Annual Report

2011-2012



BOSE INSTITUTE

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NOMINE ET AUCTORITATE SOCIETATIS SCIENTIARUM FENNICAE:

From the Director's Desk



It is my honour and privilege to present, on behalf of all my colleagues at Bose Institute, the Annual Report of Bose Institute for the year 2011-2012. This is a statutory requirement for all institutions like ours, who survive on people's money. Thus, the people have a right to know how we are serving their cause.

The Editorial Committee of Bose Institute Annual Report takes this task very seriously indeed. The attempt in this report has been to provide a readable account of our activities during the past year. The emphasis is on the word 'readable'; efforts have been made not to confuse the general reader with technical jargons which can be appreciated only by the specialist in the area. In some cases, that has not been entirely possible; our advance apologies for that. The full scientific and technical details of the work that we carry out are provided in our Technical Reports which we publish at regular intervals and are available for the expert colleagues through our website.

In the 95 years of our existence, Bose Institute has constantly been guided by the two principal objectives that our illustrious Founder, Acharya Jagadis Chandra Bose, outlined: the advancement of scientific knowledge and the widest possible diffusion of the knowledge to all sections of the society. Our services in creating new scientific knowledge at the international cutting-edge have steadily grown from strength to strength and this year was no exception. The Institute has recorded improvement in terms of all the parameters that are normally used to judge scientific organisations, be that the quality of research papers published, amount of extramural funding for sponsored research or the recognitions that our scientists, senior and junior alike, have won. During the period under review in this report, substantial progress has also been achieved in fulfilling the second objective – the dissemination of knowledge, both for the purpose of capacity building and through our outreach programmes. I congratulate all my colleagues who have taken up this task with great enthusiasm.

My gratitude to all the members of the Publications Committee of Bose Institute, which has served as the Editorial Committee for this report, for their sincere efforts in not only completing the task in a timely manner but also for ensuring an aesthetically pleasing production.

Sibaji Raha
Director

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 95 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:

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

II. Protein Structure, Function and Engineering :

Resolution of Protein structure is the key criteria to determine functional organization of a protein. Study on the structurefunction 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 :

One of the important focuses of the Division is to develop drug(s) against cancer based on the information obtainded about the mexchanism of intiation and/or propagation of cancer. Participants have taken initiatives in identifying and characterizing the active principles of biomolecules useful in pathophysiology. Development of novel peptides/ bio-molecules against specific disease(s) 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 Heady 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.

FROM ARCHIVE BI



Universis et Singulis,
in quacunque dignitate constitutis quorum haec nosse interest,
Senatus Inclitae Universitatis Aberdonensis,
S.I.D.S.

Noveritis nos eâ auctoritate quam summi ac potentissimi Principis Almae huic Universitati amplissimam indulsere Tabellarum praesentium Latorem, Eruditione Insignem,

Jagadim C. Bose, Equitem.

Ex Senatus Academici decreto, promovente Juris Facultatis Decano, omnibus quae dignitatis ratio aut Academiae consuetudo postulat, rite peractis Utriusque Juris tam Canonici quam Civilis Doctorem et Magistrum constituisse, creâsse, proclamâsse, renunciâsse. Nec non eidem potestatem fecisse docendi, legendi, scribendi, commentandi, omniaque id genus alia praestandi, quae hic aut alibi uspiam Juris Canonici et Civilis Doctoribus et Magistris concedi solent; Omnibusque honoribus, dignitatibus, et privilegiis ipsum affecisse et ornâsse, quibus affici et ornari solent qui ad illum dignitatis gradum ullibi terrarum legitimâ ratione evehuntur. Quod ut felix faustumque sit, Deum ter Opt. Max. comprecamur. In cuius rei fidem Tabellas hasce communi Universitatis Sigillo et Chirographis idoneis muniendas curavimus Aberdoniae Anno Salutis MCMXX die Mensis Martii vigesimo quarto

Georgius Adam Smith Eq. LL.D.
Jur. Cancellarius et Praefectus
A. Mackenzie Stuart
Juris Facultatis Decanus
Senatus Academici Secretarius

Management of the Institute

The Bose Institute is a grant-in-aid autonomous institution under the Department of Science and Technology (DST), Ministry of Science & Technology, Government of India. It has a Governing Body consisting of twelve members including the Director. The management of the Institute is vested in the Bose Institute Council 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. Mr. 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 and Technology, Government of India or his nominee
2. Director General, Council of Scientific and Industrial Research 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), West Bengal
6. Secretary, Higher Education (Nominee of the Govt. of West Bengal)
7. Municipal Commissioner, Representative of the Calcutta Municipal Corporation

8. Director, Bose Institute Ex-officio
9. Prof. S. S. Hasan, DST nominated Scientist from outside West Bengal
10. Prof. M. Udayakumar, DST nominated Scientist from outside West Bengal
11. Director, Indian Association for the Cultivation of Science, Kolkata - Permanent Invitee
12. Director, SN 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 West Bengal.
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.

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. A. Bhunia (*Biophysics*)
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. A. B. Datta (*Biochemistry*)
Dr. J. Mukhopadhyay (*Chemistry*)
Dr. S. Sau (*Biochemistry*)
Dr. P. C. Sil (*Molecular Medicine*)

III. Bioinformatics and Computational Biology :

Dr. P. Chakrabarti [*Biochemistry (Coordinator)*]
Dr. R. Chattopadhyay (*Biochemistry*)
Dr. T. C. Ghosh (*Bioinformatics Centre*)
Dr. G. Basu (*Biophysics*)
Dr. Tapan K. Dutta (*Microbiology*)
Dr. Debjani Roy (*Bioinformatics Centre*)

IV. Molecular Medicine :

Dr. P. C. Sen [*Molecular Medicine (Coordinator)*]
Dr. Kaushik Biswas (*Molecular Medicine*)
Dr. Tanya Das (*Molecular Medicine*)
Dr. Kuladip Jana (*Molecular Medicine*)
Dr. Mahadeb Pal (*Molecular Medicine*)
Dr. S. Majumder (*Molecular Medicine*)
Dr. Atin Mandal (*Molecular Medicine*)
Dr. N. N. Mandal (*Molecular Medicine*)
Dr. A. K. Misra (*Molecular Medicine*)
Dr. A. K. Ray (*Molecular Medicine*)
Dr. Gaurisankar Sa (*Molecular Medicine*)
Dr. P. C. Sil (*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. Gaurisankar Sa (*Molecular Medicine*)
Dr. S. Banik (*Chemistry*)
Dr. B. K. Chatterjee (*Physics*)
Dr. T. K. Ghose (*DPB*)
Dr. A. Lohia (*Biochemistry*)
Dr. A. K. Ray (*Molecular Medicine*)
Dr. Pratima Sinha (*Biochemistry*)

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

Dr. D. Home [*Physics & CAPSS (Coordinator)*]
Dr. Indrani Bose (*Physics*)
Dr. Manas Chakrabarty (*Chemistry*)
Dr. B. K. Chatterjee (*Physics*)
Dr. Sanjay K. Ghosh (*Physics& CAPSS*)
Dr. Amitabha Mitra (*Physics & CAPSS*)
Dr. Rajarshi Ray (*Physics & CAPSS*)
Dr. A. Singha (*Physics*)
Dr. S. S. Bandopadhyay (*Physics & CAPSS*)
Dr. Abhijit Chatterjee (*ESS & CAPSS*)
Dr. Pradip Das (*Chemistry*)
Dr. Dhruba Gupta (*Physics & CAPSS*)
Dr. S. Raha (*Physics & CAPSS*)
Dr. S. K. Saha (*Physics & CAPSS*)
Dr. T. P. Sinha (*Physics*)

Scientific Reports

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

Alternaria brassicicola mediated auxin repression in susceptible *Brassica juncea* : **Debabrata Basu**

Upregulation of the immediate effectors of auxin signaling in susceptible *Brassica juncea* compared to resistant *Sinapis alba* upon challenge with *Alternaria brassicicola* indicate auxin response is a determining factor for resistance. Overexpression of one novel Small Auxin Up RNA (SAUR) gene, identified as downregulated gene from *S. alba*, in *B. juncea* showed altered morphology, down regulation of auxin responsive genes (ARFs) and enhanced susceptibility against *A. brassicicola*. Study of interplay of hormones has established a unique combination of ABA and auxin responses for expression of resistance against this pathogen.

Analysis of *A. brassicicola* induced upstream element of *glucosyl hyrolase* genes : **Debabrata Basu**

The upstream region of a *glucosyl hyrolase*, family 3 (GH) gene has been cloned to understand the mechanism of resistance response in *Sinapis alba*. Subsequently, the promoter was deleted and fused with GUS gene in a plant expression vector. Expression analysis of GUS gene under the control of the GH promoter and its deletions in transgenic *B. juncea* plants and transient expression in *Nicotiana tabacum* confirmed presence of functional ABA, JA and SA responsive motifs. Comparison of the expression pattern of the GH promoter and its deletion constructs in susceptible *B. juncea* with its endogenous expression in resistant *S. alba* upon challenge with *A. brassicicola* indicate ABA and JA mediated response in resistant *S. alba* whereas SA response is dominated in susceptible *B. juncea*.

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

The transformed *Plumbago indica* clones survived ex vitro by 90% and grew normally. It was revealed from a study with twenty of such plants that stem of the well grown plants had short stature due to condensed internodes. Leaf lamina was enlarged showing significantly higher stomatal frequency and increased wax content on both surfaces in comparison to that of its wild relative. Roots of healthy plants were strong with wider girth.

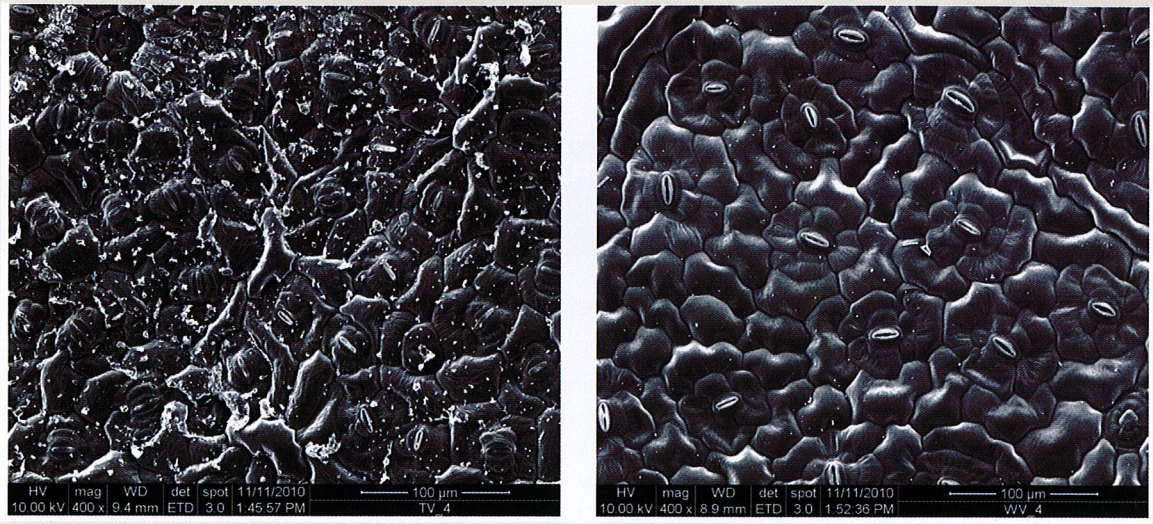


Fig 1. Scanning view of leaf surface of *Plumbago indica* (A) transformed, (B) non-transformed. Copious stomata and deposited wax (white spots and lumps) in (A) in comparison to (B)

Understanding the epigenetic regulation involved in the transcription of salt stress induced genes in rice : ***Dr. Shubho Chaudhuri***

Preliminary work has been initiated to understand the epigenetic regulation in the stress induced genes from Rice. In this project we have selected one of the important candidate in the abiotic stress signaling, DREB (Dehydration responsive element binding protein). It was seen that DREB proteins were differentially expressed in response to salt (DREB2) and cold stress signal (DREB1b). In order to study the transcription regulation of this locus in response to stress, we have first mapped the nucleosome positioning in the upstream and the coding region of DREB1b and DREB2. We have found that the upstream of DREB1b and DREB2 loci have four positioned nucleosome at the promoter and upstream regulatory region. Using ChIP analysis we have identified the changes in the epigenetic marks in the nucleosome of upstream and 5'genic region of DREB loci when the plant is subjected to salt or cold stress. We are at present in the process of understanding how chromatin arrangement changes in these loci to facilitate transcription of these stress responsive genes in plants. Using the same approach we are also analysing the epigenetic modifications involved in the promoter and upstream region of salt stress induced genes like OsINO1, OsBZ8 etc.

Investigating the role of ARID/HMG in modulation of chromatin structure in planta : ***Dr. Shubho Chaudhuri***

One of the key proteins responsible for causing structural changes in the chromatin is the high mobility group (HMG) proteins superfamily. They are the second most abundant family of chromosomal proteins after histones. Studies have shown that HMGs are needed for facilitating various DNA-dependent processes include gene transcription, replication, recombination and DNA repair. Plants have a novel class of HMG protein known as ARID/HMG

because of the presence of both AT-rich interaction domain and HMG box in a single polypeptide. It can be hypothesized that the presence of two DNA-binding motifs in ARID/HMG proteins can regulate transcription by either modulating chromatin accessibility or by acting as transcription activators. Till date very less biochemical and physiological information are available about plant ARID/HMGs. We have cloned two ARID/HMG group of protein (At1g55650 and At1g04880) from *Arabidopsis*. Electro mobility shift assay (EMSA) shows that ARID/HMG have lower affinity for linear DNA compared to classical HMGs. ARIDs show high affinity for the supercoiled plasmid DNA compared to linear DNA whereas classical HMGs show no DNA topology biased. Both HMGA and HMGB bind linear and supercoiled DNA with equal affinity. ARID/HMG can bend the DNA molecule (<200bp) with equal efficiency like classical HMGs and can form DNA mini-circles. Semi-quantitative RT-PCR shows that ARID/HMG genes were differentially induced when plants were exposed to different environmental stress signals. We are at present screening the homologous line of ARID/HMG genes. These homologous lines will be used to study the function of ARID/HMG genes in *planta*

Identification and Expression of insect/pathogen resistant gene(s)/ protein(s) with special emphasis on investigating their mode of action and addressing their biosafety aspects : ***Dr. Sampa Das***

An extensive transgenic plant development programme has been going on for last couple of years using Allium sativum leaf lectin (ASAL) to develop insect resistant plant types. Addressing the bio-safety aspect of ASAL, a detail analysis based on clinical tests on mammalian systems, pepsin resistance and thermostability assay was conducted which revealed that ASAL as a biologically safe molecule without having any apparent features of a potential allergen may be used for generating genetically engineered insect resistant plants (Mondal *et al* 2011).

Additionally, study was undertaken to investigate how the oligomeric conformational changes influence the functional alteration of an insecticidal lectin to antifungal protein (Banerjee *et al* 2011).

A Microarray based comparative transcriptomic profiling between susceptible and resistant genotypes of rice against bacterial blight has been accomplished at a very early stage of infection. Calcium and lipid signaling as well as MAP Kinase cascade were found to be modulated by signals from surface receptors and cytosolic R-proteins, to arouse jasmonic acid and ethylene signaling and suppress auxin signaling through various transcription factors. Adjustments in expression levels of components of primary as well as secondary metabolism, protein trafficking and turnout highlighted the complexity of defense response of rice against *Xanthomonas oryzae* (Grewal *et al* 2012).

Functional genomic and proteomic analyses are being undertaken for understanding defense mechanism of chickpea against wilt causing *Fusarium oxysporum* at molecular and cellular level.

Bose Institute, Library
Centenary Building

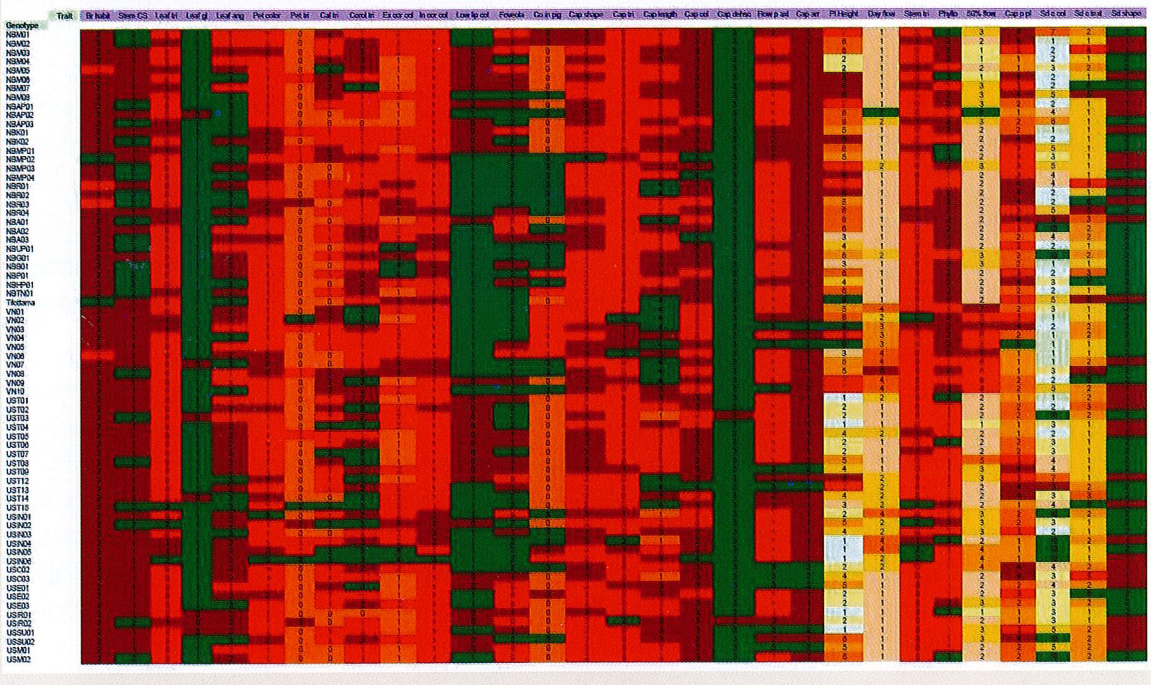
The key residues of Cry 1 Ac toxin involved in binding to the previously identified receptor proteins of *Helicoverpa armigera* were mutated .The real time binding analyses of the receptor with native as well as mutated toxins carried out through Surface Plasmon Resonance and other assays threw in sight to the mode of binding of the toxin-receptor complex which is indeed the essential prerequisite for insecticidal activity of the toxin.

