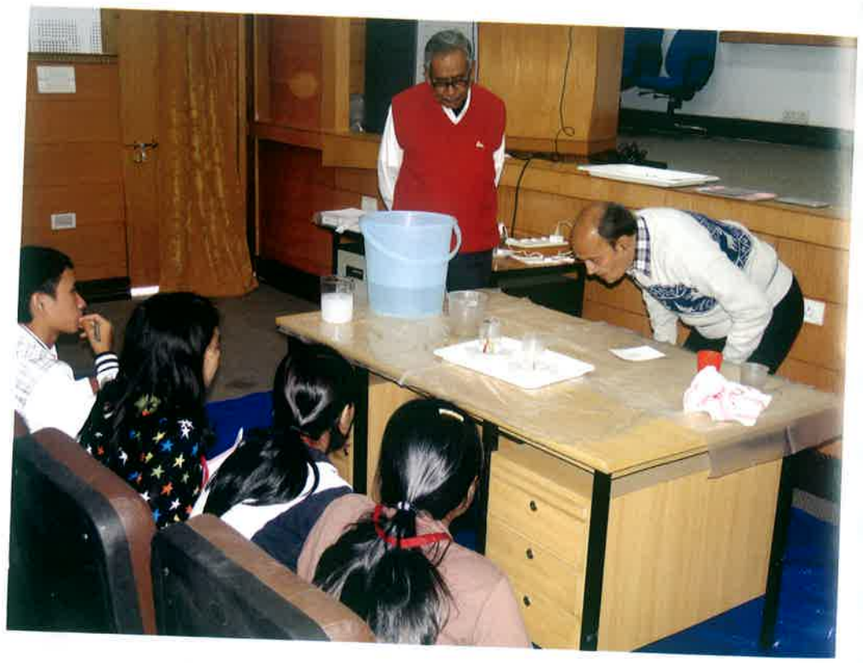
Manpower Development

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

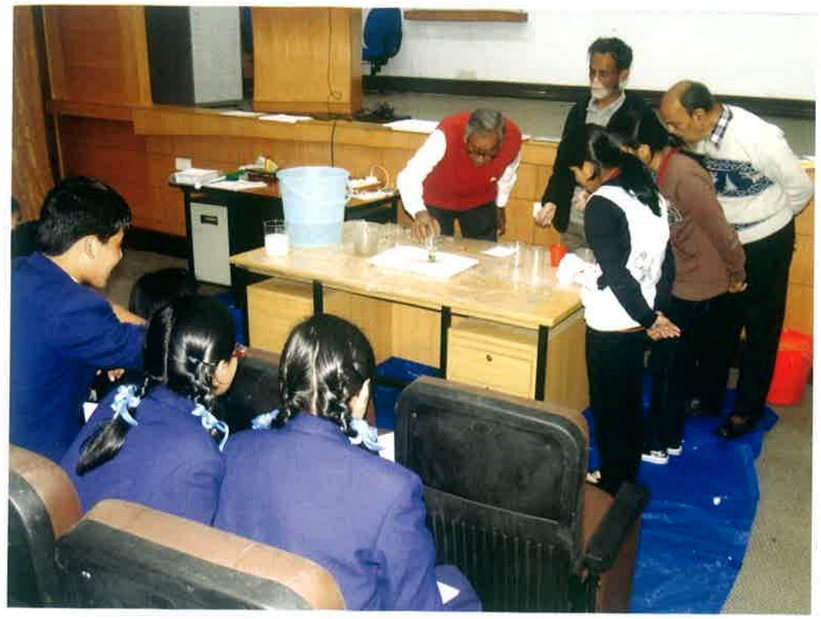
Resource persons from Bose Institute: Dr. S. Das, Dr. R. Ray, Dr. S. Bandyopadhyay, Dr. D. Gupta, Dr. A. Mitra, Dr. P. S. Joarder, Dr. S. K. Ghosh, Dr. S. Saha

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 Bose Institute. Degree of this course is awarded by University of Calcutta. Presently, 1st semester classes are held two days in a week and 3rd semester classes are held three days in a week at Salt Lake campus of Bose Institute. Rest of the days classes are held at St. Xavier's College, Kolkata. Laboratory sessions on general and special papers are held at either of the Institutes. Every year 16 students are admitted through written test and interview. Out of all students, who have passed out in last three batches, some have already joined at various Institutes to pursue their research career after qualifying in the NET/GATE examination.



Outreach Programme

- Several sets of meteorological instruments were installed at different schools around Darjeeling. The main goal of this exercise 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.



- Several posters were presented on the scientific activities of CAPSS in "Frontiers of Science" conference held in Kolkata in March, 2011.

NESST-BASE 2010:

The north-east students' summer training programme on Basic sciences (NESST-BASE) which has now become an annual event of the Institute, was held at Darjeeling during May 16-29, 2010. Prof. Ramaswami, Secretary, Department of Science & Technology inaugurated the programme. This year, 24 students from north-east states as well as Sikkim and Darjeeling, along with one science teacher from each place, participated in this programme. The students were selected by the state authorities. These students were given hands-on training on physical, chemical and biological sciences. There was also a session with the aim to introduce the students with the fun of mathematics.

Environmental Sciences Section

Environmental Sciences Section is currently engaged as the important analytical facility for the ongoing several studies in atmospheric science which are being carried out over Darjeeling, Kolkata, Siliguri and Falta. Those studies include the studies on chemical characterization of atmospheric particulate matter (aerosol), Organic and Inorganic

pollutants, Carbonaceous pollutants etc. Several samples are being collected using various air samplers installed in Darjeeling campus, Centenary campus, Falta campus and also in High Energy Cosmic Ray Physics Department in North Bengal University campus. The samples collected from those sites are brought to the Environmental Sciences Section for the analysis.

Ion Chromatography is used for the analysis of several water soluble ionic components of aerosols. Atomic Absorption Spectrophotometer is used for the analysis of several water insoluble trace metals of aerosol. HPLC is used for the analysis of some important organic pollutants (Volatile Organic Compounds, Carbonyls) in the atmosphere. Prior to the analysis, the collected pollutants is gravimetrically estimated using semi-micro balance after proper desiccation using desiccators. Ultra-sonic bath is used for the digestion of the collected pollutants.

Based on the chemical analysis, we have been able to find the exact sources of the aerosols over Darjeeling. We observed the transport of dust aerosols (Calcium and Silicon) from the distant Desert regions during Premonsoon, the transport of sea-salt aerosols (sodium and chloride) from marine source regions (Bay of Bengal and Arabian Sea) and the contribution from local anthropogenic sources (biomass and fossil fuel burning) in terms of sulphate, carbonaceous species, potassium etc. Several heavy metals have also been identified in aerosol samples indicating several source types like industrial (Cd, Fe, Mn, Co, Ni, Cu), vehicular (Fe, Zn, Cd, Pb) and soil dust (Fe, Al and Si).

Apart from this Environmental Sciences Section these instrumental facilities are being provided to other institutional scholars for their respective research activities. Practical analytical classes are also being conducted for MSc students in Space Science.

Falta Experimental Farm

In the Rural Biotechnology Programme at Falta Experimental Farm two training programmes were conducted on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" during 3 -14 December 2010 and 10-21 March 2011. Total twenty-four trainees were trained in the above two training programmes.

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

Dr. Sampa Das and Dr. D. N. Sengupta (Division of plant Biology): Joint Coordinators

Dr. P. C. Sen, Dr. I. Bose, Dr. S. Dasgupta, Dr. G. Basu, Dr. P. Parrack, Dr. P. C. Sil, Dr. G. Sa, Dr. T. Das, Dr. 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 third year in the month of August, 2010. The first two batches of fifteen students have been awarded the M.Sc. degree, of which seven have joined the Ph.D. programme at the Bose Institute. The third batch of nine students has completed the third semester in February, 2011 and 4th batch of six 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 understood 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) CD 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 was opened in 1983. In the year 2007 a small library was also set-up in the Salt Lake Campus of the Institute. Library provides latest information resources to the Bose Institute faculty, researchers, Integrated M.Sc. Ph.D. students and staff for their day-to-day research and development work. Library also extend its facilities to other Institutions / universities in and around Kolkata as well as West Bengal. Faculty / researchers from Eastern India use the library extensively for reference. Library also extend its services to all DST and CSIR Institutes in India.

The library has total collection of 40,839 reading materials out of which 27198 Bound journals, 13169 Books, 472 Theses as on 31.03.2011. Library is also having a huge collection of other materials including Sir J. C. Bose collection. During this year library subscribed approx. 300 numbers of foreign and Indian periodicals out of which print only 25 numbers. Library has subscribed to more than 4500 online journals in different packages which are online-only fulltext journals / databases of different academic societies such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier, Blackwell, IOP, AIP. Library also subscribed to Science@direct of Elsevier and all Nature Group Journals online. All these journals has been accessing from 1997 onwards.

Library also subscribed to different databases such as : a) Century of Science - Science Citation Index Expanded and ENDNOTE Web of ISI Web of Science, Thompson, USA. b) SCOPUS the largest abstract and citation database of research literature and quality web sources of Elsevier.

c) SCIFINDER of ACS, d) full-text databases of H. W. WILSON, e) Blackwell / John Wiley Journal's Premier Online. f) Current Protocols (Online) of John Wiley / Blackwell. g) Annual Reviews Online (Back volume). h) Methods in Enzymology (Online) etc.