Towards improvement of cultivated sesame varieties: ***Dr. Gaurab Gangopadhyay***

Sesame is a non-model crop; its genomic information is scanty. Unique genotype specific polymorphisms are being converted into SCAR (Sequence Characterized Amplified Region) markers. Co dominant SSR (Short Sequence Repeat) primers are also being worked out in the short listed genotypes and the allelic information obtained from these SSRs is to be utilized in future Marker Assisted Selection to detect the desired QTLs.

Genotyping of Mulberry varieties: ***Dr. Gaurab Gangopadhyay***

Mulberry (leaves of which are the only feed of silk worms) genotypes face serious challenge from the point of view of genotyping. Work has been initiated in collaboration with CSR&TI (Central Sericulture Research and Training Institute), Berhampore, WB, to characterize the genotypes developed at CSR&TI supplementing the morphological data with more discrete molecular information to strengthen the 'passport data'.



"Phenomic hit map" developed for assessing Sesame genotypes prior Marker Assisted Breeding programme for improvement of this oilseed crop (Published in **J Plant Breeding Crop Science, 2011,** 3 (13): 336-352 by Prasad and Gangopadhyay).

Understanding of molecular factors behind *in vitro* plant morphogenesis: ***Dr. Gaurab Gangopadhyay***

In vitro culture systems of some monocotyledonous and dicotyledonous plants have been established to look for the changing profiles of morphogenesis during developmental processes.

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

We are maintaining over 250 rice landraces in the field as an effort of conservation. Of these, 125 genotypes were selected for detailed characterization including DNA fingerprinting using 23 SSR markers along with requisite statistical analysis of DNA polymorphism data. A paper has been published on the SSR profiles. From this set, 22 rice genotypes were selected and the diversity was studied using 34 pairs of primers designed from 6 bacterial leaf blight resistance genes. Requisite statistical and phylogenetic analysis and DNA sequencing were done. A total of 61 sequences were submitted to, and given accession numbers by, the NCBI GenBank. The above work had been submitted by Basabdatta Das to Jadavpur University as her Ph. D. thesis on 5th June 2011. The follow up bioinformatics work and publication of the related data are now in progress.

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

Twenty microsatellite primer pairs were used assess the genetic diversity in 41 papaya genotypes. Requisite statistical analysis of the DNA profiles was done. A total of 134 SSR-derived DNA bands were sequenced, submitted to, and given accession numbers by, NCBI. PCR profiles have also been generated using 16 resistance gene analogue primer pairs. Statistical and phylogenetic analysis was done from the PCR profile and 24 RGA derived polymorphic DNA bands were sequenced, submitted to, and given accession numbers by NCBI. This work had been submitted by Samik Sengupta to Calcutta University as his Ph. D. thesis on 28th December 2011.

An endeavour towards understanding the host- pathogen interaction for bacterial leaf blight of rice : ***Dr. T. K. Ghose***

Bacterial leaf blight of rice, caused by *Xanthomonas oryzae* pv oryzae, is one of the most serious diseases of rice. It is prevalent in all the major rice growing areas of the world. Bacterial blight is reported to be responsible for reduction in annual rice production of Asia by as much as 60 percent. As strains in tropical areas are more virulent than that of temperate regions, India is more severely affected than Japan or China, putting the yield loss between 6 to 60 percent (IRRI). Intensive research has been done to develop resistant varieties and thirty genes have been successfully isolated which were reported to confer resistance against this disease. The Ph.D programme of Bipasha Roy is directed towards correlating the various alleles of the BLB resistant genes with disease phenotype.

DNA Sequences given accession numbers by NCBI

1. 61 rice DNA sequences from 6 bacterial leaf blight resistant genes.
2. 134 papaya SSR sequences from 41 different papaya genotypes.
3. 24 papaya DNA sequences from 16 resistant gene analogs.

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

Rhizopus oryzae & coconut pollen grains are common source of aeroallergens and their allergic potential was studied primarily by SPT and ELISA. Several immunoreactive zones have beeen identified in IgE specific immunoblots using sera of allergic pateints. 2D-gel was prepared and the 2D-blot was confronted with pooled sera. MALDI-TOF-TOF analysis of the IgE reactive spots were done and the major 45 KDa allergen of *Rhizopus* has been identified as Eukaryotic aspartyl endopeptidase. For coconut pollen the major 19 kDa allergenic spot was identified and its MALDI Tof analysis is in progress. Glycoprotein staining and Periodate modification confirmed that both the proteins to be glycoprotein but the glycan moiety is not antigenic determinant. Side by side the biomonitoring of allergic aerosol is being done in a suburban city of Hooghly district where a good occurrence of allergic patients were reported during health survey of over 500 people.

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

miRNAs are regulators of gene expression and important in plant stress response. We have found that certain miRNAs are differentially expressed during necrotrophic fungus *Alternaria* stress response in tomato. One of these miRNAs targets subtilisin like proteases in tomato and probably is a regulator of necrotroph induced cell-death. With an aim to understand the mechanism of stress-induced regulation of these miRNAs we have identified the transcription start site of their genes and subsequently the promoter-regulatory regions. Promoter activities will be confirmed in promoter-luciferase assays. Importance of stress related cis-acting W-boxes present in their promoter is under investigation. To find out the global changes in small RNA expression pattern during infection the sRNA transcriptome analysis using next generation sequencing technique is in progress.

Analysis of the role of the membrane bound transcription factors (MTFs) in transmission of stress signals **: *Dr. Pallob Kundu***

Tomato genome encodes more than 1000 transcription factor genes and it has been estimated that about 10% of these, representing all major groups (e.g. NAC, bZIP, MADS etc.), is membrane-associated. MTFs are released from membranes and mobilized into nucleus upon realization of stress. Our analysis with available tomato genome data indicated that there are at least five NAC-domain containing MTFs in tomato. Expression of these MTFs was differentially altered after infection of tomato plant with biotrophic and necrotrophic pathogens. Further characterization of these MTFs and their role in biotic-stress response are in progress.

Functional characterization of a serine-threonine protein kinase gene isolated from *Bambusa balcooa* : **Dr. Amita Pal and Dr. Shubho Chaudhuri**

The full length cDNA (3342bp) of BbKst, a serine-threonine protein kinase was isolated from *Bambusa balcooa* comprising of six LRR domains at N-terminal end and a kinase domain at the C-terminal end. The genomic sequence shows the presence of a1107 bp long promoter-like region at the upstream region and three exons at the coding region. Bacteria-expressed BbKst-kinase domain showed Mg^{2+} dependent kianse activity at pH 7.0. Bioinformatics study followed by phospho-amino analysis further confirmed that BbKst-kinase belongs to serine/threonine protein kinase family. Transcript analysis of the *BbKst* gene following RNA slot blot hybridization and qPCR revealed higher expression of *BbKst* during initiation and elongation stages of fiber development. Tissue specific expression studies showed much higher expression of *BbKst* transcript in stems and internodes of *B. balcooa* than in leaves and rhizomes. Ectopic expressions of *BbKst* under control of 35S promoter in transgenic tobacco resulted in high cellulose deposition in the xylem fibers. Vascular zone was much extended in transgenic plants offering enhanced mechanical strength to the transgenic plants, which was also substantiated by their strong upright phenotypes.

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

Different accessions were selected from 72 Sesame accessions by phenotypic studies for RAPD and ISSR analysis. Fourteen RAPD primers of OPA and OPM series among 48 primers screened from OPA, OPB and OPM series resulted diversity.

Twelve out of 17 ISSR primers showed highly polymorphic banding patterns. The results of cluster analysis depicted that all the 18 accessions could be well distinguished by RAPD and ISSR markers separately. Finally, *the combined dendrogram of* RAPD and ISSR analyses *showed* two main clusters. Cluster I containing *S. indicum* and Cluster II containing *S. mulayanum* accessions. These data collectively demonstrated large phenotypic and genotypic diversity among the selected genotypes that can be considered as a valuable gene pool for sesame breeding programmes.

Regulation of Gene Expression In Response To Abiotic Stress and During Fruit Ripening in Plants : **Dr. D. N. Sengupta**

For a long time we are interested on SAMdecarboxylase, a key enzyme in polyamine biosynthesis and OsBZ8 , bZIP class basic- leucine zipper type transcription factor, as they are involved in polyamine(polycation) biosynthesis and ABA or abiotic stress inducible transcription factor, respectively. By bioinformatic study two genes for each of them have been identified from rice genome. Therefore, by RT-PCR using the sequence specific oligonucleotides their cDNAs have been amplified, cloned and their expression have been studied.. Recently the cDNA for SAMdc2 have been cloned in plant expression vector and transformation of rice plants (IR64) have been started. By genomic PCR few plants with the 35S:SAMdc have been identified. Characterization in detail is going on and the construction of the vector with the cDNA for OsBZ8 has been started. Here, our goal is to enhance their

tolerance to water or salinity stress as because both of them are salinity stress or water stress inducible. In addition the presence of long lived transcripts of several ABA inducible genes within rice seeds were detected and comparison shows that salt tolerant cultivars have more of their transcripts than in salt sensitive rice cultivars.

Enzymatic activity of DNA polymerase λ protein (ddNTP sensitive but aphidicolin resistant) was found to be enhanced after NaCl treatment of the germinated rice seeds. Similarly in maize seeds after treatment with the DNA alkylating agent, MMS, the enhancement of DNA Pol λ was observed by activity gel analysis. Our goal is to clone the full length cDNA for DNA polymerase λ and to overexpress in rice to enhance the DNA repairing activities.

Work on fruit ripening in tomato and banana fruits were continued in relation to the presence of cis-acting elements e.g. light responsive elements and anaerobiosis , on the upstream of RIN gene. RIN is a MADS box transcription factor, known to induce the ethylene biosynthetic genes. Red light was found to trigger the ripening process before the blue light. The inhibitory effect on fruit ripening by anaerobic condition was found to inhibit or delay expression of many genes like RIN, ACS4, ACS2, etc.. To study the expression of lycopene biosynthesis, RT-PCR was done and it showed the enhancement of the expression of Phytoene desturase gene but down-regulation of Lycopene β-cyclase gene. The expression will be studied in more detail to identify the mechanism of the down-regulation of lycopene conversion to β-carotene.

Molecular documentation and Bioprospecting of Medicinal potential in Plant Diversity of Eastern and North Eastern India : ***Dr. Swati Sen-Mandi***

Acorus calamus L.

Acorus calamus landraces collected from Arunachal Pradesh, Sikkim and Assam i.e places at variable elevations (50-556 m) showed similarity in AFLP fingerprinting pattern thereby establishing Species Specific Markers.

Curcuma longa L.

AFLP analysis of three species of *Curcuma* have shown Species Specific AFLP fingerprinting pattern.

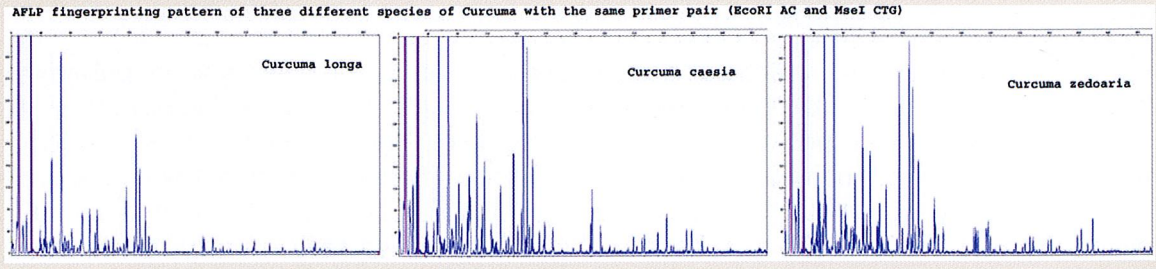


Fig 1

Curcumin II (demethoxycurcumin) the most effective among Curcuminoids in Cancer therapy, showed variation (by GC-MS analysis) in content among landraces collected from high altitude(viz. Sikkim 1411m) and from low altitude(viz. West Bengal 11m).

Digitalis purpurea L.

AFLP analysis of *Digitalis purpurea* collected from Meghalaya established similarity in DNA fingerprinting pattern among the landraces.

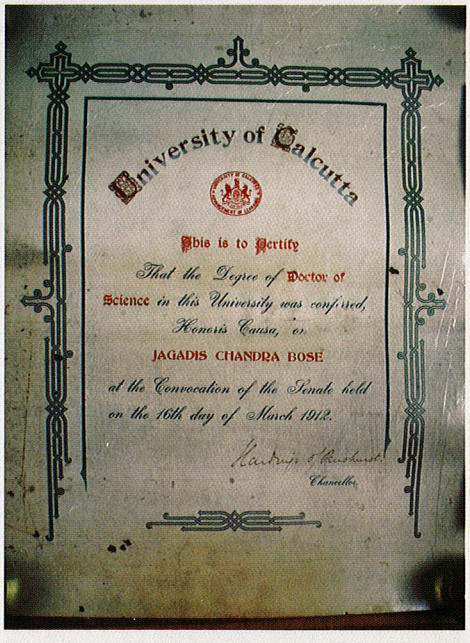
Analysis of the candidate defence response gene(s) for aphid resistance in wild crucifer : ***Dr. Samir R. Sikdar***

The aim of this study is to identify candidate defence response and/or resistance gene(s) against mustard aphid *Lipaphis erysimi* from the aphid tolerant/resistant wild crucifer *Rorippa indica*. *In silico* analysis of thirty transcript derived fragments differentially expressed on cDNA AFLP analysis of infested and uninfested *R. indica* samples with *Lipaphis erysimi* revealed that these candidates are involved with signalling, redox-regulation, photosynthesis, structural and metabolic functions. These candidates were subjected to time course real time relative expression analysis to understand the temporal pattern of regulation of gene expression on aphid challenge. The analysis so far points towards jasmonic acid mediated effective resistance response causing the *R. indica-L. erysimi* incompatibility.

Production and genetic stability study in second generation of hybrid mushroom strains : ***Dr. Samir R. Sikdar***

Second generation fruit bodies were produced from the mycelia derived through tissue culture of fruit bodies of six hybrid lines generated from each of the somatic hybridization programme between *Pleurotus florida* + *Lentinula edodes* and *P. florida* + *Lentinus squarrosulus*. RAPD and ISSR analysis revealed genetic stability in 80% of the second generation lines compared to first generation hybrid lines.

FROM ARCHIVE BI


University of Calcutta

This is to Certify

That the Degree of Doctor of Science in this University was conferred, Honoris Causa, on

JAGADIS CHANDRA BOSE

at the Convocation of the Senate held on the 16th day of March 1912.

Chancellor

II. Protein Structure, Function and Engineering

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

Several mutations were performed at the N-terminal catalytic domain and the C-terminal anticodon-binding domain of *E. coli* GluRS followed by activity and structural studies. The aim of this work is to desipher domain-domain communication in *E. coli* GluRS.

Crystal structure of *E. coli* GluRS : ***Dr. Gautam Basu***

We had earlier shown that a functional loop in *E. coli* GluRS in uniquely different than all available crystal structures of bacterial GluRS. To characterize this loop and to understand the functional role it plays, several variants of *E. coli* GluRS were expressed, purified and crystallization was attempted.

Molecular action of caffeine : ***Dr. Gautam Basu and Dr. Samir Pal, SNBNCBS***

In collaboration with Prof. Samir Pal of SNBNCBS, extensive NMR experiments were performed to decipher the mechanism of caffeine in arresting the action of mutagens. Two papers were published reporting our results.

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

We published our earlier findings on Pro-Pro-Xaa in J. Am. Chem. Soc. The work was extended on the peptide series Xaa-Pro-Aro and Xaa-Pro-Gly-Aro series of peptides using NMR spectroscopy.

Design, Synthesis and High Resolution Structure Determination of Peptides and Oligonucleotides Using Nuclear Magnetic Resonance (NMR) Spectroscopy : ***Dr. Anirban Bhunia***

(a) Main aim of my lab is to design new antimicrobial peptides which can significantly bind to the outer membrane of the gram negative bacteria and can penetrate through the bacterial membrane. This special kind of peptides not only ruptures the cell membrane but also alters the DNA folding which leads to stoppage of bacterial replication. Both mechanisms of action are different and a solid platform to generate new antibiotic library for the next generation drugs.

(b) We are also engaged to discover novel type of antifreeze proteins for the commercial and medical use.

(c) In biology, protein aggregation is a fatal event. Various types of diseases including neuronal disorders happen due to misfolding and aggregation of many important proteins. We have designed some short peptides, structured with a β-hairpin loop significantly binding to the amylodogenic states of proteins and helps to prolong their high mass aggregated states. The

research is under way and we hope to discover some interesting peptide analogs to stop protein aggregation.



ПОИСК Еженедельная газета научного сообщества №26 (1152). 1 июля 2011 г. 20

Многоликое глико

Россия и Индия сошлись на ниве углеводов

В Институте органической химии им. Н.Д.Зелинского РАН (ИОХ) прошел Российско-индийский симпозиум по гликонукам. В нем приняли участие ведущие специалисты, занимающиеся синтезом углеводов, изучением их структуры, биосинтеза и механизма участия в процессах клеточного распознавания, в том числе и определяющих развитие многих болезней.

Приставка "глико" обозначает принадлежность органического соединения к углеводам. Посвященная им область наук о жизни сегодня очень активно развивается именно в связи с тем, что она открывает новые возможности для создания эффективных лекарственных препаратов для борьбы с та кими заболеваниями, как рак, бактериальные, грибковые и другие инфекции, астма, диабет. Поэтому кроме таких терминов, как гликохимия, гликобиология, гликотехнология, гликонука, в международном научном лексиконе уверенно закрепился и термин "гликолекарство". Это, например, зарегистрированные в последние годы или находящиеся сейчас в конечной фазе клинических испытаний инновационные антикоагулянты, противогриппозное и антиметастатические средства, лекарство от астмы.

"Более 20 лет Россия и Индия реализуют долгосрочную программу научно-технического сотрудничества, рассказывает сопредседатель симпозиума с нашей стороны, заведующий лабораторией химии гликоконъюгатов ИОХ, профессор Николай Нифантьев. Некоторое время назад гликонуки были выбраны одними из приоритетных научных направлений этой программы. Задачами нашего симпозиума было не только обсуждение последних "гликодостижений", но и определение главных направлений двусторонних исследований и их участников. Эти работы будут сфокусированы на синтезе и иммунологических исследованиях углеводов клеточной стенки грибков, бактерий и паразитов, углеводных соединений, выделенных из морских животных и водорослей, а также на структурном анализе и изучении биологической активности растительных полиса харидов. Первые совместные результаты будут обсуждаться на следующем симпозиуме, который запланирован на конец 2012 года в Индии".

Обширная научная программа встречи в Москве включала доклады по самым разным направлениям гликонук и стала не только площадкой для общения маститых ученых из двух стран, но и школой для молодых. Они прослушали со общения о самых последних достижениях в области исследования углеводов.

Например, доклад директора Индийского института интегративной медицины Рама Вишакармы был посвящен синтезу и биохимии гликолипида – гликозилфосфатидилинозитола, являющегося якорным элементом многих гликопротеинов для их фиксации из клеточной мембраны. Заведующий лабораторией химии углеводов ИОХ Юрий Книрель рассказал о структуре и биосинтезе липополисахаридов бактерий. Заведующая лабораторией химической трансформации антибиотиков НИИ по изысканию новых антибиотиков РАМН Марина Преображенская показала взаимосвязь между структурой и противоопухолевой активностью аурео лиевых антибиотиков.

Директор индийского Центрального исследовательского института лекарств Тушар Чаработри в своем выступлении просуммировал результаты изучения нового класса бирдных соединений, содержащих углеводные фрагменты, в ряду которых найдены перспективные антимикробные препараты. О новых структурах и свойствах олигогликозидов, извлеченных из морских губок и плодовых, а также о результатах, полученных при изучении олиго- и полисахаридов морских микроорганизмов, рассказал директор Тихоокеанского института биоорганической химии ДВО РАН академик Валентин Стонин.

Большой интерес вызвал и пленарный доклад сотрудницы лаборатории гликоконъюгатов ИОХ Надежды Устюжаниной, посвященный итогам широких исследований, направленных на выяснение строения фармакофорных фрагментов полисахаридов фукоидов, выделенных из бурых водорослей и морских беспозвоночных. В результате этих работ, в которых кроме лаборатории Николая Нифантьева, Анатолия Усова и Александры Шашкова из ИОХ активно участвуют специалисты из ведущих зарубежных исследовательских центров, уже найдены и синтезированы весьма перспективные лекарственные соединения, показавшие высокую активность в экспериментах на животных.

Лекционная часть симпозиума длилась два дня до позднего вечера – так много было участников, представлявших самые разнообразные институты и регионы своих стран. Симпозиум проводился при поддержке грантов РАН, РФФИ и Министерства науки и технологии Индии, а также компании АКРУС, торгующей химической продукцией. Это позволило обойтись без ретстрационных взносов и расширило аудиторию форума, в том числе и молодежную ее часть. Молодые ученые активно участвовали и в стендовой сессии, которая была развернута в фойе рядом с конференц-залом ИОХ.

Учитывая, что в 2011 году по инициативе ЮНЕСКО во всем мире отмечается Международный год химии, в ходе симпозиума была проведена специальная сессия, посвященная химическому образованию в России и Индии. О подготовке научных кадров в Индийском институте науки, образования и исследования в Пуне рассказал сопредседатель симпозиума профессор Кришна Ганеш. Возглавляемый им институт необычен: это высшее учебное заведение, специально созданное для подготовки исследователей.

ИОХ, хоть и сугубо научная организация, но в нем тоже много делается для подготовки кадров. Ключевыми элементами созданной и широко известной теперь уже не только в России, но и в мире системы непрерывного химического образования являются Московский химический лицей (МХЛ) и Высший химический колледж РАН (ВХК), учащиеся которых имеют возможность работать в лабораториях ИОХ и других академических институтах уже со школьной скамьи.

Об истории создания и сегодняшних задачах системы подготовки научных кадров для химических академических институтов в своих выступлениях рассказали заведующий отделом химии нестабильных молекул и малых циклов ИОХ, председатель ВХК, академик Олег Нефедов, а также директор МХЛ и сотрудник ИОХ Сергей Семенов. А в завершение сессии студенты, работающие в лаборатории химии гликоконъюгатов и других лабораториях ИОХ, дали участникам симпозиума замечательный концерт, исполнив произведения российской и мировой классической музыки.

Каждый докладчик симпозиума получил портрет Марии Кюри и оригинальный памятный сувенир в виде небольшого глобуса на прозрачном кубическом пьедестале с лазерными надписями "Российско-индийский симпозиум по гликонукам", "2011 - Год химии". По замыслу организаторов симпозиума, сувенир символизирует широкое распространение химии на земном шаре и потребность в ней, как и в гликонуках, всего человечества.

Елена МОРУНОВА
Фото Николая СТЕПАНЕНКОВА

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■ научного сотрудника по специальности лазерная физика в отделе СПЯ ЦЕНИ ИОФ РАН - 1 вакансия;
■ младшего научного сотрудника (0,5 ставки) по специальности лазерная физика в отделе СПЯ ЦЕНИ ИОФ РАН - 1 вакансия;
■ научного сотрудника по специальности лазерная физика в отделе ЛФ ЦЕНИ ИОФ РАН - 1 вакансия;
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Телефон для справок: (499) 503-83-27.
С победителем конкурса будет заключен срочный контракт.
Срок подачи документов - 2 месяца со дня публикации.

"Indo-Russian conference on Glycoscience" symposium was held at Moscow from 13th of June-16th of June 2011, had been published in the following Russian Newspaper, **"Ioisk: weekly newspaper on scientific community "**. The main focus of the meeting was to tie the knot of India-Russia conjugative research on carbohydrate chemistry.

Cloning, expression, purification and structural studies on a toxin, Ace 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. 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. To determine whether purified Ace is biologically active, we measured Isc in T84 monolayers after apical addition of Ace to the Ussing chamber. Purified Ace alone did not alter Isc. However, it induced a dose-dependent increase in the Isc across T84 monolayers along with ATP stimulation.

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

For application in drug delivery and as nano-medicines, one needs to understand the nature of the interaction of nanoparticles with well-characterized proteins. In collaboration with Dr. SP Singh of NPL, Delhi we have synthesized ZnO nanoparticles and their surface-modified derivatives, as well as drug-capped gold nanoparticles. The ZnO nanoparticles have antibacterial and anti-tumor properties. These are very effective against multiple drug resistant bacteria. The thermodynamics of interaction, the effect on protein structures, biodistribution (binding site in bovine serum albumin) have been worked out for many of these nanoparticles. It has been shown that because of the difference in the surface properties, gold nanorods have deleterious effect on the structure of proteins, while nanoparticles are in general benign.

Design, synthesis of novel aptamers, peptides, small molecules that selectively bind telomeric and oncogenic G quadruplexes **: *Dr. Subhrangsu Chatterjee***

Focus of my research is to design new kinds of aptamers (LNA, BNA, ENA), antimicrobial peptides, small molecules which significantly bind to the telomeric and oncogenic G quadruplexes which are essential structures to be investigated and targeted to cause cancer cell death. We also want to investigate the role of POT1 protein and other transcription factors in controlling the telomerase activity. We employ high resolution NMR and other biophysical techniques to unravel molecular interactions.

Understanding misfolding and aggregation of proteins and peptides by high resolution NMR : ***Dr. Subhrangsu Chatterjee***

Protein and peptide aggregation can be very fatal and cause different kinds of neurodegenerative diseases. Our focus is to design and synthesize new kinds of peptides and small molecules which inhibit protein/peptide aggregation and misfolding.

pH- Dependent oligomerization and crystralization studies of a lectin from the Rhizomes of Turmeric (*Curcuma longa* L.) : ***Dr. Rajagopal Chattopadhyaya***

Curcuma longa lectin, a -methyl mannopyranoside/glucopyranoside-specific 60 KDa homo-tetrameric glycosylated lectin, was purified by aqueous extraction, 80% ammonium sulfate precipitation and ConA Sepharose affinity chromatography. Using circular dichroism and ?uorescence spectroscopy the unusual stability of the tetrameric protein seems to be due to a high degree of inter-subunit interactions, hence stability. The thermodynamic parameters for

the dissociation of *Curcuma longa* agglutinin tetramer to monomers have been measured. The monomeric species predominates at pH 2, is most highly populated at pH 1.9, and aggregates at lower values of pH as evident from size-exclusion chromatography and dynamic light scattering studies. Circular dichroism and ?uorescence spectroscopy analyses suggest that the monomer is well folded, and that it has certain characteristic features when compared to its tetrameric counterpart. In this study we are also trying to crystallize *Curcuma longa* lectin to get detail of its structural assembly.

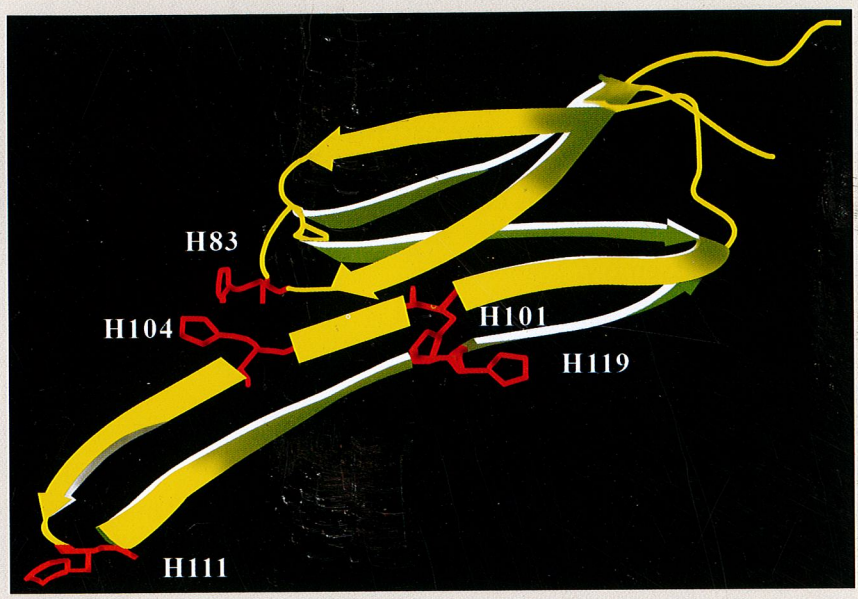
Influence of Plant Extracts on Fenton-reaction mediated DNA damage : ***Dr. Rajagopal Chattopadhyaya***

Though superoxide anion is relatively unreactive with DNA, it can produce H_2O_2, which could produce hydroxyl radical via the Fenton reaction : $Fe^{2+} + H_2O_2 + H^+ \rightarrow Fe^{3+} + OH^{\cdot} + H_2O$. This $OH^{\cdot}$ can attack DNA and other important biomolecules, playing a major role in the aging processes and a variety of diseases such as cancer [R. Chattopadhyaya & B. Goswami (2012) : Oxidative damage to DNA constituents by iron-mediated Fenton reactions: the deoxyadenosine family, *Journal of Biomolecular Structure and Dynamics*, doi:10.1080/07391102.2012.682206].

Indian plants selected are known for their medicinal uses in several diseases; Dr. N. Mandal's group studied them for their antioxidant properties. We have analyzed the effect of 70% methanolic extract of *Terminalia chebula, Terminalia belerica,* and *Emblica officinalis* fruits on damage to DNA components, quantitated using UV spectroscopy and reverse phase HPLC. We found that for all four deoxynucleosides, dAMP and dTMP, the plant extracts enchance the amount of Fenton-reaction mediated damage [I. Kar & R. Chattopadhyaya (2011) *Terminalia chebula* Extract Enhances Fenton-reaction Mediated Nucleoside Damage, Book of Abstracts: Albany 2011, Conversation 17, p1098]. We are also carrying out similar studies with various other DNA components and other plants.

Characterization of metal binding sites in α-crystallin : ***Dr. K. P. Das***

In order to understand the mechanism of stabilization of α-crystallin by some bivalent metal ions, the three histidine residues H79, H107 and H115 of αA-crystallin that bind Zn^{+2} were identified last year. We found out that in αB-crystallin H104, H111 and H119 bind to Zn^{+2}. In the aligned sequences of αA- and αB-crystallin, the sites H107 and H115 of αA-crystallin are equivalent to H111 and H119 of αB-crystallin. H107 and H115 of αA-crystallin are also binding site for Cu^{+2}, the third histidine linked to Cu^{+2} being H100. Thus H107 and H115 or H111 and H119 form common points in bivalent metal interactions in α-crystallin. It is interesting to note that all these histidine residues are located in a histidine rich region of the 'α-crystallin domain'. H111 in αB-crystallin is located at the loop region connecting two β-sheet region β5 and β6 and H119 reside along the β-sheet chain β7+ β7 (see diagram below). It is likely that the bivalent metal ions Zn^{+2} and Cu^{+2} join the β5- β7 strands in the central domain of the neighboring subunits to form the intersubunit bridge to stabilize the structure.



Bivalent metal biding region in αB-crystallin

Effect of TFE on the fibrillation properties of insulin : ***Dr. K. P. Das***

Insulin formed fibrillar aggregation at low pH and high temperature. In absence of TFE, soluble protofibrillar oligomeric intermediates were formed directly from the insulin trimer. The protofibrillar aggregates transformed into mature fibrils over time. We demonstrated that although TFE did not prevent the appearance of matured amyloid fibrils, it prevented the appearance of soluble aggregates of insulin. TFE converted the insulin trimer into monomers and fibril formation proceeded from the monomeric state in a cooperative way avoiding the soluble oligomeric phase. At 25% TFE, distinct morphological changes resulting in more discrete fibrils were visible.

Molecular basis of specificity of ubiquitination machinery in eukaryotes : ***Dr. Ajit Bikram Datta***

Ubiquitination, a post-translational modification of proteins in eukaryotes, serves regulatory role in diverse cellular processes including cell cycle, transcription and DNA repair apart from its well established role in protein degradation. Ubiquitination occurs via a three-step enzymatic cascade requiring the activating enzyme (E1), a conjugating enzyme (E2) and an ubiquitin ligase (E3) resulting in the covalent attachment of the C-terminal Gly of Ubiquitin to a specific lysine residue in the substrate protein. Ubiquitin E3 ligases "choose" the proper substrate for modification apart from dictating the correct topology of modification by their choice of the E2 partner. Though numerous E3s and their substrates have been identified the molecular basis of their specificity is far from being understood.

We have recently identified few such E3s for characterization and have been able to express and purify them for detailed characterization. These E3 ligases have also been tested for their activity in vitro along with different conjugating E2 enzymes and relevant substrate proteins. Work is now underway towards detailed biochemical and biophysical characterization of these E3s along with the ubiquitinated substrates.

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

We have developed a method to purify recombinant Mt RNAP holo enzyme. The methods involve co-expression of genes for α, β, β', and σ 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, σ genes.

We have developed a method to purify recombinant Bs RNAP core enzyme.

We have developed procedures that enable preparation of Bs 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 Bs σ^A and its single-cysteine derivatives. Single-cysteine derivates of σ^A are subsequently labeled with TMR dye for studying its interactions with RNAP and promoter DNA.

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

P22 C1 protein is a homotetramer that influences the lysis/lysogeny decision in phage P22. The 92-residue C1 protein is functionally very similar to λCII (97 residues). We have set up crystallization trials of purified C1, though diffraction-quality crystals are yet to be obtained.

Three point mutants of C1 (L70E, V74D and L78D) were prepared by site directed mutagenesis. These residues correspond to leucine zipper forming residues in λCII, and the same mutations destroy the four-helix bundle holding the subunits of λCII in a tetrameric organisation, thereby rendering λCII functionally inactive. Each of the C1 mutants failed to produce tetramers and showed a dimeric association of the subunits, though the L70E mutant did form a small percentage of tetramers while being predominantly dimeric. Each of these mutants were tested for activity by *in vitro* transcription. The L70E mutant activated transcription from the P22 P_{RE} promoter, while the other mutants failed to do so.

III. Bioinformatics and Computational Biology

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

Our earlier work on electrostatic control of subunit orientations in protein-protein complexes was continued, with newer insights.

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

MD simulations were performed on tubulin and unique properties of a functionally important loop, the T7 loop, were established.

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

By analyzing bacterial whole genomes we have established a role for tRNA isoacceptors. We have shown that $tRNA^{Glx}$ isoacceptors play an important role in functional evolution of bacterial glutamyl-tRNA synthetases. A manuscript is being written.

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. We have characterized the features of the interface formed between two ab dimers of hemoglobin that are involved in the allosteric transition associated with the binding of oxygen to the protein. In addition to the size, fraction of the polar atoms, the interfaces in the R and T states of hemoglobin also differ in the number of cavities present in them.