Library also subscribed to e-books packages such as : E-Books of E-brary (2400 e-books), E-Books of Cambridge University Physics E-Books package, E-Books package of Elsevier: Agricultural and Biological Sciences (202); Biochemistry, Genetics and Molecular Biology (260); Environmental Science (113). Current Protocols package of Springer (20225 e-books). Knovel E-Book Collections : Biochemistry, Biology & Biotechnology.

BI Library has gone for Open Access membership(s) of (1) Nucleic Acids Research of Oxford University Press, (2) Biomed Central (BMC) (3) Public Library of Science (PLoS). These membership allows faculty members and scholars of Bose Institute considerable amount of discount on paper handling charges as well as enables faster processing of paper publishing. This membership facilitates faculty / scholars to publish in open access journals.

During the year 2010-2011, 1657 readers used the Library (both campuses) for their reference work. Under Inter Library Loan system books / 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 **45,000 documents** were scanned for faculty members as well as research scholars and more than 5532 hours computer / internet used for accessing in full-text subscribed / free journals by the scholar from the both campus Library itself. Library also provides citation services to its faculty members. Library Computers are used by researchers for accessing full-text subscribed / open access journals from Library apart from their laboratory / department computers.

Photocopy services are provided to all research workers of the institution. A total **2,16,786 pages** of photocopies (Xerox) were given to our faculty and outside users. Some 692 bound volumes of books / journals and 302 loose periodicals were issued to our research scholars and faculty members throughout the year for their reference work.

Library has joined with consortia viz. National Knowledge Resource Consortia (NKRC) which is joint consortia of CSIR and DST Institutes for accessing online resources. Through this consortia faculty scholars can access more than 7000 online resources, SCIFINDER, Patent databases etc. Library could fulfill faculty / scholar demands for article resources from CSIR / DST Institutes subscribed journals. BI Library also provides article resources services to faculty/ scholars of DST / CSIR Institutes and also other institutes in India and abroad sometimes. It is expected to have more journal purchase through consortia from next year. Library is also member of FORSA Consortia.

All Library resources can be accessed by Bose Institute Library faculty / scholar from any campuses of Bose Institute. Bose Institute Library also provides off campus access to its resources to Institute faculty members. Library uses open sources software KOHA for OPAC and D-Space for IDR.

Workshop

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

UNITS	REQUISITION RECEIPTS	JOB DISCHARED	CONTINUING JOB
ELECTRICAL	865 (M.C. & N.C.)	100%	nil
MECHANICAL	35	100%	nil
CARPENTRY	56	95%	5%
REFRIGERATION	20 (MC & MC)	100%	nil
DRAFTING	30	100%	Nil
LECTURE,SEMINARS & course work class attended	Above 300 (M.C & N.C.)	100%	Nil

The Mechanical section has been fabricated various types of Gel Electrophoresis apparatus, reading & writing table stand with made of Perspex sheet and Anaerobic chamber etc. Carpentry section has done laboratory setup work for various departments & A.J.C. Bose Museum.

Electrical renovation work has been carried out in various departments like Physics, Botany etc. New electrical connection has been arranged at Shaymnagar Experimental Farm through WBSEDCL. The capsule lift has been installed at Mayapuri Campus, Darjeeling.

Socially Relevant

Dr. S. Sen Mandi (Division of Plant Biology) Biodiversity rich NE India that constitutes one of the 18 hotspot regions of the world has been taken under study for Documentation and Evaluation of Plant Diversity of this region. The studies include:

- developing authentication parameters viz. species specific DNA markers for medicinally important plant species with an aim to **a)** establishing **sovereignty rights over locally(NE) available (indigenous) plant genetic resource** and **b)** towards **supplementing conventional drug assessment protocols** for avoiding adulteration in herbal drug preparation
- development of medicinal potential associated DNA markers; such studies would help to explore wild plant germplasms for identifying hitherto unutilized medicinal plants.

With an aim towards HRD among young researchers of the NE, efforts are well underway for inculcating awareness and also competence on DNA fingerprinting of plants that have been used through the years for production of herbal-/ethno-/medicine.

In addition to medicinal plants bamboo, that is of wide commercial use as food, fodder, building material and raw material for production of paper plays a major role in the Socio-Economic development of NE India where additionally young bamboo shoots of the edible varieties are used as fresh vegetable as well as fermented food (prepared domestically as well as in recent industrial development), is also under study.

Hands-on-training on DNA Fingerprinting have been provided:

- to Faculty member of Silchar University, Assam, on AFLP analysis of genomes in different species of *Zingiber*.
- a Research Associate of Institute of Biodiversity and Sustainable Development (IBSD, DBT Institute) Imphal, Manipur as trainee, in collaboration have developed genome profile (AFLP patterns) of 12 species of edible bamboo and 10 landraces of *Dendrocalamus*.
- AFLP patterns of 36 species of non-edible bamboo, collected from different locations in and around Manipur have also been developed.

Dr. M. Chakrabarti (Chemistry) The work that is being pursued has been designed in the model of a well known antitumour compound. Once the project is completed, the synthesised final products, i.e. pyrroloindoles and pyrroloindazoles will be screened for antitomour properties. In view of the widespread occurrence of tumour, most of which is malignant, the pursuit of the synthesis of potential antitumour compounds is relevant to the society.

Dr. N. Mandal (Division of Molecular Medicine) Shrimp aquaculture industry is one of the most economically important, job generating, hard currency generating industry all over the world. It involves development of rural farmers along with their destitution and investment, which results in a circulation of billions of dollars around the glove including India. Among different infections in shrimps White spot syndrome virus is the most threatening one causes a huge economic destruction every year thus destructing the socio-economic backbone of the country. The success so far from the Dr. N. Mandal's laboratory under the Marine Biotechnology program has opened a door in the development of disease resistant broodstock as well as the progeny which will be very beneficial for the aquaculture industry as well as the farmers. This will prevent the huge economic loss due to the virus outbreak and this will cause species preservation, socio-economic upliftment and rural and urban development.

Acute myocardial infarction (AMI), commonly known as heart attack is the interruption of blood supply to a part of the heart, causing heart cells to die. Increased stresses, diabetes, hypertension, sedentary lifestyle, and many other factors have contributed quite drastically in the development and increment of acute myocardial infarction (AMI). Conventional risk factor alone is only partially explaining the causes of this predisposed AMI. The effort from Dr. N. Mandal's laboratory under Medical Biotechnology program have resulted some novel parameters for prediction of predisposed AMI among Asian Indian population in the Eastern part of India. This prediction will be useful for early diagnosis and prognosis of AMI, thus becoming advantageous to the society, and establishing once again that "Prevention is better than cure".

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.

List of Personnel

Administration

Dr. Sibaji Raha	*Sr. Professor & Director*
Sri Tushar Kanti Ghorui	*Registrar*
Dr. Utpal Sadhu	*Deputy Registrar (on Lien at IACS)*

Centenary Campus : Ram Krishna Kundu (Retd. on 30.4.10), Debidas Saha, Satyananda Pal (Retd. on 31.12.10), Parimal Ch. Das, Tapan Datta, Arup Kr. Sengupta, Sankar Nath Sinha, Subir Sen, Ashis Chakraborty, Noreen Bhattacharjee, Sisir Chakraborty, Bidyut Kr. Mandal, Manick Ch. Das, Tapan Chakraborty (Retd. on 31.12.10), Ankur Dutta (Retd. on 31.3.11), Nikhilesh Roy Ghatak, Amit Kr. Ghosh, Nilanjana Bhattacharya, Baldeb Goswami, Rina Roy, Amitabha Bhattacharjee, Ram Raj Pandey, Elizabeth Pal, Swapan Kr. Sinha (VRS. on 31.12.10), Susanta Das, Dhrubajyoti Sen, Montu Bhattacharya, Achintya Mukherjee, Rubi Sarkar, Sudam Jana, Bably Marick, Rina Das, Somnath Das, Prodip Kr. Mullick, Sanjoy Krishna Chaki, Debasis Koley, 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, Khairul Baser Mollah, Nagnarayan Yadav, Kanai Hazra, Prafulla Bhunya, Kanak Baran Hazra, Duryodhan Nayak, Bablu Mandal, Sukanta Chakraborty, Subrata Banerjee, Amarnath Hela (Re-deployed on 5.10.10), Ranjit Das, Sarada Devi, Sukumar Mandal, Bulaki Das, Jagabandhu Nayak, Jagannath Das, Prabir Halder (1).

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 (Retd. on 31.8.10), Fulchanda Sardar, Kalicharan Turi, Kisson Das, Munna Turi. Kodan Das, Nagaswar Das, Rajbrat Ram, Rajkumari Balmiki, Tapas Chakraborty.

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

Faculty : Dr A N Lahiri Majumder, Sr. Professor (Chairman till 28.02.2011), Dr. S. Raha Director & Chairman (from 1.3.2011) Dr P K Saha, Scientist and Executive Chairman (from 1.3.2011), Dr. P K Chakrabartty (CSIR-ES), Dr S K Datta (CSIR-ES).

Supporting Staff : (Lab) : Dr Supriya Roy, Dr Sutanu Maji, Dr. Gargi Biswas, 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

Biochemistry Department

Faculty : Dr. B. Bhattacharyya (Raja Ramanna Fellow), Dr. Pinakpani Chakrabarti, Sr. Professor & Chairman (From 08.07.10), Dr. Rajagopal Chattopadhyaya, Professor, Dr. Ajit Bikram Datta, Assistant Professor (From 31.01.11), Dr. Anuradha Lohia, Sr. Professor, Dr. Pradip Kumar Parrack, Professor (From 28.04.10), Dr. Subrata Sau, Associate Professor, Dr. Pratima Sinha, Sr. Professor,

Students/RA/Project Assistant : Dr. Subhash Haldar, Dr. Tanaya Chatterjee, Dr. Snehasish Basu, Soumyananda Chakraborty, Himadri Biswas, Rajkrishna Mondal (upto 15.12.10), Jaspreet Singh Grewal, Debadrita Mukherjee, Amitava Bandhu, Abinit Saha, Avisek Mondal, Aditi Ghosh, Aritrika Pal, Dipak Kumar Manna (Upto 04.02.11), Subhanwita Sarkar, Sudeshna Saha (Upto 31.07.10), Tanusree Bhattacharyya (Up to 31.08.10), Devlina Chakraborty, Prabal Chakraborty, Biswanath Jana, Sandeepan Sengupta (From 28.09.10), Indrani Kar (From 27.09.10), Gopa Dhar (From 20.01.11), Chanchal Mallick (From 20.01.11), Priyadarshini Saha (From 23.03.11)

Supporting Staff : Durga Charan Das, Swapan Kumar Das, Ashim Kumar. Banerjee, Narayan Chandra Datta (retired on 31.07.10), Subhash Chakraborty, Asim Kumar Poddar, Debarati Kanjilal, Md. Asrafali Molla, Sudhanshu S. Maity, Basudev Ghorui, Dulal Chandra Mondal, Ranubala Das, Atanu Pramanik (From 13.01.11).

Bioinformatics Centre

Faculty: Dr. Pinak Chakrabarti Sr. Professor & Scientist In-charge, Dr. Tapash Chandra Ghosh, Professor, Dr. Subhra Ghosh Dostidar, Asstt. Professor, Dr. Zhumur Ghosh, Faculty Fellow, Dr. Debjani Roy, Asstt. Professor.

Students: Arumoy Pal(upto March 2010), Srihari (upto April 2010), Madhurima Das(upto April 2010), Sangeeta Kundu(upto Sept. 2010), Bratati Kahali(upto Oct 2010), Sucharita Dey, Soumita Poddar, Tenusree Bhattacharyya, Tina Begum, Kamalika Sen, Prantik Chakraborty (upto Dec. 2010), Sandeep Chakraborty, Deya Saha, Arindum Dutta (upto June 2010), Debadrita Mitra (upto June 2010), Debipriya Paul (upto June 2010), Siddhi Chaudhur (upto May 2010), Paramita Ghosh (upto Oct. 2010)

Biophysics Department

Faculty : Dr. Gautam Basu

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

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

Chemistry Department

Faculty : Dr. Suman Kr. Banik, Asstt. Professor, Dr. Joyoti Basu, Sr. Professor, Dr. Manas Charkarbarty (CSIR Emeritus Scientist from 21/01/2011), Dr. K. P. Das, Sr. Professor & Chairman, Dr. Pradip Das, Assoc. Professor, Dr. Manikuntala Kundu, Sr. Professor, Dr. Jayanta Mukhopadhyay, Asstt. Professor, Dr. Soumen Roy, Asstt. Professor.

Student: Joyes De, Priyanka Halder, Victor Banerjee, Srabani Karmakar, Dr. Sujit Ray, Kuldeep Kumawat, Sourav Sanyal, Sambha Gupta, Rajdeep Banerjee, Arnab Bandyopadhyay, Ranjit Kr. Prajapati, Paulami Rudra, Ranjeet Kumar, Shreya Sengupta, Arun Kumar Sharma, Prantik Chakrabarty, Payel Banik, Srijon Kaushik Banerjee, Malay Kr. Sannigrahi, Sanjoy Kr. Sahoo.

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

Central Instrumentation Facility

Faculty : Dr. Sujoy K. Das Gupta, Professor & In Charge, Dr. T. P. Sinha, Professor

Supporting Staff (Cent. Campus) : Amit Kumar Mahindar, Jaganmay Guin, Jaideb Chattopadhyay, Mrinal Das, Ranjan Kumar Dutta, Smriti Ranjan Maji, Swaroop Kumar Biswas, Amarendra Nath Biswas, Sheolee Chakraborty (Ghosh), Alpana Bhattacharya

Supporting Staff (Main Campus) : Tapan Datta (redployed to Admn); Gobinda Das; Shyamsundar Kundu; Arup Kr.Sen; Subhas Ch. Maikap; Samir Kr. Mukherjee; Pradip Kr. Karmakar; Tanima Modak Dhar; Ranjit Kr.Ghosh; Debabrata Polley; Sankar Kr. Santra; Saraswati Sarkar Sen

Division of Molecular Medicine

Faculty : Dr. Kaushik Biswas, Assistant Professor, Dr. Tanya Das, Associate Professor, Dr. Kuladip Jana, Scientiest-C, Dr. Atin Kumar Mandal, Assistant Professor, Dr. Nripendranath Mandal, Associate Professor, Dr. Subrata Majumdar, Professor, Dr. Anup Kumar Misra, Associate Professor, Dr. Mahadeb Pal, Associate Professor, Dr. Gaurisankar Sa, Professor, Dr. Parimal C. Sen, Senior Professor and Head, Dr. Parames Ch. Sil, Professor, Dr.

Students : Pallab Ray (Upto 14.01.2011), Santanu Biswas, Pinki Nandi, Gaurav Gupta, Swatilekha Ghosh, (From 01.02.2011), Argha Adhikari, Abhijit Sarkar (From 23.09.2010), Parna Bhattacharya (from 01.06.2010), Kirti Kajal (From 23.09.2010), Argha Manna (From 20.12.2010), Nikhil Baban Ghate (From 01.12.2010), Supriya Chakraborty (From 24.09.2010), Joyita Hazra (From 20.09.2010), Joydeep Roy (From 20.09.2010), Manjari Kundu (From 21.09.2010), Dr. Anamika Bose (From 08.03.2011) (CSIR SRA, Pool Officer), Anandita Roy (From 01.04.2010), Swatilekha Ghosh (upto 31.01.2011), Prasenjit Manna (Upto 31.10.2010), Suchismita Mohanty, Rajib Panchadhayee (Upto 08.03.2011), Parna Bhattacharya (Upto 31.05.2010), Anupam Adhikari (From 01.12.2010), Bibhabasu Hazra, Joydeep Das-I (from 01.02.10), Jyotirmoy Ghosh (from 01.02.2011), Joydeep Das, Saikat Majumdar (From 01.10.2010), Dewan M.S. Hossain, Shravanti Mukherjee (From 01.08.2010), Gautam Guchhait, Saikat Majumdar (Upto 30.09.2010), Gautam Guchhait, Abhishek Santra, Anupam Adhikari (upto 30.11.2010), Shravati Mukherjee, Pabitra Bikas Pal, Sayantan Banerjee, Abhijit Sau, Poulami Khan (From 15.04.2010), Monoranjan Ghosh, Kuntal Halder, Shibali Das (From 16.09.2010), Shravanti Mukherjee (Upto 31.07.2010), Barun Mahata (From 08.02.2011), Samik Chakraborty, Samir Ghosh, Abir Kr. Panda, Amrita Bhattachajee (From 10.02.2011), Sreeparna Chakraborty (From 06.08.2010), Taniya Saha (From 20.09.2010), Deblina Guha (from 20.09.2010), Soumyadip Paul (From 24.01.2011), Shahana Mitra (From 03.01.2011), Somanjana Khatua (From 03.05.2010 to 30.12.2010), Bidisha Paul Chowdhury (23.11.2010), Bibhabasu Hazra (upto 31.12.09), Surav Dutta, Subhajit Mandal (From

23.08.2010 to 30.09.2010), Usri Chakraborty (From 23.08.2010), Ajoy Mallik (From 25.11.2010), Shilpi Saha (Upto 08.07.2010), Shilpi Saha (From 09.07.2010), Pushpak Bhattacharjee (From 11.05.2010 to 30.06.2010), Argha Manna (Upto 19.12.2010), Sourav Mandal (from 31.8.2010) Sukhendu Dolui (Upto 07.06.2010), Pushpak Bhattacharjee (From 01.07.2010), Dr. Minakshi Mazumdar, Santanu Kar Mahapatra (From 01.12.2010), Dr. Amrita Dutta (Fom 01.07.2010), Samir Ghosh, Sankhadeep Pal

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

Division of Plant Biology

Faculty (Cent. Campus) : Dr. Debabrata Basu, Assoc. Professor, Dr. Shubho Chowdhuri, Asstt. Professor, Dr. Sampa Das, Sr. Professor & Head (from 01.03.2011), Dr. Pallob Kundu, Asstt. Professor , Dr. A.N. Lahiri Majumder, Sr. Professor & Head (till 28.2.2011), Dr. Amita Pal, Sr. Professor, Dr. S.R. Sikdar, Professor.