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.

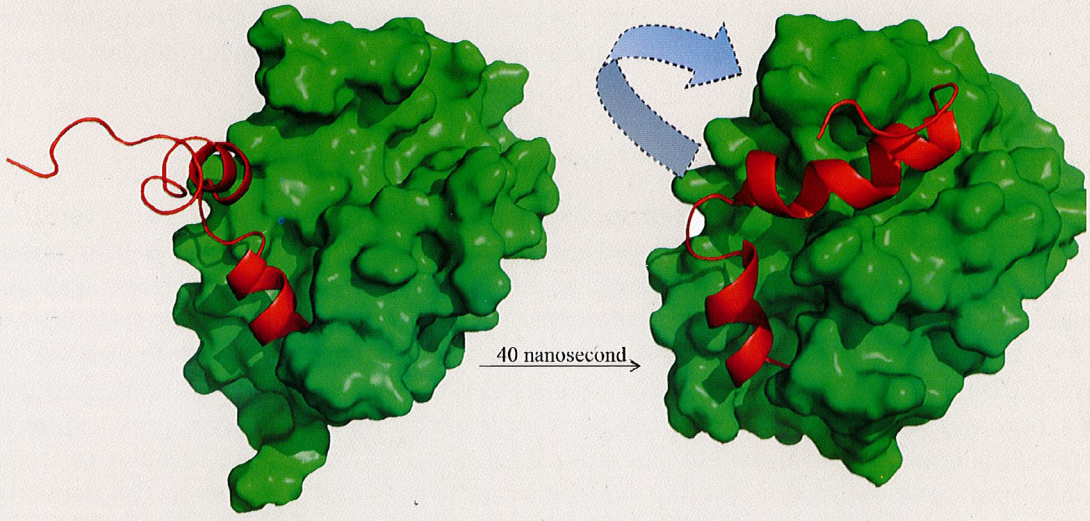
Evolutionary studies on bacterial ring-hydroxylating oxygenases : *Dr. Tapan K. Dutta*

Aromatic compounds in the environment exhibit enormous diversity both in terms of structure & chemistry. In accordance with the variation of substrates, bacterial catabolic potential of aromatic ring-hydroxylating oxygenases (RHOs) have also diversified in such a way so as to oxidize such wide range of compounds. Dealing with evolutionary studies on bacterial RHOs, we have previously elucidated the pathway leading to the evolution of RHOs towards a wide substrate-range from structural and functional analyses. These observations have further been extended towards understanding the role of selection pressure guiding evolution of nitroarene dioxygenase from naphthalene dioxygenases. In another study, the polycyclic

aromatic hydrocarbon (PAH)-dioxygenase from one of our bacterial isolates, *Sphingobium* sp. strain PNB, has been modeled *in silico* to gain structural insights into the substrate-access channel and active-site pocket responsible for broad substrate specificity of the enzyme.

Insight into Structural dynamics of biomolecules, leading to drug design *(Dr. Shubhra Ghosh Dastidar)*

The broader area of interest of our 'Structural Dynamics' group is to gain novel insight into the mechanism of functioning of biomolecules from computational modeling and simulations of their structures. The research projects aim for the fundamental understanding of the 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. For example, investigating the mechanism of conformational transitions (shown in figure) of Bcl2 family of proteins that control the apoptosis has been a primary objective. We use high performance computing (HPC) technology to perform our scientific investigations and work in a truly interdisciplinary manner with active collaborations with experimentalists.



Dynamics of the tail' of Bcl-xl to open and close its binding pocket

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 molecular evolution. 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 (2011-12) are as follows:

- Protein translation has been elucidated to be dictated by evolutionary constraints, namely, variations in tRNA availabilities and/or variations in codon-anticodon binding that is manifested in biased codon usage. We have performed a comprehensive analysis

of the diverse factors guiding translation leading to desired protein levels irrespective of the corresponding high or low mRNA levels. It has been elucidated that different combinations of most abundant/ non abundant tRNA isoacceptors are selected for in *S. cerevisiae* that helps in achieving the optimum speed and accuracy in the protein translation process. This is also accompanied by the strategic location of codon pairs in coherence to mRNA secondary structure folding stability.

- We resolved a fundamental question, why severe mutations often do not result in a detectable abnormal phenotype with the conception of functional buffering by means of gene duplication. Higher backup capacity of non-disease gene duplicates shields themselves from deleterious mutation while lower backup capacity of disease duplicates persuade disease incidence. Moreover, reduced buffering capacity of polygenic disease compared to monogenic disease observed in our study also can explain the higher incidence of polygenic disease e.g. diabetes, heart disease etc than monogenic disease like cystic fibrosis, hemophilia etc. Analyzing immunological genes we also showed that mutation accumulation at gene level (genetic rearrangement through copy number variation, single nucleotide polymorphism, recombination) /m-RNA level (single nucleotide polymorphism at alternative splice site) /protein level (intrinsic disorder, post translation modification) to switch over from functional immunological genes to malfunctioned immunological genes including autoimmune disease gene.

Regulatory RNA and stem cell biology : ***Dr. Zhumur Ghosh***

Our work has been focused towards dissecting the interwoven character of pluripotency and tumorigenicity of stem cell and its derivatives which is acting as the main barrier towards using them for safer regenerative therapy. The result of such investigation will also lead us to understand the key hubs which are responsible for the generation of cancer stem cells. We carried out a detailed transcriptional analysis of the different stem cell derivatives and corresponding human primary cells that have been previously reported. We compared these transcriptomes with different cancer cell lines to delineate the tumorigenic gene expression patterns still remaining within these differentiated derivatives. Our analysis reveals that there is a significant gene expression overlap between cancer cells and these stem cell-derivatives which substantiate their oncogenic potential. Further our work on the effect of miRNA target SNPs in Alzheimer's disease shows a novel regulatory aspect which helps in disease progression. I have also been involved with collaborative works on different projects within the Institute as well as with Stanford University School of medicine, USA.

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

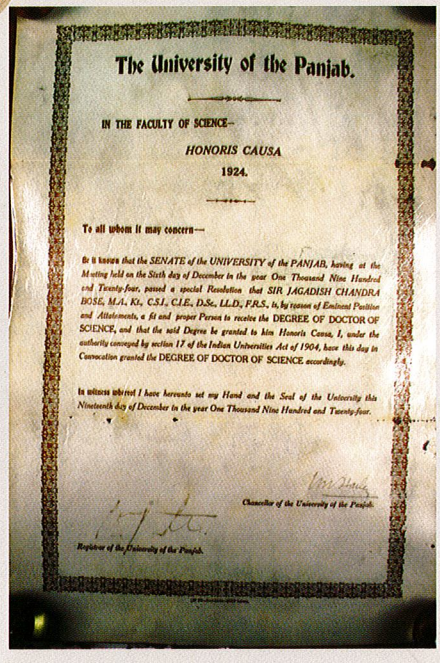
Parkinson's disease (PD) is second most common neurodegenerative disorder after Alzheimer's disease, affecting almost 4 million people worldwide. Therefore, the urgency to understand cause and pathogenesis as well as to develop better therapeutics for this disease is paramount. We used systems biology approach based on weighted gene co-expression

network analysis to determine transcriptional network in PD. We identified distinct modules, each of which represented a biological process perturbed in PD. Our findings reveal that PD genes and other disease related genes namely psychological and metabolic disorder are co-expressed and may be co-regulated. Our study further provides the opportunity to identify the biological pathways that may co-occur with each other in different disease conditions.

Type II Antifreeze Proteins: A Comparative Molecular Dynamics Simulation Study : ***Dr. Debjani Roy***

Comparative molecular dynamics simulations of Ca^{++} dependent psychrophilic type II antifreeze protein (AFP) from herring (*Clupea harengus*) (hAFP) and Ca^{++} independent type II antifreeze protein from long snout poacher (*Brachyopsis rostratus*) (lpAFP) have been performed. We have tried to investigate whether the Ca^{++} dependent protein obtains any advantage in nature over the independent one. To this end the dynamic properties of these two proteins have been compared. At 298 and 373 K the flexibility of the Ca^{++} independent molecule is higher which indicates that Ca^{++} could contribute to stabilize the structure. The thermal unfolding pathways and the essential subspaces explored by two proteins have also been monitored. Our results may help in understanding the role of Ca^{++} for hAFP to express antifreeze activity. Furthermore our study may also help in elucidating the molecular basis of thermostabiltiy of two structurally similar proteins, which perform the same function in different manner, one in presence of Ca^{++}, and the other in absence of the same.

FROM ARCHIVE BI



The University of the Panjab.

IN THE FACULTY OF SCIENCE—

HONORIS CAUSA

1924.

To all whom it may concern—

Be it known that the SENATE of the UNIVERSITY of the PANJAB, having at the Meeting held on the Sixth day of December in the year One Thousand Nine Hundred and Twenty-four, passed a special Resolution that SIR JAGADISH CHANDRA BOSE, M.A., Kt., C.S.I., C.I.E., D.Sc., LL.D., F.R.S., in by reason of Eminent Position and Attainments, a fit and proper Person to receive the DEGREE OF DOCTOR OF SCIENCE, and that the said Degree be granted to him Honoris Causa, I, under the authority conveyed by section 17 of the Indian Universities Act of 1904, have this day in Convocation granted the DEGREE OF DOCTOR OF SCIENCE accordingly.

In witness whereof I have hereunto set my Hand and the Seal of the University this Nineteenth day of December in the year One Thousand Nine Hundred and Twenty-four.

Chancellor of the University of the Panjab.

Registrar of the University of the Panjab.

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 gangliosides in suppressing anti-tumor immunity in tumor bearing host, the role of gangliosides in regulating tumor growth and progression has not been studied with any great detail. Our project aims in defining the role of gangliosides in tumor cell motility, migration, invasiveness and metastatic potential. In order to address these questions, different human tumor cell lines, namely kidney cancer, liver cancer, lung carcinoma, brain tumor and breast cancer alongwith a normal kidney epithelial cell line (NKE) were successfully cultured and maintained in asceptic conditions using standard mammalian cell culture protocols for ganglioside profiling and subsequent studies. Expression profiling of the different cell lines were performed to look for expression of the enzyme GM2/GD2 synthase, a key enzyme involved in the biosynthesis of the ganglioside GM2, which may have a potential role in tumor cell migration, motility and invasiveness. RT-PCR analysis of the different tumor cell lines showed differential levels of GM2/GD2 synthase message, while immunofluorescent microscopic analysis exhibited significant levels of ganglioside GM2 in the cell lines SK-RC-26B, CCF52 and H1299 with very little or no GM2 expression in NKE, which will be used as a control cell line for future studies. siRNA transfection in the cell lines to transiently knockdown expression of GM2/GD2 synthase and hence GM2 expression has been successfully established and verified by RT-PCR and immunofluorescent microscopic staining. Experiments are currently underway to elucidate the functional role of GM2 in regulating growth, migration, motility and invasiveness in selected tumor cell lines.

Role of cancer stem cells in drug resistance: A molecular insight : ***Dr. Tanya Das***

Current anti-cancer therapies succeed at eliminating bulky disease but often fail to root out tumor reservoir that is the source of disease recurrence and metastasis. Growing evidence indicates that this resting cellular subpopulation with stem cell-like features, commonly referred to as cancer stem cells (CSCs), remains at low frequency among a heterogeneous tumor mass critical for tumor generation and maintenance. Our findings demonstrated that different cancer cell lines and primary human mammary carcinoma tissues, which were obtained from surgical biopsies with prior consent of patients, encompassed a small fraction of cells that exhibited characteristic 'stemness signature' and displayed self-renewal, tumorigenic and differentiation properties of cancer stem cells (CSCs). These cells also exhibited resistance to commonly practiced anti-cancer therapies. It was perceived that upon exposure to genotoxic drugs, percentage of CSCs gradually increased both in tumor explants and *in vitro* cancer cell lines. Our attempt to unveil the underlying molecular mechanism revealed that slow-cycling character and low reactive oxygen species (ROS) state of CSCs protected them from drug-induced apoptosis by synergistically inducing increased expression of the master regulator, NFκB. Augmented nuclear activity of NFκB then triggered IL-6-driven STAT-3

cascade, whereby NFêB/STAT-3 partnership stimulated self-renewal transcription factor, Oct-4, in one hand, and fueled ATP-driven ABC efflux pumps on the other. Our study for the first time not only delineates the molecular mechanisms that are adopted by the CSCs to evade genotoxic-drug-induced cell death but also identifies NF-κB as an attractive therapeutic tool for the successful eradication of 'root of all evils', CSCs.

Role of integrin dynamics and recycling during cancer cell adhesion and migration in 3-dimensional micro-environment : ***Dr. Tanya Das***

Cancer metastasis consists of a complex cascade of biological events, including adhesion, migration, and invasion, which finally allows tumor cells to escape from primary site and invade and proliferate at ectopic environments. The ability to block the migratory and invasive capacity of tumor cells offers a new approach to treating patients with malignant disease. Our study reveals that integrin $\alpha 5\beta 1$ is the most important molecule localized within the lipid raft micro-domain that aids in cancer cell adhesion to the matrix followed by migration in three dimensional (3D) micro-environment *in vivo*. Further exploration reveals that lateral mobility of integrin nanoclusters within lipid raft micro-domain maintains the adhesion and migration of cells in 3D. Treatment of cancer cells with lipid raft disrupting agent disrupts these clusters to scatter integrins within and outside the cell. Disruption of lipid rafts causes disorder in the integrin dynamics that inhibits cancer cells from proper adhesion and migration since the downstream signaling is also weighed down.

Targeting RET to induce medullary thyroid cancer cell apoptosis: An antagonistic interplay between PI3K/Akt and p38MAPK/caspase-8 pathways : ***Dr. Tanya Das***

Mutations in RET (REarranged during Transfection) receptor tyrosine, followed by the oncogenic activation of RET kinase is responsible for the development of medullary thyroid carcinoma (MTC) that responds poorly to conventional chemotherapy. Targeting RET, therefore, might be useful in tailoring surveillance of MTC patients. Here we showed that theaflavins, the bioactive components of black tea, successfully induced apoptosis in human MTC cell line, TT, by inversely modulating two molecular pathways: i) stalling PI3K/Akt/Bad pathway that resulted in mitochondrial transmembrane potential (MTP) loss, cytochrome-c release and activation of the executioner caspases-9 and -3, and ii) upholding p38MAPK/caspase-8/caspase-3 pathway *via* inhibition of Ras/Raf/ERK. Over-expression of either constitutively active myristoylated-Akt-cDNA (Myr-Akt-cDNA) or dominant-negative-caspase-8-cDNA (Dn-caspase-8-cDNA) partially blocked theaflavin-induced apoptosis, while co-transfection of Myr-Akt-cDNA and Dn-caspase-8-cDNA completely eradicated the effect of theaflavins thereby negating the possibility of existence of other pathways. A search for the upstream signaling revealed that theaflavin-induced disruption of lipid raft caused interference in anchorage of RET in lipid raft that in turn abridged its interactions with Ras and PI3K. In such anti-survival cellular micro-environment, pro-apoptotic signals were triggered to culminate into programmed death of MTC cell. These findings not only unveil a hitherto unexplained mechanism underlying theaflavin-induced medullary thyroid cancer cell death, but also validate RET as a promising and potential target for MTC therapy.

Unveiling the molecular mechanisms of tumor angiogenesis : ***Dr. Tanya Das***

Hypoxic regions are common in solid tumors and have an impact on tumor progression and on the therapeutic response. In order to survive in the hypoxic environment, tumor cells have developed a coordinated set of responses to increase their blood supply through angiogenesis. Development of anti-angiogenic therapy may therefore, be an effective approach toward regressing cancer. Among the most important pro-angiogenic determinants is vascular endothelial growth factor (VEGF) which is triggered on by hypoxia, targeting which appears to be potential remedy for cancer management. An in depth analysis revealed that hypoxia-mediated VEGF up-regulation at both mRNA and protein levels in mammary epithelial carcinoma cells can be regulated by adopting a bi-faceted approach, i.e., (a) p53-dependent HIF-1 degradation and (b) SMAR1-dependent decrease in the nuclear localization and transcriptional aptitude of HIF-1 due to suppression of pro-angiogenic factor Cox-2. Further study established a feed-back loop between p53 and SMAR1 in down-modulating the angiogenic potency of HIF-1. These findings provide an intricate model of a control measure of tumor angiogenesis that involves SMAR1-p53-Cox-2-HIF1α interplay regulating VEGF expression in cancer cells. Such development in understanding may offer the panorama of exclusively targeting pro-angiogenic factors and pathways to achieve more efficient and cogent cancer therapy.

Molecular signalling involved in Benzo(a)pyrene, an natural aryl hydrocarbon receptor (AhR) ligand induced alteration in testicular steroidogenesis and steroidogenic acute regulatory gene(StAR) expression : ***Dr. Kuladip Jana;*** *in collaboration with* ***Dr. Parimal C. Sen,*** Div. of Molecular Medicine

Polycyclic aromatic hydrocarbons (PAHs) are widespread environmental and occupational contaminants formed by the incomplete combustion of organic material. Epidemiological studies carried out in occupational settings have shown that exposure to these chemicals may lead to serious diseases such as lung cancer. Among the carcinogenic PAHs, benzo[*a*]pyrene (B[*a*]P) found in significant amounts in diesel exhaust, cigarette smoke, charcoal-broiled foods, and industrial waste by-products. Although B[*a*]P released into the environment but it can be accumulated in human tissues to toxic levels within a short time, and the causal relationship between exposure to this agent and potential reproductive problems in humans remains uncertain. However, little attention has been given to the effect that chemicals have on steroidogenesis in Leydig cells, even though this may directly affect sperm production and quality. However, the precise cellular and biochemical mechanism(s) by which B[*a*]P affects steroidogenesis in Leydig cells has not yet been identified. In the rat testis, LH binds to Leydig cell receptors and initiates the activation of adenylate cyclase, resulting in an attendant increase in cAMP production. Steroidogenic acute regulatory protein (StAR) transfers cholesterol from the outer membrane to the inner mitochondrial membrane, where the enzyme cytochrome P450 side chain cleavage (P450scc) resides. P450scc converts cholesterol into pregnenolone, which is ultimately transferred to smooth endoplasmic reticulum, where the synthesis of testosterone takes place via the actions of 3β-hydroxysteroid dehydrogenase (3β-HSD), 17α-hydroxy/C_{17-20}–lyase (P450c17; CYP17A1), and 17β-hydroxysteroid

dehydrogenase (17β-HSD). We hypothesized that long-term exposure to low concentrations of B[*a*]P might disrupt testosterone production by Leydig cells via the alteration of steroidogenic proteins or enzymes, such as StAR, P450scc, and 3β-HSD. To test this hypothesis, we examined the expressions of these proteins in relationship to testosterone production in Leydig cells and evaluated spermatogenesis and alteration of sperm occurring in the testis and epididymis.