Faculty (Main Campus) : Dr. Sabita Bhattacharya, Professor, Dr. Gourab Gangopadhyay, Asstt. Professor , Dr. T.K. Ghose, Assoc. Professor , Dr. P. K. Saha, Sr. Professor, Dr. D.N. Sengupta, Sr. Professor, Dr. Swati Sen-Mandi, Sr. Professor, Dr. Swati Gupta-Bhattacharya, Professor

Students (Cent. Campus) : Dr. Saswati Sengupta, Dr. Sanjukta Dey, Dr. Sujoy Paul, Soumitra Maiti, Pijush Mullick, Dr. Sumanti Gupta, Rumdeep Kaur Grewal, Subhodipa Sengupta, Lekha Bandopadhyay, Subrata Kundu, Anirban Kundu, Anindita Sengupta, Suparna Ghosh, Arpita Bala, Amit Roy, Ayan Das, Anirban Jyoti Debnath, Sritama Mukherjee, Monia Chatterjee, Anirban Bhar, Dr. Rajeswari Mukherjee, Shiny Ch. Sangma, Niranjana Behura, Prithwi Ghosh, Ritesh Ghosh, Arunava Mondal, Gargi Biswas (Saha), Anindya Bhattacharya, Mrinmoy Majumder, Upala Saha, Deepti Sarkar, Jayanti Joddar, Dipan Roy, Aindrila Chatterjee, Adrita Roy, Souvik Dhar, Sourav Bhattacharya, Amit Paul, Niladri Shakhar Roy

Students (Main Campus) : Basabdatta Das (terminated on 18.01.11), Himadri Sekhar Chakraborty (terminated 18.01.11), Suranjana Sarkar, Supratim Basu, Boddhisattwa Saha, Puja Hor (resignation letter yet to be submitted), Ananda Sankar Sahu (resigned w.e.f. 12.03.2010), Kavita Ghosal, Saptadwipa Sanyal, Bipasha Roy, Gourab Sircar, Dr. Sangita Dey, Dr. Harshata Pal, Subhobrata Ghosh, Shekhar Ghosh, Debmalya Dasgupta, Debabrata Paul (resignation letter yet to be submitted), Priyanka Chakraborty, Shreyasi Pal, Ranjana Prasad, Shealee Chakraborty (ressigned w.e.f. 22.11.2010), Sanjoy Kr. Singh (resigned w.e.f. 02.12.2010), Priyanka Paul, Dr. Yasmin Begam (terminated on 31.12.2010), Sakri Banerjee (resigned w.e.f. 08.06.2010), Sayantani Sihi

Staff members (Cent. Campus) : Puspita Mukherjee, Ashim Kumar Nath, Subal Basak, Motilal Singh, Arup Kumar Dey, Nadiram Kayal, Birendra Kumar Bari, Jayasish Ghosh, Uttam Das, Swarnava Das, Abhishek Mukherjee, Sri Dipak Roy Mondal, Binoy Krishna Modak, Soumya Shankha Biswas, Sashanka Sekhar Bera, Srabani Sen, Bapi Sen, Sudipta Basu

Staff members (Main Campus) : Dr. Ramit Poddar, Sukumar Majumder, Chanchal Chakraborty, Chaitali Roy, Jadab Kr. Ghosh, Kaberi Ghosh, Bipul Kr.Nag, Siddhartha Roy, Sarama Pradhan, Moumita Basu Roy.

Environmental Science Section

Faruity : Dr Abhijit Chatterjee, Faculty Fellow, Dr. Sibaji Raha, *Sr. Professor, Head & Director,*

Students : Chirantar Sarkar

Supporting Staff : Anandamay Adak, Saral Chandra Das, Bhaskar Roy, Miss Debolina Seal.

Falta Experimental Farm

Faculty: Dr. K.K. Mukherjee (Consultant and resource person), Dr. S.R. Sikdar (DPB), *Professor & Coordinator Rural Biotechnology Programme*

Supporting Staff: Mr. Sobhan Roy Chowdhury (Senior Technical Assistant on contract), Sk. Ansar Ali (Mali)

Microbiology Department

Faculty: Dr. Sujoy K. Dasgupta, *Professor*, Dr. Tapan K. Dutta, *Assoc. Professor*, Dr. Wriddhiman Ghosh, *Faculty Fellow*, Dr. Sibaji Raha, *Director & Chairman*

Students : Arnab Basu, Madhumita Roy (upto 31/08/10), Boudhyan Bandhopadhyay, Joyita Sarkar, Debajyoti Ghosal, Priyanka Bhowmick, Pratick Khara, Prithwiraj Kirtania, Piyali Pal Chowdhury, Soumita Dutta, Masrure Alam , Shreya Ghosh (from 23.08.10), Soumik Basu (from 01.11.10), Arindam Dutta (from 14.12.10), Prasenjit Pyne (from 03.01.11), Sourav Samaddar (03.01.11), Soniya Chatterjee (from 03.01.11), Joydeep Chakrabarty (from 11.03.11)

Supporting Staff: Biswanath De Sarkar, Provat K. Chattopadhyay, Saifullah Gazi, Debashis Sarkar, Prabir Halder, Dilip Bhattacharyya, Ramesh Prasad, Robin Paul, Narayan Patali.

Physics Department

Faculty: Dr. Somshubhro Bandyopadhyay, (Physics/CAPSS), Asstt. Professor, Dr. Indrani Bose, Sr. Professor & Chairperson, Dr. Barun Kumar Chatterjee, Sr. Professor, Dr. Supriya Das, (Physics/CAPSS), Asstt. Professor, Dr. Sanjay Kumar Ghosh (Physics/CAPSS), Assoc. Professor, Dr. Dhruba Gupta, (Physics/CAPSS), Asstt. Professor, Dr. Dipankar Home (Physics/CAPSS), Sr. Professor, Dr. Amitabha Mitra, (Physics/CAPSS), Assoc. Professor, Dr. Sibaji Raha, Sr. Professor & Director, Dr. Rajarshi Ray, (Physics/CAPSS), Asstt. Professor, Dr. Swapan Kr. Saha, (Physics/CAPSS), Professor, Dr. Tripurari Prasad Sinha, Professor, Dr. Achintya Singha, Faculty Fellow.

Scientist/RA: Prof. Parthasarathy Ghose, Senior Scientist, Dr. Partha S. Joarder, Dr. Ajay Kumar Singh, Dr. Sandhya Dey (Mandal), Dr. Samita Saha, Dr. Purnendu Chakraborty, Dr. Rajesh Gopal, Dr. Alok Kr. Pan, Dr. Rupa Sarkar, Dr. Alo Dutta.

Student: Atanu Maulik, Prasanna Kumar Mandal, Anirban Lahiri, Sarbani Majumder, Amit Pal, S(I)RS, Sayantri Ghosh, Chandrahas Bharti, Goutam Manna, Soumitra Maity, Subhasis Samanta, Kinkar Saha, Rama Prasad Adak, Sujoy Saha, Sadhan Chanda, Dipanwita Majumder, Sayan Biswas, Sudipa Upadhyay, Rupamoy Bhattacharyya, Shyam Bihari Mehta, Avik Banerjee.

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

DRDO Project SMS: Dr. Ajay K. Datta, Scientist-E, Manabendra Maiti, Scientist-C, Soumendra Singh, Scientist-B, Vineet Surana, Scientist-B, Ayona Chakraborty, Scientist-B, Arun K. Dasgupta, Sarmistha Saha, Abhirup Biswas, Bikram Mahatha.

IRHPA Astrophysics: Sumana Das (Singh), Bhaskar Roy, Bivek Gurung, Sabyasachi Majee.

J. C. Bose Centre (Publication and Museum)

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

Supporting Staff : Tarun Kumar Maji, Chandra Kanta Sasmal

Library

Faculty : Dr. Arun Kumar Chakraborty, *Librarian*

Supporting Staff : Dr.(Mrs.) Rukmini Mitra, (Retd. on 31.12.2010), Kalipada Hait, (Retd. on 31.10.2010) Samir Kumar Pal, Pradip Kumar Sarkar, Dr. Banhisikha Chaudhuri, Gopa Dasgupta, Ananya Raha, Sumita Dey, Gautam Mukherjee, Sarat Chandra Bhuiyan, Mrityunjoy Jogsharma, Arun Kumar Nandi, Dinanath Das.

Workshop

Mr. A.K. Mukherjee, *Engineer B*

MAIN CAMPUS : Ashutosh Sarkar,Samar Dutta, Sisir Ghosal, Sk. Md. Ehia Hossain, Basanta Kr. Shit, Bholanath Saren, Abdul Rahaman Molla, Panchanan Santra, Panchugopal Karak, Sk. Md. Farruck, W.D. Rozario, Kalachand Sen, Rajkumar Das, Pranab Banerjee, Brahmdeo Prasad, Subrata Basak, Sanjoy Santra. Nageswar Das, Fullchand Sardar & kishan Das

NEW CAMPUS : Tapan Mondal, Ashit Bsnrejee, Md. Raffick, Murari Mohan Shee, Baidya Nath Murmu

Statement of Accounts for the year 2010-2011

M. Saha & Co.
Chartered Accountants

Office :
P-36, Radhabazar Street, 4th Floor,
Room No. 58, Kolkata-700 001
☎ : (O) (033) 2225-3615, 2455-1236
E-mail : msaha_co@yahoo.com

AUDITORS' 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, 2011 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 conducted our audit in accordance with auditing standards generally accepted in India. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statements presentation. We believe that our audit provides reasonable basis for our opinion.

2.0 On the basis of our audit as indicated in paragraph 1.0 above and subject to our Audit Observations (Annexure-I) 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.

iv. 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 in our Audit observations (Annexure I, Srl. No. 1) attached herewith.

v. 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 1to 18 enclosed thereto and subject to our comments in Audit Observations as stated above, give the information in the manner so required and give a true and fair view.

a. In the case of the Balance Sheet, of the state of affairs of the Institute , as at 31st March, 2011;

and

b. In case of the Income & Expenditure Account, of the surplus for the year ended on that date.

Place : Kolkata
Date : 17.10.2011

For **M.Saha & Co.**
Chartered Accountants

Sd/-
(DEBARSHI SAHA)
Partner
MEM.NO:061398
FRN:305135E

M. Saha & Co.
Chartered Accountants

Office :
P-36, Radhabazar Street, 4th Floor,
Room No. 58, Kolkata-700 001
☎ : (O) (033) 2225-3615, 2455-1236
E-mail : msaha_co@yahoo.com

ANNEXURE 1

AUDIT OBSERVATIONS

1. The Financial Statements of the reporting Institution have not been prepared in accordance with the prescribed Form for Central Autonomous Bodies (Non Profit Organizations and similar Institutions) in the following cases

   i) The management of the Institution has charged Rs. 9,59,54,598/- in its Revenue Accounts on account of Capital Expenditure made during the year which is in contrary to the prescribed Form. According to management contention the Grant received by the Institution does not contain any bifurcation for recurring and non-recurring expenses and hence the entire grant has been recognised as income and credited to Income and Expenditure Account and correspondingly the capital expenses met out of the grant money are claimed as expenses in the Income & Expenditure Account. This system of accounting has been followed by the management consistently over the years which in fact the generally accepted accounting principle.

   ii) Depreciation on fixed assets have been shown by way of netting off from Capital Fund instead of charging the same to Income and Expenditure account as mentioned in the prescribed Form. Depreciation for the year of Rs. 5,43,78,993.30 has been shown as deduction from Capital Fund. According to management contention, since Capital expenditure made out of grant money have been charged to Income and Expenditure Account, hence the depreciation has been shown by way of deduction from related fixed assets and correspondingly the same has been deducted from Capital Fund. This system of Accounting which is in accordance with the generally accepted accounting principles has been followed by the management over the years.

   iii) Statutory Liabilities have not been segregated between a) overdue and b) others as required by the Prescribed Form.

   iv) Serial no 7 of the Fixed Assets Schedule (Sch- 8) prescribed separate account for "Computer/Peripheral" which has not been done and purchases of Computers are shown under "Apparatus & Equipment".

   v) Segregation of Sundry Creditors between goods and others has not been made and the entire Sundry Creditors for both goods and others have been shown under "Sundry Creditors".

2. **Fixed Assets Register :**

   Fixed Assets Register was not made available to us for our verification. Assets purchased out of grants for different Projects were shown under the head "Projects" and not taken in total Fixed Assets Schedule on the plea that those Fixed Assets do not belong to the

Institute and will be accounted for only on termination of the Project. In the absence of Fixed Assets Register for the "Projects" those assets could not be identified. Physical Verification of the Fixed assets purchased during the year under audit have been only been made. Identification Marks were not found on the Fixed Assets. In the absence of proper physical verification, no provision for impairment of Fixed Assets could be made.

3. **Contingent Liabilities :**

In the absence of relevant papers and lawyer's opinion on the suits filed by Kalipada Das (Case No: 274 of 2009) and Tarun Chakrabarty (MAT No: 1436 of 2008) the Contingent Liability could not be ascertained.

4. **Prior Period Adjustments:**

The following payments were made during the financial year under audit and have been debited to expense head on cash basis as the same were not provided for in last year's financial statements-

i) Arrear D.A. of Rs. 18,03,689/- for the months of January to March, 2010 as per office order dated 31.03.2010.

ii) Arrear 6th C.P.C. A/C of Rs. 7,05,619/- being arrear salary /D.A. for 30nos. staff vide officer order No 72/10 dated 02.02.2010, 03.03.2010 and 10.03.2010.

5. **Unascertained & Unpaid Statutory Liabilities:**

In cases of the following statutory liabilities out of the ledger balances as on 31st March 2011 some amounts still remain unpaid for which the management is yet to produce year-wise details-

Sl. No.	Nature of Liabilities	Balance as on 31.03.2011	Paid during the F.Y. 2011-12	Unpaid / Unascertained Balance
I	Party Income Tax Deducted at Source	2,37,164.00	2,03,840.00	33,324.00
II	Sales Tax	1,39,631.00	1,05,165.00	33,466.00
III	Profession Tax	6,135.00	1,370.00	4,765.00
IV	Labour Welfare Cess	3,08,100.00	0.00	3,08,100.00

The management is requested to ascertain the liabilities immediately and make payment of the same.

6. **Insurance on House Building Loan:**

Insurance covers of the building or flats purchased out of House Building Loans taken by staff were not available for verification.

7. **Pension & Provident Fund:**

No trust deed of the Bose Institute Pension Fund, Contributory Pension Fund and General Provident Fund were available for verification. There is no structured Investment Plan for the aforesaid Funds and investments have been kept with Banks Fixed Deposits.

8. **Import of Equipment in Progress:**

Out of total work in progress of Rs. 3,99,59,422.60 as on 31.03.2011 Rs. 1,37,69,690.60 involves import of equipment in progress. Again out of such Rs. 1,37,69,690.60:

a) Rs. 7,56,694.60 pertains to balance brought forward since last year for which no necessary details were produced. It is not ascertainable whether such Equipments have actually been received or not. Under these circumstances it is not possible for us to determine to what extent depreciation has been under provided.

b) Rs. 1,30,12,996/- was shown as addition in Import of Equipment in Progress for the year under audit for which the necessary details are enlisted below:

Name of the Supplier	Description of Equipment	Price in US Dollars	Price in Indian Currency (Rs)	L/C No.	L/C date	Date of actual receipt by Bose Institute
M/s Bruker Biospin International, Switzerland	Electronic Spectrometer	2,65,120	1,17,98,742	085211FLCS0016	22.03.11	18.07.11
Thermo Electron LED GmbH, Robert Bosch - Strasse 1, D63505, Langenselbold, Germany	Super-speed Refrigerated High Speed Centrifuge	27,000	12,14,254	085211FLC0015	17.03.2011	01.06.2011
TOTAL			1,30,12,996			

The expenditure in relation to the above equipments have been considered as expense for the current period under audit as the Letter of Credit in favour of the foreign supplier has already been opened within the year and the events occurring after the Balance Sheet date confirms the actual import. Moreover the same accounting policy is being followed by the reporting Institution consistently over the years.

9. **Advances:**

Out of total advances of Rs. 19,65,427/-, a sum of Rs 1,21,090/- was given to parties other than staff and which are being carried forward over the years. The management is advised to take necessary steps to adjust the same immediately.

10. **Unadjusted Earmarked Funds:**

Out of total Earmarked Funds of Rs. 30,63,91,949/- as on 31.03.2011, balances of Council Fund of Rs. 99,42,791.00/-, Other Funds Rs. 46,27,079.00/-, Development Fund of Rs. 8,56,05,296/- and Infrastructure Development Fund Rs. 63,30,000.00/- have been brought

forward from last year. The management is yet to produce the purpose of carrying forward such Fund balances without adjusting the same with expenses made.

11. **Gratuity:**

Gratuity has been accounted for on cash basis on actual payment which is in contrary to AS-15 issued by the Institute of Chartered Accountants of India. No approved Gratuity Fund has been set up and no provision for Gratuity has been made during the year under audit. In the absence of actuarial valuation the provision for Gratuity required for the year and the total liability as 31st March 2011 could not be ascertained.

12. **Unreconciled Bank Balances:**

A sum of Rs. 46,029.90 (Dr.) included in Loans, Advances and other assets of Rs. 54,63,563.04(Sch-7) and Rs. 6,04,388 (Cr.) included in Total other liabilities of Rs. 53,60,689.60 (Sch-3) have been shown under the head "Bank Suspense A/c" and " Bank suspense Project A/c" respectively which are pending for reconciliation.

For **M.Saha & Co.**
Chartered Accountants

Sd/-
(DEBARSHI SAHA)
Partner
MEM.NO:061398
FRN:305135E

Place:Kolkata
Date:17.10.2011

BOSE INSTITUTE
KOLKATA

BALANCE SHEET AS AT 31ST MARCH, 2011

(Amount in Rs.)