Effect of Resveratrol on the Wnt/ β- catenin signalling in cervical cancer cell line (Hela) : ***Dr. Kuladip Jana,*** *in collaboration with* ***Prof. Sanghamitra Raha,*** *Crytallography & Molecular Biology Division, Saha Institute of Nuclear Physics, Kolkata*

Resveratrol, (trans – 3,4', 5 – trihydroxystilbene)is a phytoalexin which can cause apoptosis in HeLa, the human cervical cancer cell line, in a dose and time – dependent manner. When working with an optimized dose of 60 μM, we have seen that it can decrease the levels of β – catenin , a major signalling protein of the Wnt pathway, in both the cytoplasm and the nucleus. Apoptosis was verified by a) flow cytometry (the sub - G_0 / G_1 population shifts considerably at ≥ 24 hours of Res. treatment) b) Annexin-V-FITC fluorescent microscopy to study the membrane PS (phosphatidyl serine) externalization [with 7-amino actinomycin D (7- AAD) as viability dye] ; and c) TUNEL assay. The TUNEL positivity was observed from ≥ 24 hours of Res Treatment. We expect to provide further insights about the mode of cell death in HeLa cells after Res. exposure. 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. A level 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.

Molecular cues to hyperhomocysteinemia mediated recurrent pregnancy loss in Polycystic Ovarian Syndrome (PCOS) : ***Dr. Kuladip Jana,*** *in collaboration with* ***Prof. Baidyanath Chakravorty,*** *Institute of Reproductive Medicine, Kolkata*

Infertility and pregnancy loss can be physically and emotionally taxing for couples, especially when faced with repeated losses. Its greatest impact is in developing countries, where it accounts for 20–80% of the strikingly increased maternal mortality. Animal models that reflect these conditions are crucial to furthering our understanding of the etiological relationship between symptoms of the metabolic syndrome and the development of cardiovascular disease and type 2-diabetes in Polycystic Ovarian Syndrome (PCOS). This is of particular relevance given the emerging public health concern of the rise in incidence of obesity, the pre-diabetic metabolic syndrome, and Polycystic Ovary Syndrome (PCOS) in adolescent girls and women. All these un-clarified issues question the possible involvement of certain as yet unresolved factors in the pathogenesis of pregnancy loss in Polycystic Ovary Syndrome (PCOS). Hence, we are trying to identify the molecular cues to hyperhomocysteinemia mediated recurrent pregnancy loss on Polycystic Ovarian Syndrome (PCOS).

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/kg bwt. 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.

Understanding the mechanism of protein kinase quality control : ***Dr. Atin Kumar Mandal***

Protein quality control maintains homeostasis of proteins critical for cell survival. Disruption of the quality control system develops many pathophysiological conditions including cancer, cardiovascular disease and late onset neurodegenerative diseases. In an attempt to study protein kinase quality control we have developed yeast as a model system. Our aim is to understand the mechanism how molecular chaperones and ubiquitin ligases collaborate in kinase folding and degradation. We are characterizing the role of molecular chaperone Hsp70 in quality control of protein kinases, mainly how Hsp70 partitions between folding and triage decision. So far our data suggest that Hsp70 may not require for stability of kinase, but involve in degradation of protein kinase. Further studies defining the role of Hsp70 are underway. We have also initiated to study quality control mechanism of oncogenic protein kinase, Raf1. Our preliminary studies confirm that molecular chaperones Hsp90 and Cdc37 are essential for Raf1 folding and stability. Ongoing works focused in understanding the role of chaperones in Raf1 maturation and activation.

Recent achievements from Marine Biotechnology research : ***Dr. Nripendranath Mandal***

Disease resistance in marine shrimp, *Penaeus monodon*:

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. Microsatellite DNA markers, which are highly variable and widely distributed in the genome, inherited in the Mendelian fashion and expressed codominantly, will be useful for this purposes. Very recently three more microsatellite DNA markers (739 bp, 299 bp and 262 bp) have been developed to distinguish between disease resistant and disease susceptible population of shrimp, *P. monodon*. All these DNA markers are highly statistically significance.

Challenge experiment is also performed in shrimp samples and WSSV propagation has been monitored both qualitative PCR as well as quantitative by real time PCR. Survivability after 72 hrs post WSSV challenge among the disease resistant shrimps is significantly ($P<0.004$) higher than the disease susceptible shrimps. After 72 hrs challenge experiment qualitative results suggested that WSSV is not propagated in most of the disease resistant shrimps whereas, WSSV is propagated in most of the disease susceptible shrimp. The quantitative analysis of WSSV propagation among both the populations suggest that the mean relative viral load is 50 fold higher in disease susceptible than that of disease resistant population.

Prevalence of WSSV and distribution of Disease Resistant *Penaeus monodon* in Natural and Cultured population:

Since WSSV is transmitted both vertically as well as horizontally and for developing disease free shrimp aquaculture, shrimp (*Penaeus monodon*) samples are screened for WSSV prevalence and disease resistant population using earlier developed two DNA markers, at four geographical locations in the east coast of India (Digha, Chilika, Visakhapatanam and Chennai). Total **443 individuals** of shrimp (*P. monodon*) samples have been collected from four geographically distant natural populations located in the east coast of India. Among these 92 individuals from Digha, West Bengal; 99 individuals from Chilika, Orissa; 156 individuals from Visakhapatanam, Andhra Pradesh and 96 individuals from Chennai, Tamil Nadu. Gill tissue, pleopod tissue and tail tissue are dissected from each individual shrimp samples and stored until used for either WSSV screening or genomic DNA preparation for screening of disease resistant shrimp. WSSV test is performed from gill tissue of each shrimp sample using the method supplied in the kit (Bangalore Genei Pvt. Ltd, Bangalore, India). The result suggests that the percentages of WSSV positive samples are **10.9%, 0.00%, 0.6%, 56.2%** among the natural populations from Digha, West Bengal; Chilika, Orissa; Visakhapatnam, Andhra Pradesh and Chennai, Tamil Nadu, respectively. It is also found that the distribution of disease resistant shrimp in the order of Chennai> Digha> Visakhapatanam> Chilika using 455 bp DNA marker and Chilika > Visakhapatanam > Chennai> Digha, using 71 bp microsatellite DNA marker. But, it is observed that distribution for the same was Chilika > Visakhapatanam > Digha > Chennai using both the DNA markers. Screening for WSSV prevalence and disease resistant population of shrimp among entire coastal area of India is also being carried out.

Shrimp samples are also screened for disease resistant population from 35 highly WSSV affected ponds from West Bengal and found that 32-35% of disease resistant shrimp is present using either single or both the DNA markers.

These informations will be very useful for the generation of disease resistant brood-stock for Marker Assisted Selection (MAS) of breeding program for shrimp hatcheries and then disease resistant post larvae can 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.

Brief achievements from Medical Biotechnology research : ***Dr. Nripendranath Mandal***

Development of biomarkers to predict Coronary Heart Disease (CHD):

Earlier it has been shown that serum TC, TG, LDL-c and apoB levels are significantly higher in CHD patient than in control, whereas the levels of HDL-c and apoA-I in CHD patients are significantly lower than in control. The genotype frequencies of ApoAI, ApoB and ApoE gene polymorphisms have been established for the first time in an Asian Indian population in the eastern part of India.

The results support the notion that a significant association of only E4 allele is observed with coronary heart disease (CHD) in addition to the other well known risk factors and this study shows that apo E3/E4 and apo E4/E4 genotypes are the prominent genetic predictors, for the development of CHD in Asian Indian population in Eastern part of India. On the other hand, the ApoAI -75G/A polymorphism is found to be significantly associated with ApoAI protein levels in this population but not +83C/T polymorphism. There is no statistically significant change in the ApoB protein among different genotypes of *ApoB EcoRI* polymorphism and also no significant difference is found in plasma levels of ApoE protein among the *ApoE HhaI* genotypes.

In conclusion, it has been developed novel five different biomarkers from biochemical and five from immunological parameters to predict CHD in Asian Indian population in Eastern part of India. It has also been completed studying of genetic parameters of three different apolipoprotein genes (*apoAI*, *apoB* and *apoE*) and three different cytokine genes (IL-6, TNF-α and IL-10) promoter polymorphism to predict CHD. It is found that only E4 allele and the promoter polymorphism of IL-6 and TNF-α are associated with CHD. These biomarkers will be useful to develop a biometric chip to identify predisposed risk of CHD among large number of populations within a short period.

Importance of medicinal plants to combat various human diseases:

Earlier various medicinal plant extracts have been characterized as sources of potential natural antioxidants. Among these, *Spondias pinnata* has been tested for active components using various solvent fractionation methods. All the fractions of *Spondias pinnata* are used to purify active compounds. Four purified compounds, SPE1, SPE2, SPE3 and SPE4 are obtained from ethyl acetate fraction. Two compounds are identified in water fraction but only one purified compound, SPW1, is isolated. The amount of chloroform extract is not sufficient to be used for the purification of active compounds, so, total chloroform fraction (SPCH) has been studied for antioxidant and anticancer activities. The antioxidant activity of all purified compounds have been evaluated by examining the scavenging activity for different free radicals such as DPPH,

hydroxyl, superoxide, nitric oxide, peroxynitrite and singlet oxygen, reducing power, iron chelating property and trolox equivalent antioxidant capacity (TEAC). Among them, SPE1 shows negligible activity and SPE3 is found most promising antioxidant whereas SPW1 is found most potent iron chelator. All compounds are also tested for their cytotoxic effect on normal spleenocytes and A549 cancer cell line. SPW1, SPCH and SPE2 show significant cytotoxicity for A549 cells, whereas, the others are not cytotoxic for both A549 and normal spleenocyte. Treatment with these three active compounds selectively have been induced apoptosis of cancerous A549 cell in a dose dependent manner and caused morphological changes in the treated cells included cell shrinkage, nuclear blebbing and DNA fragmentation.

It is also screening ten different medicinal plants extracts (70% methanolic crude) for their anticancer potential in the various cancer cell lines. All plant extracts are also tested for their cytotoxic effect on normal spleenocytes and A549 cancer cell line. It is found that only five plant extracts have significant cytotoxicity for A549 cells, whereas the others are not cytotoxic for both A549 and normal spleenocytes. The same five plant extracts selectively have been induced apoptosis of cancerous A549 cell in a dose dependent manner and caused morphological changes in the treated cells included cell shrinkage, nuclear blebbing and DNA fragmentation.

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

(a) Our laboratory 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 and other research institutes (SINP, NICED, CDRI).

(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 with the synthetic glycoconjugates are ongoing.

Understanding molecular mechanism of action of human heat shock factor 1 (HSF1) in human cancer cells : ***Dr. Mahadeb Pal***

Many tumor cells become addicted to elevated levels of inducible heat shock proteins such as Hsp70 and Hsp90 that are known to act as chaperones to promote protein folding in cells under variety of stress conditions. The inducible heat shock genes are transcriptionally activated by HSF1. Although HSF1 is considered a good drug target, precise mechanism of induction of HSF1 function has to be resolved to understand the specificity of HSF1 inhibition. An aim in the lab is to understand upstream and downstream regulators of HSF1 activated under different cellular stress conditions using proteomic and molecular genetic approaches.

Understanding role of promoter poised RNA polymerase II in gene regulation in human cancer cells : ***Dr. Mahadeb Pal***

It has now been understood that under normal condition the majority of cellular stress-induced genes including the targets of the products of various onco-genes and tumor suppressor genes carry promoter paused but transcriptionally engaged RNA polymerase II (pol II) which is rapidly released into elongation mode soon after an activation signal is encountered. Thus the release of promoter paused pol II into elongation mode not the recruitment of pol II to a promoter as originally thought is a limiting step in stress-induced gene expression. We are interested to understand critical determinants of promoter proximal RNA pol II pausing and release on stress induced genes.

Novel gain-of-function for transcription factor FoxP3 as co-transcription factor of **STAT3** in T-regulatory cells : ***Dr. Gaurisankar Sa***

FoxP3, a lineage-specification factor required for $T_{\text{-regulatory}}$ (T_{reg}) cell differentiation and function, executes its multiple activities mostly through transcriptional regulation of its target genes. The molecular bases underlying the phenotypic and functional diversity of Foxp3+ Treg cells remain obscure. Our study identifies an IL-10-producing $FoxP3^{+}$ T_{reg} cell population that contributes to IL-10-dependent type-2 cytokine bias in breast cancer patients. Although FoxP3 knock-out inhibits *il10* transcription in these cells, genome-wide analysis rules out its role as a transcription factor for *il10*. An in-depth analysis reveals that FoxP3, in association with HAT1, docks on STAT3 to epigenetically modify *il10* promoter through histone acetylation thereby inducing transcription. Such activity of FoxP3 is extended to other STAT3 *target genes, e.g., il6, vegf, c-myc, bclxl, ccnd1,* that lack FoxP3-binding site. These results suggest a 'conditional' gain-of-function of FoxP3, even in absence of mutation, where failing to achieve direct promoter-occupancy, FoxP3 promotes transcription in association with a locus-specific transcription factor, STAT3, in T_{reg} cells.

MEK/ERK perturbation channelizes oncogenic Ras-induced proliferative-signaling towards apoptotic-signaling : ***Dr. Gaurisankar Sa***

Though active-mutant or oncogenic Ras is primarily attested with potent transforming ability, the Ras proto-oncogene, in addition to its mitotic potential, has an additional apoptogenic activity although the mechanism as to how oncogenic transformation promotes apoptosis is not well elucidated. Here we report that while in mitogen-stimulated wild-type *Ras*-expressing cells perturbation of Raf/MEK/ERK pathway resists apoptosis, intervention of this proliferative pathway sensitizes active-mutant *Ras*-expressing cells by channelizing oncogenic Ras-signal towards p38MAPK/JNK1 pro-death circuitry. This apoptogenic signal ensures phosphorylation of p53 at Ser^{33}/Ser^{46} and Thr^{81}, respectively, for optimal activation of this tumor suppressor protein. Cumulatively, our findings delineated the hitherto unexplained but critical mechanisms underlying the role of oncogenic Ras as a signal-switch-molecule that oscillates between survival and apoptogenic cascades thereby deciding the fate of oncogenic Ras-expressed cells. Since uncontrolled *ras* activation is probably the most common genetic defect

in human cancer cells, these findings describing a novel and specific approach towards tumor regression through differential regulation of different MAP kinase family members down-stream of oncogenic Ras, may be critical and of potential therapeutic significance.

Elucidation of the involvement of p14, a sperm protein during maturation, capacitation and acrosome reaction of caprine spermatozoa : ***Dr. Parimal C. Sen***

Mammalian sperm capacitation is an essential prerequisite to fertilization. Although progress is being made in understanding the physiology and biochemistry of capacitation, little has been yet explored about the potential role(s) of individual sperm cell protein during this process. Therefore elucidation of the role of different sperm proteins in the process of capacitation might be of great importance to understand the process of fertilization. The present work describes the partial characterization of a 14-kDa protein (p14) detected in goat spermatozoa using an antibody directed against the purified protein. Confocal microscopic analysis reveals that the protein is present in both the intracellular and extracellular regions of the acrosomal and postacrosomal portion of caudal sperm head. Though subcellular localization shows that p14 is mainly cytosolic, however it is also seen to be present in peripheral plasma membrane and soluble part of acrosome. Immuno-localization experiment shows change in the distribution pattern of this protein upon induction of capacitation in sperm cells. Increased immunolabeling in the anterior head region of live spermatozoa is also observed when these cells are incubated under capacitating conditions, whereas most sperm cells challenged with the calcium ionophore, A23187 to acrosome react, lose their labeling almost completely. Intracellular distribution of p14 also changes significantly during acrosome reaction. Interestingly, on the other hand the antibody raised against this 14-kDa sperm protein enhances the forward motility of caprine sperm cells. Rose-Bengal staining method shows that this anti-p14 antibody also decreases the number of acrosome reacted cells if incubated with capacitated sperm cells before induction of acrosome reaction. All these results taken together clearly indicate that p14 is intimately involved and plays a critical role in the acrosomal membrane fusion event.

Arylsulphatase and ultrastructural changes in different organs of rat during streptozotocin induced diabetes and the effect of polyunsaturated fatty acids : ***Dr. Parimal C. Sen***

Immuno-cross reactivity of both P70 and commercial arylsulphatase from abalone entrails when probed against rabbit anti-P70 shows sensitivity, the former with higher sensitivity. The expression of arylsulphatase activity associated with P70 is found to be increased in the cytosolic fraction of different organs of rat during streptozotocin induced diabetes. However, following 5-6 weeks of polyunsaturated fatty acid or PUFA (DHA and EPA enriched) treatment, the activity returns to almost normal level. In case of diabetic rat, mean body weight is found to be decreased compared to control animals. Body weight is found to be regained after several weeks of PUFA treatment. Western blot analysis of the cytosolic fraction of rat brain, liver and kidney shows strong intensity against anti-P70 antibody with higher intensity

observed in diabetic rat organs which returns close to the normal level on PUFA treatment. Scanning electron microscopic study shows external morphological change of different organs during diabetes, which however recovers significantly nearing to normal shape on PUFA treatment. Histological studies of rat organs also reveal internal morphological changes during diabetes which also returns to almost normal condition on PUFA treatment.

Regioselective N1-Alkylation of 3, 4-dihydropyrimidine-2(1H)-ones: Screening of their biological activities against Ca^{2+}-ATPase : ***Dr. Parimal C. Sen*** *in collaboration with* ***Dr. Arijit Chakraborty,*** *Maulana Azad College*

A regioselective N1-alkylation of 3,4-dihydropyrimidin-2(1H)-ones on using a very efficient mild base Cs_2CO_3 and alkyl halides at room temperature has been reported. The selectivity of this methodology is excellent and the yields of the alkylated products are very good. Furthermore inhibitory action of the dihydropyrimidones have been tested on Ca^{2+}-ATPase, an enzyme which maintains cellular calcium homeostasis in all mammalian cells.

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

Main objectives:

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

Recently diabetes has been emerged as an epidemic and it remains to be a major cause of morbidity and mortality worldwide due to its complex pathogenesis. It is characterized by a state in which carbohydrate and lipid metabolism is improperly regulated by insulin. A large body of earlier investigations has examined the role of oxidative stress in 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

Nanomaterials, ranging from 1 nm to 100 nm in size, have received enormous attention to create new types of analytical tools for biotechnology and life sciences because of their novel physical (ultra small size, large surface area to mass ratio) and chemical functional properties (extremely high chemical reactivity). 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. 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. We are conducting research to evaluate the pathophysiological effect of various nanostructures.

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

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, TNFa, 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?

During the period of April '11-March '12, we got answers of some of these quarries and work is still going on to get a complete picture of the beneficial effect of this protein molecule.

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

Recently, A 43 kD 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 including India. 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, neurotoxicity and related pathophysiology induced by various environmental toxins and drugs.

Effect of D-saccharic acid-1,4-lactone in Diabetes and other organ pathophysiology

D-saccharic acid-1,4-lactone (DSL) is a beta-glucuronidase inhibitor and possesses detoxifying, anticarcinogenic and antioxidative properties. We began to study whether DSL alone can ameliorate the oxidative stress in hepatocytes exposed to TBHP and observed the antioxidant property of DSL. We have also demonstrated that DSL can attenuate alloxan-induced diabetes mellitus in rat model by suppressing the oxidative and inhibiting pancreatic beta-cell apoptosis. The role of DSL in reducing the oxidative stress mediated damage in spleen tissue of diabetic rats was also studied.

V. Microbial Genomics and Infection Biology :

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 function of Rv2147c which forms part of the dcw cluster of *Mycobacterium tuberculosis*, and is similar to the *Bacillus subtilis* SepF protein. By sedimentation analysis we have demonstrated that it induces polymerization of the cell division protein FtsZ. The critical residues of SepF, responsible for its binding to FtsZ have been identified. Overexpression of SepF in *Mycobacterium tuberculosis* alters cell morphology and SepF localizes to the septum as observed by fluorescence microscopy. A mutant of SepF lacking the ability to interact with FtsZ, does not localize to the septum. Further study on the physiological role of SepF is under progress.

Evolutionary link between RepB, a mycobacterial plasmid replication protein and ECF family factors : ***Dr. Sujoy K. Das Gupta***

Mycobacterial plasmid pAL5000 represents a family of plasmids found mostly in Actinobacteria. It replicates using two plasmid-encoded proteins, RepA and RepB. While BLAST searches indicate that RepA is a replicase family protein, the evolutionary connection of RepB cannot be established, as no significant homologous partner ($E < 10^{-3}$) outside the RepB family can be identified. To obtain insight into the structure-function and evolutionary connections of RepB, an investigation was undertaken using homology modeling, phylogenetic, and mutational analysis methods. Such investigations revealed the presence of a three-helical helix-turn-helix domain characteristic of region 4 of extra-cytoplasmic function (ECF) σ factors in the C-terminal region of RepB. At the N-terminal region, there is a helical stretch, which may be distantly related to region 3 of σ factors. Mutational analysis identified two arginines indispensable for RepB activity, one each located within the C- and N-terminal conserved regions respectively. RepB like replication factors found in the pAL5000 family of Actinobacterial plasmids and the domain 4.0 of ECF family sigma factors appear to share a common ancestor. Replication proteins and transcriptional factors may have therefore evolved by recruiting single domain DNA binding HTH modules, an example of which is RepB, from a common ancesteral pool.

Exploring bacterial catabolic potential to counter toxic environmental pollutants: ***Dr. Tapan K. Dutta***

With our continued interest on the identification of novel bacterial strains capable of degrading recalcitrant aromatic pollutants, strains belonging to the genus *Sphingobium*, *Burkholderia* , *Acinetobacter* and *Gordoni* have been isolated and are being extensively studied

to characterize metabolic pathways and understanding the underlying regulatory mechanisms in the mineraliziation of various PAHs and estrogenic phthalates,. Apart from characterization of novel *meta*-cleavage dioxygenase, a complex catabolic network involved in the degradation of various aromatic hydrocarbons in *Sphingobium* sp. strain PNB has also been identified revealing its potential for processing a wide range of substrates. On the other hand, a non-oxidative decarboxylase, involved in the degradation of 2-hydroxy-1-naphthoic acid, has been characterized from *Burkholderia* sp. strain BC1 along with other catabolic enzymes of the assimilating pathway including ring-hydroxylating oxygenase system, while cloning and expression of the individual genes are underway. In addition complete mineralization pathways of acenaphthene and *n*-dioctyl phthalate by *Acinetobacter* sp. strain AGAT-W and *Gordonia* sp. strain Dop5 have also been studied. Apart from these, three different esterase genes have been cloned and identified from a metagenomic library constructed from phthalate-contaminated soil samples, while their cloning and expression studies are in progress.

De novo whole genome sequencing of important sulfur-chemolithotrophic bacteria : ***Dr. Wriddhiman Ghosh***

Taxonomically diverse bacteria render the ancient process of sulfur lithotrophy by apparently distinct biochemical pathways. This mechanistic multiplicity notwithstanding, *sox* (sulfur oxidation) genes are omnipresent in *Bacteria*. However, functional essentiality of the Sox complex is proven only in facultatively lithotrophic alphaproteobacteria that oxidize all sulfur compounds directly to sulfate. The soil-dwelling alphaproteobacterium *Pseudaminobacter salicylatoxidans* KCT001 [family *Phyllobacteriaceae*, order *Rhizobiales*], is a well-studied Sox model, but unlike the prototypical *Paracoccus pantotrophus*, it can utilize tetrathionate as a substrate and produces distinct ^{34}S fractionation during thiosulfate oxidation (Unpublished data of this laboratory). Evidently, there is more to sulfur lithotrophy even within *Alphaproteobacteria* than what is explained by the Sox system alone. As such, whole genome information on KCT001 would not only help understand sulfur lithotrophy better, but also elucidate adaptations and evolution of free-living soil bacteria vis-à-vis their symbiotic and invasive relatives. Genome sequencing was performed on the Ion PGM Sequencer using an Ion 316 sequencing chip. MIRA 3.4.0 was used to assemble 1,640,570 reads (mean length 226 nucleotides) into 53 contigs at 66X overall coverage. The genome was annotated by compiling results obtained from the RAST server with those derived from manual analyses. In the estimated 4,612,407 bp genome of KCT001 4553 potential CDSs could be identified, out of which ~800 were hypothetical genes. G+C content of the genome was 62.8%. One copy each of the 16S, 23S and 5S rRNA genes were identified together with 48 tRNA genes. Corroborating KCT001's phylogenetic proximity with the nodule-forming and nitrogen-fixing mesorhizobia, its genome revealed at least one homolog each of *nodB* (involved in nodulation signal synthesis), *nodF* and *nodE* (that defines the host range of rhizobia). Additionally, several *exo* genes, attributed to succinoglycan biosynthesis for infection thread formation, plus one *ntrYX-ntrBC* global nitrogen regulatory system were also identified. Neither any Pathogenicity Island nor any gene for toxins or superantigens, quorum sensing, biofilm formation or adhesion was detected. The genome, however, encompassed 14 constituents of the mycobacterial virulence

operon, six colicin V and bacteriocin producing genes, 53 flagellar motility and chemotaxis genes, 56 genes for resistance to antibiotics and toxic compounds, and 12 encoding a Type II protein secretion system. Salient genomic features reflecting KCT001's adaptation to tropical soil include tetrathionate respiration, use of anaerobic respiratory reductases; oxidation of carbon monoxide and sulfur, dehydrogenation of succinate, formate, etc.; nitrate and nitrite ammonification and ammonia assimilation; methanogenesis; CO_2 fixation, photorespiration; di- and oligosaccharide biosynthesis; glycerate metabolism; lactate utilization; butanol biosynthesis; glycerol and glycerol-3-phosphate utilization; use of acetone as carbon and energy source; and monosaccharides metabolism. The **KCT001 Whole Genome Shotgun (WGS) project** has been deposited at the **EMBL/DDBJ/GenBank** under the accession **CAIU00000000**, version **CAIU01000000**.

The betaproteobacterium *Tetrathiobacter kashmirensis* is another central model of our studies related to the evolution of sulfur lithotrophy. This facultative chemolithotroph apparently oxidizes thiosulfate via the *Tetrathionate Intermediate Pathway, even* though it possesses a complete *sox* gene cluster. Last year we had determined the WGS sequence of this bacterium using the SOLiD 4 system; this year we completed its whole genome sequencing and annotation, and found it to encompass a 4,365,995 bp circular chromosome (**GenBank accn. no. CP003555 / NCBI ref. no. NC_017964**) and a 57,884 bp circular plasmid (**GenBank accn. no. CP003556 / NCBI ref. no. NC_017965**). The genome project was finished by the following strategy:

1) Deep sequencing was done on the Ion PGM Sequencer using a 316 chip, following which an assembly of 898,717 reads (mean length 231 nucleotides) at an overall coverage of 37X using the MIRA 3.4.0 yielded a sum total of 52 contigs.

2) Subsequently an iterative scaffolding was done by HAPS (http://solidsoftwaretools.com/gf/project/haps/) using the current PGM data (aforesaid 52 ungapped or unpadded contigs) and the previous SOLiD 4 data (33,854,957 mate-paired 50 bp-long reads). This was executed in three stages: a) Error correction of the SOLiD 4 reads using SAET tool, b) Mapping & Pairing of the SOLiD 4 reads onto PGM contigs using Bioscope software, c) Scaffolding using SST tool (SOLiD Scaffolding Tools). Iterative scaffolding was performed to improve the results. As such, we first generated scaffolds using the 52 PGM contigs as reference, following which the obtained scaffolds were used as reference to perform the second round of scaffolding. The entire exercise generated 7 scaffolds, out of which one represented a ~ 59 kb long plasmid and the remaining 6 the chromosome.

3) Gaps within the scaffolds were finally filled up by capillary sequencing.

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

Bacteria are exposed to changing environmental conditions of stress and have evolved regulatory responses that adjust the rates of intracellular metabolic processes. Two-component systems (TCSs) form essential components of the mycobacterial machinery that

senses environmental signals and responds to these signals. Towards this end, we have cloned, expressed and purified the response regulators MprA and RegX3 which are co transcribed with their cognate kinase MprB and Senx3 respectively. We have generated several mutants in order to understand structure-function relationships of these regulators.

Regulation of polyphosphate kinase under stress : ***Dr. Manikuntala Kundu in collaboration with Dr. Joyoti Basu***

Poly P is a key regulator of, among others, the response to high salt, nitrogen/phosphate limitation, amino acid starvation, induction of the SOS system for DNA repair, biofilm formation, quorum sensing and virulence. Increased stress resistance is a feature of stationary phase *M. tuberculosis*. Polyphosphate kinase 1 (PPK1) regulates an important signal transduction cascade involving phosphorylation and activation of the response regulator MprA, activation of sigma E, and finally activation of the stringent response regulator Rel, during nutrient starvation. We provide evidence that the *ppk1* promoter is activated under conditions of phosphate starvation. We have identified the response regulator RegX3 (a partner of the sensor kinase SenX3) as a transcriptional activator of *ppk1*.We have identified the binding sites of RegX3 on the *ppk1* promoter using electrophoretic mobility shift assay. In addition, we also provide evidence that *ppk*1 is regulated by SigE in *M. tuberculosis*.. Our studies provide novel insights into the regulation of expression of *ppk1* a central regulator in signal transduction cascades closely associated with the response of *M. tuberculosis* to stress.

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

In the last year we have completed the project on multi-functional kinesins of *E. histolytica*. In this study we have identified novel proteins that act as 'linkers' to form kinesin- F-actin networks and thereby regulate cytoskeletal function in this organism (Jaspreet Grewal). We have also characterized a hypothetical protein that showed similarity eukaryotic Cdc6/ORC1. Our studies have demonstrated that EhCdc6/ORC1 is involved in regulating DNA replication in amoeba (Prabal Chakraborti). Currently, we are studying the role of EhCaBP6 in regulating chromosome segregation (Jaspreet Grewal, BI; collaboration with Alok Bhattacharya, JNU). We have identified two unique proteins that bind to EhCaBP6 a) a Zn finger domain protein and b) the ribosomal protein P0. The other project in the lab focuses on EhFormin5 and EhFormin8 (Subhanwita Sarkar and Jaspreet Grewal). The role of these two proteins in regulating F-actin dynamics involves the identification of interacting proteins. We are also studying their role in regulating chromosome segregation. In this context we discovered quite serendipitiously- that the Zn finger protein that bound EhCaBP6 also binds to EhFormin5. This suggests that EhFormin5 is part of a larger complex including EhCaBP6 and is involved in MT assembly and chromosome segregation.

Autophosphorylation activity of *E. coli* HflX : ***Dr. Pradeep Parrack***

HflX is a GTPase that is highly conserved across both prokaryotic and eukaryotic organisms, but its cellular function is unclear. *E. coli* HflX also exhibits autophosphorylation activity. We have identified that the autophosphorylation occurs at a serine residue. In addition, various

deletion mutants of the protein have been studied in order to better understand and characterize the autophosphorylation activity of HflX. It was found that HflX(C), the C-terminal part of HflX (residues 171-426) exhibits an enhanced autophosphorylation activity compared to the full-length HflX.

The rate of autophosphorylation by wild type HflX is enhanced in the presence of Mn^{++}. Consequently, growth patterns of three *E. coli* strains, (i) the wild type, (ii) Δ*hflX,* and (iii) in which *hflX* was overexpressed from a plasmid were studied in the presence of various concentrations of $MnCl_2$. It was observed that while the first two were sensitive to 10 mM $MnCl_2$, the cells overexpressing *hflX* were able to withstand Mn stress and grew well.

Confocal microscopy of wild type and Δ*hflX* cells showed that in the presence of 10 mM $MnCl_2$, wild type cells exhibited a normal morphology but Δ*hflX* cells showed significant elongation.

Studies on the Drug and DNA binding proteins of bacteria and bacteriophages: ***Dr. Subrata Sau***

To understand the domain structure and the unfolding mechanism of *E. coli* FKBP22 (a peptidyl-prolyl *cis-trans* isomerase), a recombinant FKBP22 (His-FKBP22) was studied by various probes. The data indicate that His-FKBP22 harbors an N-terminal domain, a C-terminal domain, and a flexible region linking the two domains. His-FKBP22 and its domains were unfolded by a two-state mechanism in the presence of urea. In contrast, GdnCl-induced equilibrium unfolding of His-FKBP22 and its N-terminal domain seem to follow a three-step process. Interestingly, intermediate formed during the unfolding of His-FKBP22 with GdnCl was not a molten globule but assumed to be composed of the partially unfolded dimeric as well as various multimeric His-FKBP22 molecules. Unfolding with either denaturant was found to be reversible in nature. Denaturation of His-FKBP22 appeared to begin at the C-terminal domain first.

Repressor of temperate mycobacteriophage L1 showed interaction with the operator DNAs having no dyad symmetry. The operator DNA binding affinity of L1 repressor was also found to be very weak in comparison with that of λ repressor. To generate a high-affinity L1 repressor, several mutant L1 repressors were created and purified to homogeneity. Currently, we are investigating their structures, DNA binding capacities, and the stabilities by various techniques.