	Schedules	As At 31.03.2011	As At 31.03.2010
CAPITAL FUND AND LIABILITIES			
CAPITAL FUND	1	412,915,986.17	371,286,121.47
EARMARKED FUNDS	2	306,391,949.42	283,620,181.31
CURRENT LIABILITIES	3	415,150,505.94	91,892,254.02
TOTAL		**1,134,458,441.53**	**746,798,556.80**
ASSETS			
FIXED ASSETS	4	432,201,209.95	390,625,605.25
INVESTMENTS-FROM EARMARKED FUNDS	5	100,485,197.15	98,868,985.15
INVESTMENTS- OTHERS	6	168,377,394.24	147,689,932.13
CURRENT ASSETS, LOANS, ADVANCES ETC.	7	433,394,640.19	109,614,034.27
TOTAL		**1,134,458,441.53**	**746,798,556.80**
SIGNIFICANT ACCOUNTING POLICIES	17		
NOTES ON ACCOUNTS	18		

Place : Kolkata
Date : 17.10.2011

Signed in terms of our separate Report of even date.

For **M. Saha & Co.**
Chartered Accountants

Sd/-
(T.K.Ghorui)
Officer on Special Duty

Sd/-
(Prof. S.Raha)
Director

Sd/-
(Subir Sen)
Accounts Officer

Sd/-
DEBARSHI SAHA
PARTNER

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

Sd/-
(Umesh)
Accounts Officer

Sd/-
(A. Mukherjee)
Accountant

BOSE INSTITUTE
KOLKATA

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2011

(Amount in Rs.)

	Schedules	For the year ended 31.03.2011	For the year ended 31.03.2010
INCOME			
Income from Services	**9**	3,569,051.00	3,346,952.00
Grants	**10**	440,000,000.00	430,000,000.00
Interest Earned	**11**	5,318,240.79	5,028,697.29
Other Income	**12**	2,306,242.85	1,255,835.00
TOTAL (A)		**451,193,534.64**	**439,631,484.29**
EXPENDITURE			
Establishment Expenses	**13**	244,183,688.54	263,840,548.30
Other Administrative Expenses	**14**	55,312,357.40	39,008,573.94
Laboratory Expenses.	**15**	50,823,033.64	55,071,334.00
Fund for Capital Expenditure	**16**	95,954,598.00	89,014,289.05
TOTAL (B)		**446,273,677.58**	**446,934,745.29**
BALANCE (A-B) BEING SURPLUS/DEFICIT (-)		**4,919,857.06**	**-7,303,261.00**
CARRIED FORWARD FROM PREVIOUS YEAR: DEFICIT (-)		**-7,337,051.59**	**-33,790.59**
CARRIED TO CURRENT ASSETS PART-B UNDER THE HEAD BALANCE RECEIVABLE		**-2,417,194.53**	**-7,337,051.59**
SIGNIFICANT ACCOUNTING POLICES	**17**		
NOTES ON ACCOUNTS	**18**		

Place : Kolkata
Date : 17.10.2011

Signed in terms of our separate Report of even date.

For **M. Saha & Co.**
Chartered Accountants

Sd/-
(T.K.Ghorui)
Officer on Special Duty

Sd/-
(Prof.S.Raha)
Director

Sd/-
(Subir Sen)
Accounts Officer

Sd/-
DEBARSHI SAHA
PARTNER

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

Sd/-
(Umesh)
Accounts Officer

Sd/-
(A. Mukherjee)
Accountant

Bose Institute, Kolkata

Receipts & Payments Account for the year 2010-11

RECEIPTS					PAYMENTS				
Particulars	**Sch.**	**Council (Rs.)**	**Project (Rs)**	**Total (Rs.)**	**Particulars**	**Sch.**	**Council (Rs.)**	**Project (Rs)**	**Total (Rs.)**
To Opening Balance	1	13,633,595.85	22,100,621.61	35,734,217.46	By Other Administrative Expenses	2	55,312,357.40		55,312,357.40
" Interest Earned	9	5,318,240.79	-	5,318,240.79	" Establishment Expenses	3	244,183,688.54		244,183,688.54
" Other Income	10	2,306,242.85		2,306,242.85	" Laboratory Expenses	4	50,823,033.64		50,823,033.64
" Income from Services	11	3,569,051.00		3,569,051.00	" Fixed Asset and Work-in-Progress	5	82,941,602.00		82,941,602.00
" Sponsored Project Grant	12		110,697,616.00	110,697,616.00	" Grant Expenses	6		87,467,655.13	87,467,655.13
" Receipt of IRHPA Project	13	-	22,292,802.00	22,292,802.00	" Payments of IRHPA Project	7		23,462,083.00	23,462,083.00
" Advances	14	16,063,344.00		16,063,344.00	" Advances	8	15,583,815.00		15,583,815.00
Inter-unit Accounts					**Inter-unit Accounts**				
" Bose Institute			464,038,871.00	464,038,871.00	" Bose Institute			514,983,343.00	514,983,343.00
" Scheme		515,155,042.00		515,155,042.00	" Scheme		464,210,570.00		464,210,570.00
" IRHPA (Prof S.Raha)		5,600,000.00	17,000,000.00	22,600,000.00	" IRHPA (Prof S.Raha)		682,337.00	2,603,813.00	3,286,150.00
" Governing Body		10,000.00		10,000.00	" Governing Body		76,632.00		76,632.00
					" IRPHA (Dr.A. Lohia)			92,431.00	92,431.00
" Grant in Aid N/P Recurring		18,000,000.00		18,000,000.00					
" Grant in Aid Plan Recurring		422,000,000.00		422,000,000.00					
" FAIR Account			275,445,942.00	275,445,942.00	" FAIR Account		108,388.00	319,100.00	427,488.00
" FAIR FD			184,350,000.00	184,350,000.00	" Import of Equipment in Progress (WIP)		13,012,996.00		13,012,996.00
" RSIC			2,400,000.00	2,400,000.00					
" Accrued Grant			430,000.00	430,000.00					
" Stale Cheque			111,400.00	111,400.00					
" Bank Suspense			3,243,388.00	3,243,388.00	" Bank Suspense			3,189,000.00	3,189,000.00
" Party Income Tax		1,563,718.00		1,563,718.00	" Party Income Tax		1,899,823.00		1,899,823.00
" Income Tax		12,699,938.00		12,699,938.00	" Income Tax		12,761,176.00		12,761,176.00
" Service Tax		165,131.00		165,131.00	" Service Tax		222,100.00		222,100.00
" Professional Tax		641,275.00		641,275.00	" Professional Tax		652,020.00		652,020.00
" Sales Tax		919,706.00		919,706.00	" Sales Tax		1,188,491.00		1,188,491.00
" Labour Welfare		478,324.00		478,324.00	" Labour Welfare		519,187.00		519,187.00
" Earnest Money		460,610.00		460,610.00	" SecurityDeposit		317,230.79		317,230.79
" Security Deposit / Earnest Money		2,412,592.00		2,412,592.00	" SecurityDeposit / Earnest Money		3,536,006.00		3,536,006.00
" GPF Subscription		23,048,010.00		23,048,010.00	" GPF Subscription		23,403,217.00		23,403,217.00
" CPC New Pension Scheme		2,037,764.00		2,037,764.00	" CPC New Pension Scheme		1,078,259.00		1,078,259.00

Receipts & Payments Account for the year 2010-11

RECEIPTS					PAYMENTS				
Particulars	Sch.	Council (Rs.)	Project (Rs)	Total (Rs.)	Particulars	Sch.	Council (Rs.)	Project (Rs)	Total (Rs.)
"					" New Pension Scheme Subscription		959,505.00		959,505.00
" Group Insurance		202,242.25		202,242.25	" Group Insurance		156,192.50		156,192.50
" Co-Operative		15,325,501.00		15,325,501.00	" Co-operative		15,323,424.00		15,323,424.00
" HBL Fund		468,094.00		468,094.00	" Prepaid Insurance		9,390.00		9,390.00
"					" TDS on Interest		17,973.00		17,973.00
" Receivable from Institute Staff		900.00		900.00	" Payable to NPS (T-1)		19,757.16		19,757.16
" IASTA - 2010		251,942.00		251,942.00	" IASTA - 2010		35,408.00		35,408.00
" Payable to Institute Staff		51,930.00		51,930.00	" Payable to Institute Staff		54,447.00		54,447.00
" Liability		23,150,865.00	557,515.00	23,708,380.00	" Liability		18,281,468.00	760,979.00	19,042,447.00
" Payable to Party		200.00		200.00	" Receivable from party		19,900.00		19,900.00
" Laboratory Caution Money		40,000.00		40,000.00	" UK - IERI Prog IISC - Bangalore		8,446.00		8,446.00
" Library Caution Money		40,000.00		40,000.00	" Registration Fees		22,928.00		22,928.00
" Advance recovery from security staff		82,500.00		82,500.00	" Fair FD			459,407,096.00	459,407,096.00
" Marging Cum FD			27,024,310.00	27,024,310.00	" Marging Cum FD			25,906,022.00	25,906,022.00
" Payable to Pension Fund		1,436,058.00		1,436,058.00	" Closing Balance	1	79,711,048.71	11,500,943.48	91,211,992.19
TOTAL		**1,087,132,816.74**	**1,129,692,465.61**	**2,216,825,282.35**	**TOTAL**		**1,087,132,816.74**	**1,129,692,465.61**	**2,216,825,282.35**

Place : Kolkata
Date :

Signed in terms of our separate Report of even date.

Sd/-
(T.K.Ghorui)
Officer on Special Duty

Sd/-
(Prof. S.Raha)
Director

Sd/-
(Subir Sen)
Accounts Officer

For **M. Saha & Co.**
Chartered Accountants

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

Sd/-
(Umesh)
Accounts Officer

Sd/-
(A. Mukherjee)
Accountant

Sd/-
DEBARSHI SAHA
PARTNER

M. Saha & Co.
Chartered Accountants

Office :
P-36, Radhabazar Street, 4th Floor,
Room No.58, Kolkata-700 001
☎ : (O) (033) 2225-3615, 2455-1236
E-mail : msaha_co@yahoo.com

AUDITORS' REPORT

We have audited the attached Balance Sheet of Bose Institute, Governing Body, 93/1, Acharya Prafulla Chandra Road, Kolkata 700 009 as at 31st March, 2011 and also Income and Expenditure Account for the year ended on that date annexed thereto. These financial statements are the responsibility of the Bose Institute, Governing Body's Management. Our responsibility is to express an opinion on these financial statements based on our audit.

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

We observed that -

1. FIXED ASSETS

Fixed Assets Register showing full particulars including quantitative details and situations of Fixed Assets was not made available to us for our verification. Physical verification of Fixed Assets has not been conducted during the year under audit. According to last year's Auditor's Report Fixed Assets were not depreciated as per Accounting Policy. In our opinion as the Balance Sheet and Income and Expenditure Account and Receipts & Payments Account of the Governing Body are consolidated with the Financial Statements of the Bose Institute, hence the Accounting Policy of the Governing Body should be in consonance with that of the Bose Institute. In the absence of Fixed Assets Register, the year of origin of the Fixed Assets could not be determined and as a result how much depreciation over the years (including the year under audit) has not been provided for could be ascertained. We recommend that the management should immediately identify the Fixed Assets and take proper steps to value them as according to management information the Fixed Assets have been acquired for more than 10 years and the same have reached their scrap value.

2. INVESTMENTS

Investment Register showing details of Investments, interest received and/ or accrued, closing balance as on 31st March of every year, has not been maintained. Physical verification of the scripts has been made and a list of Term Deposit with State Bank of India, Calcutta Main Branch has been submitted for our verification. Further, the share certificates of 843 Nos 7.5%

preference shares of CESC Ltd. were not available for verification. Dividend on Preference Shares has not been accounted for.

3. ADVANCES

The detail list of Festival Advance Rs 9,300/- and Advance to staff Rs. 16,820/- were not available. While the Festival Advance of Rs. 10,000/- was adjusted during the year, Advance to staff has not been adjusted at all during the year under audit. In the absence of list of advances we are unable to ascertain the realisability of the advances

4. CASH IN HAND

The cash in hand balance as on 31st March 2011 of the Governing Body of Rs. 8,150.05 is same as the cash balance as on 31st March 2010 as per the last year audited Balance Sheet. No Cash transactions were noticed during the year under audit. The management of the Governing Body did neither produce any physical cash balance certificate nor we were able to physically verify the actual cash balance.

5. In our opinion and to the best of our information and according to the explanations given to us subject to the effect on financial statement of matters referred to in the preceding paragraph and the financial statements give a true and a fair view in conformity with the accounting principles generally accepted in India:

i) In the case of Balance Sheet, of the state of affairs of Bose Institute, Governing Body as at 31st March, 2011;

and

ii) In the case of Income and Expenditure Account, of the surplus of income over expenditure for the year ended on that date.

For **M. Saha & Co.**
Chartered Accountants

Sd/-
(DEBARSHI SAHA)
Partner
MEM.NO:061398
FRN:305135E

Place:Kolkata
Date:17.10.2011

BOSE INSTITUTE (GOVERNING BODY)
93/1, Acharya Prafulla Chandra Road, Kolkata - 700009

BALANCE SHEET AS AT 31st MARCH 2011

FUNDS & LIABILITIES	*Schedule No.*	*As on 31/03/2011 Rs.*	*As on 31/03/2010 Rs.*
CAPITAL FUND			
AS PER LAST ACCOUNT		2,317,833.36	2,317,833.36
ACHARYA JC BOSE CENTENARY FUND			
AS PER LAST ACCOUNT		1,599,768.40	1,599,768.40
SPECIAL FUND			
AS PER LAST ACCOUNT	6	3,027,310.96	3,027,310.96
DEPOSITS & OTHER LIABILITIES	5	1,120,273.66	1,045,801.66
TOTAL		**8,065,186.38**	**7,990,714.38**
PROPERTIES & ASSETS			
FIXED ASSETS			
AS PER LAST ACCOUNT	1	2,374,712.85	2,374,712.85
INVESTMENTS			
AS PER LAST ACCOUNT	2	3,776,367.73	3,776,367.73
RECEIVABLE &DEPOSITS			
AS PER LAST ACCOUNT	3	32,795.00	42,795.00
CASH & BANK BALANCES	4	779,207.37	640,475.37
INCOME & EXPENDITURE A/C			
EXCESS OF EXPENDITURE OVER INCOME		1,102,103.43	1,156,363.43
TOTAL		**8,065,186.38**	**7,990,714.38**

Place : Kolkata
Date : 17.10.2011

Signed in terms of our separate Report of even date.

For **M. Saha & Co.**
Chartered Accountants

Sd/-
(T.K.Ghorui)
Officer on Special Duty

Sd/-
(Prof. S.Raha)
Director

Sd/-
(Subir Sen)
Accounts Officer

Sd/-
DEBARSHI SAHA
PARTNER

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

Sd/-
(Umesh)
Accounts Officer

Sd/-
(A. Mukherjee)
Accountant

BOSE INSTITUTE (GOVERNING BODY)

93/1, Acharya Prafulla Chandra Road, Kolkata - 700009

Income & Expenditure Statement for the year ended 31st March 2011

Particulars		*Balance as at 31/03/2011 (Rs.)*	*Balance as at 31/03/2010 (Rs.)*
INCOME			
Interest on Term Deposit	137,884.00		93,455.00
Interest on Savings Bank	848.00	138,732.00	
Excess of expenditure over income			61,703.00
TOTAL		**138,732.00**	**155,158.00**
EXPENDITURE			
To Salary & Wages		71,200.00	141,600.00
"Printing & Stationary		–	837.00
"Accounting Charges		5,000.00	5,000.00
"Audit Fees		8,272.00	7,721.00
Excess of income over Expenditure for the year		54,260.00	
TOTAL		**138,732.00**	**155,158.00**
Income brought down and adjusted with last year		(54,260.00)	61,703.00
Balance brought down from last A/c		1,156,363.43	1,094,660.43
Balance taken to Balance Sheet		**1,102,103.43**	**1,156,363.43**

Place : Kolkata

Date : 17.10.2011

Signed in terms of our separate Report of even date.

For **M. Saha & Co.**
Chartered Accountants

Sd/-
DEBARSHI SAHA
PARTNER

Sd/-
(T.K.Ghorui)
Officer on Special Duty

Sd/-
(Prof. S.Raha)
Director

Sd/-
(Subir Sen)
Accounts Officer

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

Sd/-
(Umesh)
Accounts Officer

Sd/-
(A. Mukherjee)
Accountant

BOSE INSTITUTE

Regional Sophisticated Instrumentation Centre Managed by Bose Institute
93/1, Acharya Prafulla Chandra Road, Kolkata - 700009

Balance Sheet 31st March 2011

As at 31st March 2010	Fund and Liabilities	As at 31st March 2011	As at 31st March 2010	Assets and Properties	As at 31st March 2011
	CAPITAL FUND : GRANT-IN-AID			**FIXED ASSETS**	
44,003,794.93	Balance as per last	44,088,844.93	29,029,556.06	As per last Account	29,029,556.06
	Grant			**SPARES**	
85,050.00	Interest Earned	35,025.00	12,940,593.63	As per last Account	12,940,593.63
	BOSE INSTITUTE		332,211.20	**FURNITURE & AIR CONDITIONERS**	332,211.20
714,177.00	As per Last Account		0.00	As per last Account	
			2,494,661.04	**CURRENT ASSETS LOANS & ADVANCES**	
				Cash & Bank Balances	
				Cash in hand	680.00
				Cash with Scheduled Bank	
				Savings Bank A/c.	7,607.78
				(i) Union Bank (IEP Br.)	121,398.26
				(ii) Union Bank (Mnt. Br.)	129,686.04
				RECEIVABLE (BOSE INSTITUTE)	
				Front Council	2,400,000.00
				Less : Payable to Bose Institute	714,177.00 1,685,823.00
				(Last year's Balance)	
				SECURITY DEPOSIT	
			6,000.00	As per last Account	6,000.00
44,803,021.93		44,123,869.93	44,803,021.93		44,123,869.93