Diverged cellular machinery for protein degradation and vesicular trafficking in *Giardia lamblia*: ***Dr. Srimonti Sarkar***

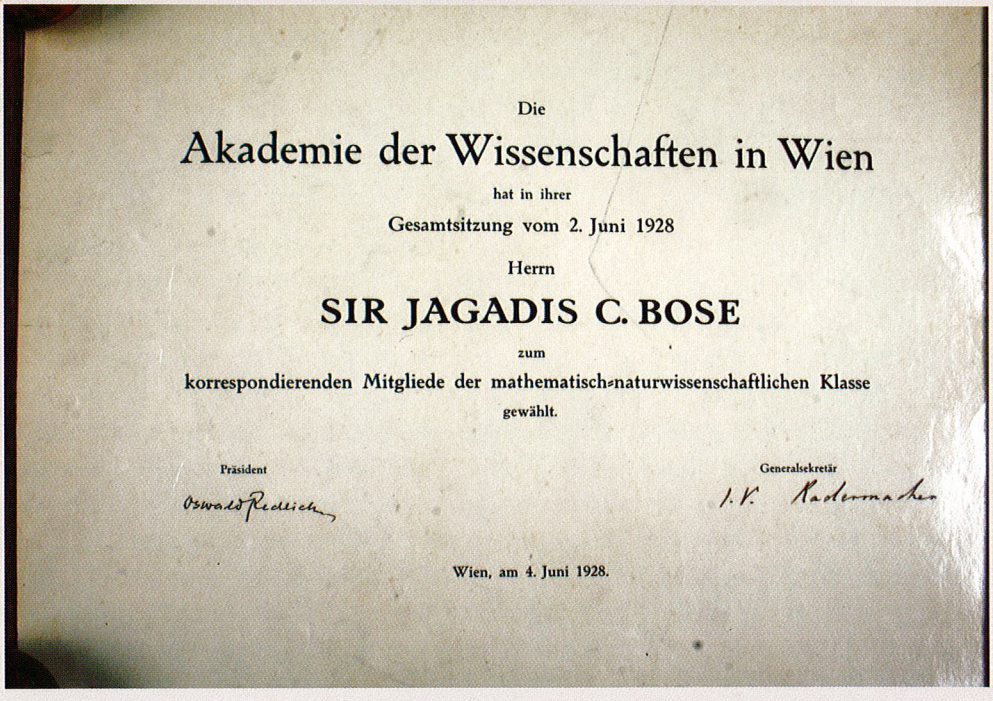
The focus of my research is to understand the cell biology of *Giardia lamblia*. This protozoan parasite is significantly-diverged and, compared to the host's machinery, accomplishes cellular tasks with simpler complexes composed of fewer proteins. Ongoing studies in the laboratory involving several different complexes (the proteasome, the SNARE complex recycling machinery and the ESCRT complex) have reinforced the rudimentary nature of this parasite and underscored its importance are a model for synthetic biology studies. The constituent proteins of each of the complexes also appear to have diverse domain architecture compared

to the orthologous proteins of the host. We are using this divergence to identify potential therapeutic targets.

Hi-fidelity chromosome segregation in eukaryotes using the baker's yeast *Saccharomyces cerevisiae* as a model system : ***Dr. Pratima Sinha***

1. Continuation of our work on the role of the Chl1 protein in yeast cell cycle has shown that, apart from S-phase, Chl1p is instrumental in maintaining sister-chromatid cohesion in G2/M phase as well. This characterization will be of use in understanding the role of BACH1, the human homolog of Chl1p, which is required to maintain genome integrity in human cells.
2. In another work we have shown that high copies of a transcriptional repressor Sum1p stabilizes wild-type microtubules against adverse conditions, such as treatment with depolymerizing drugs, cold temperatures and mutations in structural and tubulin folding genes.

FROM ARCHIVE BI



Die

Akademie der Wissenschaften in Wien

hat in ihrer

Gesamtsitzung vom 2. Juni 1928

Herrn

SIR JAGADIS C. BOSE

zum

korrespondierenden Mitgliede der mathematisch-naturwissenschaftlichen Klasse

gewählt.

Präsident

Oswald Redlich

Generalsekretär

I. V. Rademacher

Wien, am 4. Juni 1928.

VI. Development of Systems Biology :

Stochastic optimization of DNA stability parameters : ***Dr. Suman K Banik***

We suggest that the thermodynamic stability parameters (nearest neighbor stacking and hydrogen bonding free energies) of double-stranded DNA molecules can be inferred reliably from time series of the size fluctuations (breathing) of local denaturation zones (bubbles). On the basis of the reconstructed bubble size distribution, this is achieved through stochastic optimization of the free energies in terms of Simulated Annealing. In particular, it is shown that even noisy time series allow the identification of the stability parameters at remarkable accuracy. This method will be useful to obtain the DNA stacking and hydrogen bonding free energies from single bubble breathing assays rather than equilibrium data.

Stochastic optimization study of protein dimerization kinetics : ***Dr. Suman K Banik***

We investigate the potential of numerical algorithms to decipher the kinetic parameters involved in multi-step chemical reactions. To this end we study the dimerization of a protein as a model system. We follow the dimerization kinetics using a stochastic simulation algorithm and combine it with three different optimization techniques (Genetic Algorithm, Simulated Annealing and Parallel Tempering) to obtain the rate constants involved in each reaction step. We find good convergence of the numerical scheme to the rate constants of the process. We also perform a sensitivity test on the reaction kinetic parameters to see the relative effects of the parameters for the associated profile of the monomer/dimer distribution.

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

miRNAs play an important role in the immune response including the development and differentiation of immune cells, antibody production, and innate immunity regulation. Network analysis connecting miRNA and mRNA identified several miRNAs which are highly interconnected with their target mRNA. We observed that miR-155 upregulation is directly linked to the attenuation of expression of BTB and CNC homology 1 (Bach1) and SH2-containing inositol 5'-phosphatase (SHIP1). The repression of Bach1 is associated with increased expression of heme oxygenase 1 (HO-1) since Bach1 is a transcriptional repressor of HO-1. SHIP1 inhibits the activation of the serine/threonine kinase AKT. HO-1 activation likely facilitates the activation of the dormancy regulon in *M. tuberculosis*, whereas AKT activation likely promotes macrophage survival. Inhibition of miR-155 hindered survival of *M. tuberculosis* in murine bone marrow derived macrophages. Thus, our results offer new insights into the role of miRNAs in modulation of the host innate immune response by *M. tuberculosis* for its own benefit.

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

MicroRNA-mediated regulation of gene expression is distinctive in nature from unregulated and transcription-factor regulated gene expression. MicroRNAs play crucial roles in a number of cellular processes like stress response, developmental transitions, differentiation, programmed cell death etc. A number of functional features of miRNA-regulated gene expression have been identified so far which include a threshold linear mode of action, suppression of protein fluctuations in the form of translational bursts, rapid response times, filtering of transient signals etc. Recently a mathematical model has been proposed describing the biochemical kinetics of microRNA-mediated regulation of gene expression. The model has been experimentally validated in single cell measurements using quantitative fluorescence microscopy and flow cytometry. We have introduced two additional features into the model to consider two specific cases. In the first case, a non-cooperative positive feedback loop is included in the transcriptional regulation of the target gene expression. In the second case, a stochastic version of the original model is considered in which the expression state of the gene switches between the inactive and active states at random time intervals. In both the cases, we demonstrate the possibility of binary gene expression in which the distribution of mRNA/protein levels has two distinct peaks. The theoretical predictions of binary gene expression are experimentally testable.

Complex dynamical systems sometimes exhibit critical point transitions involving dynamical regime shifts. Examples range from ecological systems, the climate, genetic circuits and financial markets. A number of early warning signals have been proposed so far which provide signatures of impending regime shifts. We have initiated the investigation of the dynamics of a number of well-known genetic circuits with the aim to provide early signatures of regime shifts which can be detected in single cell experiments. We demonstrate the utility of this type of analysis in the identification of the appropriate dynamics resulting in well-observed cellular phenomena like the development of genetic competence in the soil bacteria B.subtilis. The study of ecological and economic models vis-à-vis early warning signals is in progress.

Micro-regulatory networks in *Mycobacterium tuberculosis* : ***Dr. Zhumur Ghosh*** *in collaboration with* ***Dr. Joyoti Basu and Dr. Manikuntala Kundu***

We performed microRNA as well as mRNA expression analysis of murine macrophages infected with *Mycobacterium tuberculosis*(M.tb) by means of microarrays as well as quantitative reverse transcription PCR (qRT-PCR). We performed an integrated analysis of microRNA and mRNA expression, target prediction and building miRNA-mRNA interaction network by Magia (http://gencomp.bio.unipd.it/magia2/) and cytoscape (http://www.cytoscape.org/) followed by a functional annotation of the essential genes in the network by Metacore (http://www.genego.com/metacore.php). We elucidated 57 potential regulatory networks contributing to the disease aetiology.

From the above study, we speculate that M. tb infection of murine macrophages causes a specific microRNA response and furthermore outlined a regulatory network of potential interactions between microRNAs and mRNAs. This study provides a theoretical concept for unveiling how distinct M.tb might manipulate host cell response.

Modulation of transcription of mRNA of gastric epithelial cell by *Helicobacter pylori* infection : ***Dr. Manikuntala Kundu*** *in collaboration with* ***Dr. Joyoti Basu***

Helicobacter pylori is known to colonize the stomach and is associated with gastric cancer. The host immune response to *H. pylori* influences the clinical outcome of the infection. Earlier we reported the role of HP0175, a secretory antigen in the modulation of signaling pathway in gastric epithelial cell, AGS. In order to understand the modulation of the transcriptome by HP0175, AGS cells were treated with HP0175 for different periods of time and RNA was isolated. Microarray analysis revealed modulation of different sets of genes at early and late time points. The data indicate that HP0175 modulates the autophagy pathway. Validation of microarray data by Real time PCR is in progress.

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

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.

For Genomic SELEX approach, we have generated approximately 400 bps random DNA fragments from Mtb Genomic DNA.

Aiming a systems level understanding in various diseases : ***Dr. Soumen Roy***

Starting with high-throughput data obtained from experimental colleagues, we have built gene-centric networks via the aid of text-mined data with the genes which were differentially expressed between the infected and control samples. Analysis of these networks has helped us in identifying potential interactions, which would be confirmed by our experimental collaborators in their labs.

Structure-function relations in Biology - A Network perspective : ***Dr. Soumen Roy***

At a completely different level, we are looking into the structural differences between different kinds of biological networks, viz. Protein-Protein, Metabolic and Gene regulatory networks. Do these networks bear signatures of function in their topology? If so, what are the possible mechanisms by which structure influences function in these networks? We are currently engaged in trying to answer these questions.

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

Quantum Information Theory: *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 question in the context of local discrimination of orthogonal quantum states.

A. LOCC distinguishability of unilaterally transformable quantum states

We consider the question of perfect local distinguishability of mutually orthogonal bipartite quantum states, with the property that every state can be specified by a unitary operator acting on the local Hilbert space of Bob. We have shown that if the states can be exactly discriminated by one-way LOCC where Alice goes first, then the unitary operators can also be perfectly distinguished by an orthogonal measurement on Bob's Hilbert space. We give examples of sets of N = d maximally entangled states in two-qudit systems for d = 4, 5, 6 that are not perfectly distinguishable by one-way LOCC. Interestingly for d = 5, 6 our examples consist of four and five states respectively. We have conjectured that these states cannot be perfectly discriminated by two-way LOCC (with Guruprasad Kar, ISI, Kolkata and Sibasish Ghosh, IMSc, Chennai).

B. Entanglement, mixedness and perfect local discrimination of orthogonal quantum states

We have shown that local distinguishability of orthogonal mixed states can be completely characterized by local distinguishability of their supports irrespective of entanglement and mixedness of the states. This gives rise to two kinds of upper bounds on the number of perfectly locally distinguishable orthogonal mixed states. The first one depends only on pure-state entanglement within the supports of the states, and therefore may be easy to compute in many instances. The second bound is optimal in the sense that it optimizes the bounding quantities, not necessarily function of entanglement alone, over all orthogonal mixed state ensembles (satisfying certain conditions) admissible within the supports of the density matrices.

C. 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.

D. Unextendible Mutually Unbiased Bases and Entropic Uncertainty Relations

We have proved a general result on constructing sets of unextendible MUBs for d = 4, 8, using maximal commuting sets of Pauli operators. The construction relies on the fact that the Pauli operators can be partitioned into d+1 commuting classes, each of cardinality (d-1). We have also shown that the sets of unextendible MUBs thus constructed saturate the entropic uncertainty relation for the collision entropy for d=4 (with Prabha Mandayam, IMSc. Chennai, and William K. Wootters, Williams College, MA, USA).

Quantum Algorithms: ***Dr. Somshubhro Bandyopadhyay***

Function evaluation and Boolean Satisfiability

Another research area that we have been pursuing is to develop 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.

In the Deutsch-Jozsa algorithm the promise is that a given *n* bit Boolean function is either constant or balanced. The DJ algorithm, as is well known, deterministically solves this problem with a single query in a black box setting. We consider the problem where the Deutsch-Jozsa promise is not given. We have developed two quantum algorithms with one-sided error to this effect. The first algorithm decides that the function is either not balanced (without error) or balanced within a pre-defined precision with arbitrary small error. The second algorithm decides that the function is either not constant (without error), or constant within a pre-defined precision with arbitrary small error. To keep the run time of the algorithms polynomial in input size, the "pre-defined precision" must be bounded from below. We have compared our results with that of a modified version of Quantum Counting Algorithm. Our algorithms turn out to be significantly better than both existing classical algorithms and modified Quantum Counting algorithm (with Gilles Brassard, University of Montreal and Kaushik Chakrabarty, ISI, Kolkata).

Quantum Optics Laboratory : ***Dr. Somshubhro Bandyopadhyay***

The setting up of a quantum optics laboratory at CAPSS is still 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.

To carry out the first phase experiments, almost all major equipments including the optical table (vibration isolated), lasers, detectors, BBO crystal, and other optical components like polarizers, lenses, beam-splitters etc. have been procured. The required electronics modules like NIM modules, counters and coincidence modules have also been obtained. We have carried out testing for the vibration isolated optical table, the lasers and the detectors.

Most civil and electrical works are now complete for the laboratory room. We have installed dehumidifiers, air-conditioners and obtained the UPS back up for the lab. Work is going on to achieve a minimal level of attaining a "clean room" status. This is necessary for proper functioning of the instruments.

We expect the infrastructure to be ready to start the basic experiments from August onwards.

Quantum spin systems : ***Dr. Indrani Bose***

The transverse-field XY model in one dimension is a well-known spin model for which the ground and excited state properties and excitation spectrum are known exactly. The model has a rich phase diagram describing quantum phase transitions (QPTs) belonging to two different universality classes. These are the transverse-field Ising model and the XX model universality classes. Quantum information-theoretic measures like entanglement, fidelity and quantum discord (QD) are known to provide signatures of QPTs. A quantum system is further subjected to decoherence due to its interaction, represented by a quantum channel, with the environment. We have considered a two-qubit state the density matrix of which is the reduced density matrix obtained from the ground state of the transverse-field XY model in one dimension. The dynamics of different types of correlations like the mutual information, classical correlations and the QD are studied assuming Markovian time evolution. The quantum channels considered are the bit-flip, bit-phase-flip and the phase-flip channels. Two different types of dynamics are identified for the channels and their physical origins explained. Appropriate quantities are defined which provide signatures of the QPTs. We have extended our study to further-neighbour two-qubit states and finite temperatures.

A one-pot Sonogashira coupling-heteroannulation route to 2-substituted pyrrolo[3,2-*e*]indoles : ***Dr. Manas Chakrabarty (External Collaborator: Dr. Gandhi K. Kar, Presidency College, Kolkata)***

In view of the presence of pyrrolo[3,2-*e*]indole nucleus as the core structure in a number of antitumour (DNA-alkylating agents) antibiotics, all being *Streptomyces* metabolites, we undertook the development of a general synthesis of this class of condensed heterocycles. We have now successfully developed an, efficient Pd(0)-catalysed, Cu(I)-mediated general synthesis of 2-H/alkyl/aryl-3*H*,6*H*-pyrrolo[3,2-*e*]indoles (ten products) starting from *N*(1)-benzenesulphonyl-4-iodo-5-trifluoroacetamidoindole and terminal acetylenes involving one-pot Sonogashira coupling and heterocyclisation, followed by *N*(6)-deprotection. The starting indole was efficiently prepared from 5-nitroindole, procured commercially, by successive *N*(1)-protection, reduction of the nitroindole to the aminoindole, iodination at C-4 and trifluoroacetylation of the iodo-aminoindole. All new products were thoroughly characterised by IR, ^{1}H and ^{13}C NMR (both 1D and 2D) and MS data.

A similar synthesis of pyrroloindazoles is currently being pursued.

Atmospheric Science Studies : *Mr Anandamay Adak, Dr Abhijit Chatterjee, Dr. Sanjay K Ghosh and Dr. Sibaji Raha*

Study has been made on the dispersion of pollutants mainly respirable particulate matter over Darjeeling collected during October 2004 - September 2005. Atmospheric dispersion model has been applied to understand the annual behavior of the dispersion of aerosols. Several dispersion parameters have been estimated to determine the source strength of the pollutants. 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). 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.

Dr. Sanjay K. Ghosh, Dr. Sibaji Raha and Dr. Ajay Singh

Concentrations of ambient NH_3, NO, NO_2 and SO_2 were measured over Bay of Bengal (BoB) during 28 December 2008 to 25 January 2009 to study their diurnal variation and relationship of NH3 with other trace gases over BoB. The measurements were done under the winter phase of Integrated Campaign on Aerosols and Radiation Budget (W ICARB). For the first time, ambient NH3 was monitored precisely over BoB based on chemiluminescence method, having estimation efficiency more precise than the chemical trap method. The average concentration of ambient NH_3, NO, NO_2 and SO_2 were recorded as 4.78±1.68, 1.89±1.26, 0.31±0.14 and 0.80±0.30 ìgm^{-3}, respectively, over BoB. The prominent latitudinal and longitudinal variations of the trace gases were observed over BoB, whereas NH_3 and NO showed the non-significant diurnal variation. Results reveal that the concentration of ambient NH_3 negatively correlated with ambient NO_2 (r2 =-0.56), SO_2 (r^2 =-0.58) and ambient temperature (r^2 =-0.27) during the study.