Sd/-
Accountant
Bose Institute

Sd/-
Audit & Finance Officer
Bose Institute

Sd/-
Accounts Officer
Bose Institute

Sd/-
Officer on Special Duty
Bose Institute

Sd/-
Director
Bose Institute

Sd/-
DEBARSHI SAHA
PARTNER

BOSE INSTITUTE

93/1, ACHARYA PRAFULLA CHANDRA ROAD
KOLKATA-700 009

COMPLIANCE REPORT OF THE INSTITUTE ON THE AUDIT OBSERVATIONS FINANCIAL YEAR 2010-11

Sl. No.	Audit Observations	Replies
1 (i)	The management of the Institution has charged Rs. 9,59,54,598/- in its Revenue Accounts on account of Capital Expenditure made during the year which is in contrary to the prescribed Form. According to management contention the Grant received by the Institution does not contain any bifurcation for recurring and non-recurring expenses and hence the entire grant has been recognised as income and credited to Income and Expenditure Account and correspondingly the capital expenses met out of the grant money are claimed as expenses in the Income & Expenditure Account. This system of accounting has been followed by the management consistently over the years which in fact the generally accepted accounting principle.	The observation is self explanatory. Bose Institute does not receive the Grant-in-Aid separately for capital and revenue expenditure and therefore procurement of all the items including capital expenses is debited to the income and expenditure account to ensure the comparability of Grant-in-Aid with the expenditure incurred there from.
(ii)	Depreciation on fixed assets have been shown by way of netting off from Capital Fund instead of charging the same to Income and Expenditure account as mentioned in the prescribed Form. Depreciation for the year of Rs. 5,43,78,993.30 has been shown as deduction from Capital Fund. According to management contention, since Capital expenditure made out of grant money have been charged to Income and Expenditure Account, hence the depreciation has been shown by way of deduction from related fixed assets and correspondingly the same has been deducted from Capital Fund. This system of Accounting which is in accordance with the generally accepted accounting principles has been followed by the management over the years.	The policy is being consistently followed year after year. Depreciation being non cash item and not taken in Income and Expenditure Account facilitates the comparison of Grant-in-Aid with the expenditure incurred there from.
(iii)	Statutory Liabilities have not been segregated between a) overdue and b) others as required by the Prescribed Form.	Noted for compliance during 2011-12 and will be segregated accordingly.
(iv)	Serial no 7 of the Fixed Assets Schedule (Sch- 8) prescribed separate account for "Computer/Peripheral" which has not been done and purchases of Computers are shown under "Apparatus & Equipment".	Noted for compliance during 2011-12 and will be segregated accordingly.
(v)	Segregation of Sundry Creditors between goods and others has not been made and the entire Sundry Creditors for both goods and others have been shown under "Sundry Creditors".	The entire Sundry Creditors is for the procurement of goods and services. However, attempts will be taken to bifurcate the Sundry Creditors during 2011-2012 as suggested.
2	**Fixed Assets Register :** Fixed Assets Register was not made available to us for our verification. Assets purchased out of grants for different Projects were shown under the head "Projects" and not taken in total Fixed Assets Schedule on the plea that those Fixed Assets do not belong to the Institute and will be accounted for only on termination of the Project. In the absence of Fixed Assets Register for the "Projects" those assets could not be identified. Physical Verification of the Fixed assets purchased during the year under audit have been only been made. Identification Marks were not found on the Fixed Assets. In the absence of proper physical verification, no provision for impairment of Fixed Assets could be made.	Fixed asset register is being updated.
3	**Contingent Liabilities :** In the absence of relevant papers and lawyer's opinion on the suits filed by Kalipada Das (Case No: 274 of 2009) and Tarun Chakrabarty (MAT No: 1436 of 2008) the Contingent Liability could not be ascertained.	Observation is self explanatory, hence no comment.
4	**Prior Period Adjustments:** The following payments were made during the financial year under audit and have been debited to expense head on cash basis as the same were not provided for in last year's financial statements- i) Arrear D.A. of Rs. 18,03,689/- for the months of January to March, 2010 as per office order dated 31.03.2010. Arrear 6th C.P.C. A/C of Rs. 7,05,619/- being arrear salary /D.A. for 30nos. staff vide officer order No 72/10 dated 02.02.2010, 03.03.2010 and 10.03.2010.	Bose Institute follows the hybrid accounting system. The expenditure of Salary is booked on Cash Basis. Hence, the arrears are not provided as liability in the books of accounts. Rather, it is booked on payment basis.
5	**Unascertained & Unpaid Statutory Liabilities:** In cases of the following statutory liabilities out of the ledger balances as on 31st March 2011 some amounts still remain unpaid for which the management is yet to produce year-wise details-	Exercise has been initiated to identify the unpaid amounts and deposit the same at the earliest.

Sl. No.	Nature of Liabilities	Balance as on 31.03.2011	Paid during the F.Y. 2011-12	Unpaid / Unascertained Balance
I	Party Income Tax Deducted at Source	2,37,164.00	2,03,840.00	33,324.00
II	Sales Tax	1,39,631.00	1,05,165.00	33,466.00
III	Profession Tax	6,135.00	1,370.00	4,765.00
IV	Labour Welfare Cess	3,08,100.00	0.00	3,08,100.00

6	**Insurance on House Building Loan:** Insurance covers of the building or flats purchased out of House Building Loans taken by staff were not available for verification.	The records are being updated to produce before the next audit.
7	**Pension & Provident Fund:** No trust deed of the Bose Institute Pension Fund, Contributory Pension Fund and General Provident Fund were available for verification. There is no structured Investment Plan for the aforesaid Funds and investments have been kept with Banks Fixed Deposits.	Institute has GPF, CPF and Pension Scheme based on CCS (Pension Rules 1972) and duly approved by the DST. Draft Trust Deed in respect of GPF for the employees prior to 01-01-2004 is under consideration of the appropriate authority for execution. In the absence of Trust, the fund is being invested in Fixed Deposits with Nationalised Banks and is earning sufficient interest to pay the interest on GPF and CPF.
8	**Import of Equipment in Progress:** Out of total work in progress of Rs. 3,99,59,422.60 as on 31.03.2011 Rs. 1,37,69,690.60 involves import of equipment in progress. Again out of such Rs. 1,37,69,690.60: a) Rs. 7,56,694.60 pertains to balance brought forward since last year for which no necessary details were produced. It is not ascertainable whether such Equipments have actually been received or not. Under these circumstances it is not possible for us to determine to what extent depreciation has been under provided. b) Rs.1,30,12,996/- was shown as addition in Import of Equipment in Progress for the year under audit for which the necessary details are enlisted below: The expenditure in relation to the above equipments have been considered as expense for the current period under audit as the Letter of Credit in favour of the foreign supplier has already been opened within the year and the events occurring after the Balance Sheet date confirms the actual import. Moreover the same accounting policy is being followed by the reporting Institution consistently over the years.	a) Administrative exercise has been initiated to identify the equipments for capitalization and will be ready for production before the next audit. b) The observation is self explanatory, hence no comment.

Name of the Supplier	Description of Equipment	Price in US Dollars	Price in Indian Currency (Rs)	L/C No.	L/C date	Date of actual receipt by Bose Institute
(i)M/s Bruker Biospin International, Switzerland	Electronic Spectro-meter	2,65,120	1,17,98,742	8521 1FLC S0016	22.03.11	8.07.11
(ii) Thermo Electron LED GmbH, Robert Bosch - Strasse 1, D63505, Langensel bold, Germany	Super-speed Refri-gerated High Speed Centrifuge	7,000	2,14,254	8521 1FLC 0015	7.03.11	1.06.11
TOTAL			1,30,12,996			

9	**Advances:** Out of total advances of Rs. 19,65,427/-, a sum of Rs 1,21,090/- was given to parties other than staff and which are being carried forward over the years. The management is advised to take necessary steps to adjust the same immediately.	Noted for compliance at the earliest and will be produced before the next audit.
10	**Unadjusted Earmarked Funds:** Out of total Earmarked Funds of Rs. 30,63,91,949/- as on 31.03.2011, balances of Council Fund of Rs. 99,42,791.00/-, Other Funds Rs. 46,27,079.00/-, Development Fund of Rs. 8,56,05,296/- and Infrastructure Development Fund Rs. 63,30,000.00/- have been brought forward from last year. The management is yet to produce the purpose of carrying forward such Fund balances without adjusting the same with expenses made.	All these funds have been created for specific purpose. Unless the expenditure is made for the purpose for which these have been created, it will be carried forward.
11	**Gratuity :** Gratuity has been accounted for on cash basis on actual payment which is in contrary to AS-15 issued by the Institute of Chartered Accountants of India. No approved Gratuity Fund has been set up and no provision for	Institute follows the policy of treating the expenditure on Gratuity on Cash Basis and is being followed consistently year after year.

	Gratuity has been made during the year under audit. In the absence of actuarial valuation the provision for Gratuity required for the year and the total liability as 31st March 2011 could not be ascertained.	
12	**Unreconciled Bank Balances :** A sum of Rs. 46,029.90 (Dr.) included in Loans, Advances and other assets of Rs. 54,63,563.04(Sch-7) and Rs. 6,04,388 (Cr.) included in Total other liabilities of Rs. 53,60,689.60 (Sch-3) have been shown under the head "Bank Suspense A/c" and " Bank suspense Project A/c" respectively which are pending for reconciliation.	The matter has been taken up with the bank to reconcile. As soon as it will be reconciled, the same will be given effect to.

Acharya Jagadis Chandra Bose Triennial Gold Medal Lecture 2011 was held on 3rd January, 2011. The prestigious lecture was delivered by **Prof. Sir Roger Penrose,** Emeritus Rouse Ball Professor of Mathematics, University of Oxford, Oxford, United Kingdom, entitled **"From Microwaves to Biology and Conscious Life"**.