Dr. Abhijit Chatterjee, Mr Chirantan Sarkar, Mr Anandamoy Adak, Dr. Sanjay. K. Ghosh and Dr. Sibaji Raha

The effect of firework activities on air quality was assessed from the ambient concentrations of PM10, water soluble ionic species, metals and SO_2 over Kolkata metropolis, India during Diwali festival in November 2010. PM10 concentrations on Diwali night were found to be ~ 5 times higher than the normal day night-time average concentration. The increase in night-time concentrations of the metals on Diwali spanned over a wide range (Al, Zn, Pb and Cd showed 5-12 times, Cu, Fe and Mn showed 25-40 times and Co and V showed 70-80 times increase in concentrations) compared to night-time concentrations on normal day. The water soluble ionic species showed 1.5-6 times higher concentrations on Diwali night than normal day. The remarkable increases were found for K^+, Ca^{2+}, Mg^{2+} and SO_4^{2-}. The diurnal variation of PM10 and SO_2 was also studied in one of the sites which showed their maximum concentrations on

Diwali night during 8 PM – 3 AM indicating maximum firework activities during this period. PM10 and SO^2 concentrations increased by ~ 5 times than normal day during this period at this site. The extensive use of firecrackers during Diwali festival was found to have significant effect on the high increase of these air pollutants which could be associated with the serious health impacts and thus use of firecrackers in this kind of festival in a highly populated metro-city like Kolkata, India needs to be controlled where air pollution is an acute problem throughout the year.

Mr Anandamay Adak, Dr. Abhijit Chatterjee, Dr. Sanjay K Ghosh and Dr. Sibaji Raha

Study has been made on the dispersion of pollutants mainly respirable particulate matter over Darjeeling collected during October 2004 - September 2005. Atmospheric dispersion model has been applied to understand the annual behavior of the dispersion of aerosols. Several dispersion parameters have been estimated to determine the source strength of the pollutants. 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). 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.

Dr. Abhijit Chatterjee, Dr. Sanjay K Ghosh and Dr. Sibaji Raha

Study has been made on the interaction between aerosol and rain over Darjeeling. It was observed that Black Carbon aerosols were washed out more by light rain which occurs for longer duration compared to the heavier rain which occurs for shorter duration. We have applied the radiative transfer model to find out the effect of washing out of BC on the optical attenuation of aerosol before and after the rain. It was observed that light rain was more efficient to lower the radiative heating rate of the atmosphere and hence cool the atmosphere compared to a heavier rain with longer duration.

Mr. Chirantan Sarkar, Dr. Abhijit Chatterjee, Dr. Sanjay K Ghosh and Dr. Sibaji Raha

Study has been made on the seasonal and diurnal variation Black Carbon (BC) aerosols over Darjeeling. Higher concentration was observed during premonsoon and winter. The premonsoon loading of BC was due to the locally generated as well as long-range transported aerosols. On the other hand, massive biomass burning during winter enhanced the loading of BC aerosols. The diurnal variation of BC shows that, the concentrations of BC peaked up during morning hours and remained higher till early afternoon. During evening, 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 to night.

Dr. Abhijit Chatterjee and Dr. Sibaji Raha

Aerosols rainwater have been analyzed in terms of water soluble ionic species collected over Gadanki, a tropical rural atmosphere in India. Analysing ions both in rainwater and aerosols the contribution from below-cloud and within cloud has been determined. It was observed that below cloud scavenging of aerosol was five times than their in cloud scavenging.

Collaborators : Dr T N Rao and Prof a Jayaraman, National Atmospheric Research Laboratory (ISRO), A.P., India

Collaboration with Massachusetts Institute of Technology, USA for monitoring of Green House Gases over Darjeeling

Continuous and real time monitoring of GHGs over Darjeeling has been started since November 2011. Methane, Nitrous Oxide, Carbon-di-Oxide are being monitored continuously over Darjeeling. The interaction of these gases with other pollutants has also been studied. The variation in the concentration both in diurnal and seasonal scale has been studied. The transportation as well as their local generation has been differentiated.

Collaborators : Prof Ronald Prinn and Anita Ganesan, MIT, USA

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

Droplets in the superheated emulsion detector (SED) are known to exist in multiple metastable states. The interstate transition rates at 1 atmosphere indicate that the second state should be absent above 30 °C (R-12 SED). The nucleation in superheated droplets is studied at high temperatures (upto 63 °C) and at high pressure (up to 22 atmosphere) using a gas manifold. At higher pressures itis seen that the second metastable state does not vanish all together as expected at 63 °C, but the interstate transition rates are seen to almost vanish, thus isolating the two states at about 3 atmosphere.

Cholesterol Esters and Membrane Lipids: Experiments and Computational Chemistry : *Dr. Pradip Das*

The molecular crystal of saturated cholesterol esters exhibits a monolayer structure with the fatty chain ranging from acetate to undecanoate. Beginning with dodecanoate, bilayer crystal structure becomes observable. Unsaturated cholesterol esters exhibit monolayer structure even for large chains. Quantum chemistry and molecular mechanics are being used to rationalize these aspects. Membrane lipids like di- and mono-palmitoylphosphatydylcholine are under study with both experiment and theory.

Testing and characterization of GEM prototype for CBM muon tracking system (in as part of CBM-INDIA collaboration) : ***Ramaprasad Adak, Dr. Supriya Das, Subhasis Samanta***

A 10 cm x 10 cm single mask triple GEM prototype of CBM muon chamber had been fabricated at VECC and tested using pion and muon beams at CERN. Self-triggered 128 channel n-XYTER ASIC, which records the position, time and energy, has been used as the front end read out system for this test. This chip has two independent pulse processing channels, one having 30 nsec peaking time and the other having 140 nsec peaking time. The faster channel provides the time stamp of the hits and the slower channel is used to record the signal amplitude measurement using a peak detection and hold circuit. A 12-bit ADC of 25 fC dynamic range is used to record the energy. As the readout system has no trigger requirement, the time stamp from a 3-fold coincidence system, using fast plastic scintillator strategically placed before and after the prototype, had also been recorded for offline reconstruction of the hit events.

The prototype chamber was operated with Ar-CO_2 gas mixture in 70:30 ratio. We used a voltage divider network to supply the bias voltage to all the 7 points (6 for the three GEM foils and one for the drift plane) from one HV channel. A uniform 2 mm gap was kept for drift, transfer and induction gaps. Under these conditions, the detection efficiency reaches 98% with ΔV_{GEM} = 360V and then saturates. This happens for both muon and pion beam, within error.

Data were also taken with a 10 cm iron slab kept in front of the detector to characterise the response of the detector to an absorber. The preliminary data shows that a large number of particles are hitting the detectors compared to mostly 1 or 2 in the case without the absorber. This larger number of particles falling on the detector can be attributed to interaction of pion with the absorber and producing secondaries. But more detailed study is needed to infer anything more precise from this set of data.

Simulation of electron avalanches in GEM : ***Ramaprasad Adak, Dr. Supriya Das, Subhasis Samanta***

We have proposed to build a muon detection system for the CBM experiment at FAIR. Due to very high particle density and significantly high interaction rate, we decided to use Gas Electron Multiplier (GEM) for the first few stations of the muon tracking system. GEM is considered to be superior over conventional wire chambers used in tracking detectors in terms of both position resolution and rate capabilities. A small triple GEM prototype has been built at VECC and tested with radiactive source and cosmic rays in the laboratory as well as with high energetic charged particle beams at CERN (mentioned above). But alongwith testing the detector response in this way, the response could also be estimated through simulation of electrostatic field inside the detector as well as the response of different gas mixtures at different conditions. We are using simulation packages such as Garfield and Magboltz to simulate the tracks of electrons and ions inside the detection media and formation of avalanches. Several parameters of the detectors such as gain, variation of gain with bias,

dependence of gain upon distances between the GEM foil and the drift and readout planes, response for different gas mixtures could be studied once the whole simulation framework is established.

Simulation of Relativistic collisions at FAIR energies detection of muon pairs in CBM experimental set up for p+Au collisions at 30GeV (as part of CBM-INDIA Collaboration): ***Ramaprasad Adak, Dr. Supriya Das, Subhasis Samanta***

We have started simulation of Au+Au collisons in CBM experimental set up at SIS 100/300 energies using the CBMROOT framework. Our aim is to study the response of the muon detection system as well as several feasibility parameters such as signal to background ratio in case of detection of J/ψ and other vector mesons. We are using "Pluto" as the generator of the signal particles and embedding the signal into the p+Au collision generated by "UrQMD" generator. Then all particles are transported through the CBM experimental set up consisting of muon tracking system alongwith other sub-detectors. For this we have used a so called "reduced geometry" having 3 tracking stations with 3 detector layers each. After the space points are recorded in the STS as well as the muon chambers (MuCh), the tracks and subsequently interaction vertex are reconstracted from those. Once the full event is reconstructed, the tracks registered at STS are extended towards the muon tracking chambers and from the hit information on those chambers the muons are identified. The signal is reconstructed from the momenta of the detected muon pairs whereas the background is estimated from like and unlike sign pairs. This way the S/B ratio is determined. In this work we have found the J/y reconstruction efficiency to be 24% and the S/B ratio to be 32. Large scale simulation involving more number of events is needed to estimate these numbers more precisely.

Active detector array in Darjeeling : ***Rupamay Bhattacharya, Sumana Das, Dr. Supriya Das***

We have started fabricating the detectors for the 7-detector array as the first phase of the proposed extended air shower array at Darjeeling. These detectors are built with fast plastic scintillators coupled with WLS fibers and fast PMTs. A small paddle instrument comprising of two small (20 cm x 20 cm) scintillators with 8 WLS fibers and one PMT each has also been built. This is needed to set the bias of detectors suitable to detect the single particle energy peak. This instrument has been calibrated using high energy cosmic muons at the laboratory.

Breakup of exotic nuclei : ***Dr. Dhruba Gupta***

Studies on breakup nuclear reactions involving light exotic nuclei, in particular ^{11}Li, ^{11}Be were carried out. Prior-form DWBA calculations over a wide range of relative energies of the breakup fragments were carried out to delineate the interplay between Coulomb and nuclear breakup. Breakup experiments on exotic nuclei are being planned. An advanced nuclear physics laboratory at Bose Institute is currently being developed to facilitate the experiments to be carried out at accelerators. A scattering chamber is being fabricated as per our design and several electronic modules have been acquired.

Astrophysical S-factor from nuclear reactions with a rare isotope beam of ^{7}Be: ***Dr. Dhruba Gupta and Dr. Swapan K Saha***

The capture rates of astrophysical relevance at low energies are extremely hard to measure directly and thus rely on extrapolations. There is also the need for rare isotope beams. To deal with the low cross sections, measurements with alternative methods like Coulomb dissociation are employed where the measurement of capture rates are obtained from breakup reactions on heavy targets. Also, with the advent of rare isotope accelerators around the world, reactions involving exotic nuclei are possible.

Despite improvements in our understanding of the $^{3}He + {}^{4}He \rightarrow {}^{7}Be + \gamma$ reaction in the past decades, there are substantial ambiguities connected with the extrapolation of the measured cross sections for the aforesaid reaction to the solar energy region and the theoretical predictions for the astrophysical S-factor $S_{34}(0)$. The existing measurements based on direct capture or by counting decay γ-rays present ambiguities that may influence the predictions of the standard solar model. Thus the present situation demands that novel experiments of breakup of ^{7}Be are carried out. The Inter University Accelerator Centre (IUAC) Pelletron, New Delhi provides the rare isotope beam ^{7}Be. This provides opportunity to study the above mentioned important astrophysical problem. To facilitate the project, a proposal for funding has been submitted to ISRO-RESPOND.

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

Quantum teleportation has been studied with the resource of non-orthogonal entangled qubit states. The loss of teleportation fidelity resulting from the use of non-orthogonal states has been compared to a similar loss of fidelity when non-maximally orthogonal entangled states are used as the teleportation resource. Our analysis leads to interesting results related to the teleportation fidelity of both pure and mixed non-orthogonal entangled states.

The state-independent quantum mechanical violation of non-contextual realist models has earlier been demonstrated for any two-qubit state using suitable choices of *nine* product observables and *six* different measurement setups. Our study,, for the separable states, provides a considerable simplification of such a demonstration by formulating a scheme that requires only *five* product observables and *two* different measurement setups.

A setup that entails nonuniqueness in the quantum prediction of the arrival/transit time distribution has been analysed using the Bohmian model, implying the plausibility of two distinct calculational schemes having empirically distinguishable predictions. One of them agrees with the results obtained from the probability current density based approach that has been postulated for predicting the quantum arrival/transit time distribution.

The weak equivalence principle of gravity has been examined at the quantum mechanical level using non-Gaussian wave packet, in terms of the mass-dependence of the position detection probabilities and mean arrival time. Such mass dependence is shown to be enhanced by increasing the non-Gaussianness parameter of the wave packet, thus signifying a stronger violation of the weak equivalence principle through a greater departure from

Gaussian nature of the initial wave packet. The compatibility between the weak equivalence principle and quantum mechanics is recovered in the macroscopic limit of the latter.

Leggett-type nonlocal realist inequalities that have been derived to date are all contingent upon suitable geometrical constraints to be strictly satisfied by the spatial arrangement of the relevant measurement settings. This undesirable restriction has been removed in our work by deriving appropriate forms of nonlocal realist inequalities, one of which involves the fewest number of settings compared to all such inequalities derived earlier.

In terms of a suitable variant of the EPR-Bohm example, it has been argued that the quantum mechanical violation of a Bell-type path-spin noncontextual realist inequality using an "intraparticle" path-spin entanglement involving single neutrons can be used to infer a form of nonlocality, distinct from Bell-type nonlocality.

Effective Model studies in the physics of strongly interacting matter: ***Dr. Sanjay K. Ghosh, Dr. Rajarshi Ray***

We have studied the thermodynamic properties of strongly interacting matter at finite volume. For this purpose we have used 2-flavor and 3-flavor PNJL model of QCD with three momentum cutoff. To incorporate the finite volume effect we have introduced a cut-off in the lower limit of the momentum integral. The system sizes ranging from 4fm to infinity have been investigated. The critical temperature at zero baryon density has strong volume dependence. Among the thermodynamic quantities specific heat and speed of sound have strongest volume dependences.

External Collaborators: Abhijit Bhattacharyya and P. Deb (University of Calcutta), Subrata Sur (Panihati College), Tamal K. Mukherjee (ICHEP, Beijing).

Dr. Sanjay K. Ghosh, Anirban Lahiri, Sarbani Majumder, Dr. Sibaji Raha and Dr. Rajarshi Ray

We have studied the effect of isospin symmetry breaking through unequal quark masses in a 1+1 flavour system of quark matter in PNJL model. While the thermodynamics of the system does not show any significant change, some correlations are affected strongly due to this symmetry breaking. Possible physical implications of these correlations and their importance in understanding the matter obtained in heavy-ion collisions are discussed.

External Collaborators: Abhijit Bhattacharyya (University of Calcutta)

Dr. Sanjay K. Ghosh, Dr. Sibaji Raha, Kinkar Saha, Dr. Rajarshi Ray and Sudipa Upadhyay

Given the model studies of strongly interacting matter one may like to confront experimental data of such matter created in high energy heavy ion collisions. Generally volume corrections may be quite important and one may try to address that question as mentioned above. Otherwise one may study ratios of certain quantities which are expected to scale with volume

in a similar manner. Examples are the ratios of various fluctuations and higher order correlations. In this study we have chosen this path and tried to predict ratios of various fluctuations that can be measured in the experiments. An important quantity that is being actively analyzed now is the D-measure which is the ratio of net charge fluctuation to the total charge. At the moment we are getting encouraging results in the PNJL model and awaiting the final analysis results from the experiments.

External Collaborators: Abhijit Bhattacharyya (University of Calcutta)

Transfer reactions with radioactive nuclear beams: ***Dr. Swapan K. Saha***

In order to develop a comprehensive understanding of nuclei that will allow approximations to be quantified requires measurements involving very neutron and proton rich exotic nuclei. We plan to carry out nuclear transfer reactions with radioactive ion beam at accelerator facilities. The focus will be on nuclei with halo structure and studying reactions with short-lived nuclei. Numerical calculations on transfer reactions involving ^{6}He nucleus were carried out. The setting up of a detector testing and electronics laboratory is under progress. Both charged particle and gamma-ray detectors would be developed as part of experiments to be conducted at accelerator laboratories.

Study of spin states of three interacting electrons confined in semiconductor quantum dots: ***Dr. Achintya Singha***

Systems of three charged particles interacting by Coulomb forces are the building blocks of a large variety of correlated quantum phases. An example of such correlated phases is Stoner ferromagnetism (SF). Here, we realize a system of three interacting fermions based on electron confined in a semiconductor quantum dots and study collective spin and charge excitation using resonant inelastic light scattering measurements. We observed a sharp spin mode. Full configuration interactions calculation shows that the sharp mode corresponds to excitation of three interacting electrons from un-polarized to spin polarized ground state as predicted by SF. Our result is a starting point for the simulation of SF in a solid-state system composed by three electrons confined in a semiconductor quantum dot. The work has been done in collaboration of Dr. V. Pellegrini, Dr. A. Gamucci, in NEST, SNS, Pisa, Italy and Prof. A. Pinczuk, Col. Univ. NY, and Dr. L. N. Pfeiffer, Dr. K. W. West, *Princeton University, USA and Dr.* M. Rontani, *CNR-NANO, Modena, Italy*.

Study of crystal structure in InAs nanowires using Raman spectroscopy: ***Dr. Achintya Singha***

InAs nanowires (NWs) are currently a subject of soaring research interest due to their unique electronic and optical properties and their potential use in nanoscale electronics, photonics, sensors, lasers. The crystalline quality of the microstructures of NWs play crucial role in determining their above physical characteristics. In this study, we realize InAs NWs containing both wurtzite (WZ) and zinc blend (ZB) phases by chemical beam epitaxy technique. We demonstrate that the temperature dependent behavior of optical phonon energies can be

used to determine the relative fraction of both phases in the InAs NWs. We also propose that the interfacial strain between ZB and WZ phases along the length of the wires manifests in the temperature-evolution of the phonon line widths. Our results show that the Raman scattering measurements, like transmission electron microscopy study, can be used as a spectroscopic tool to study polytypism in such NWs. This work is being carried out in collaboration with Prof. A. Roy in IIT Kharagpue and Prof. L. Sorba and Dr. V. Pellegrini in NEST, SNS, Pisa, Italy.



Micro-Raman Setup in the Department of Physics, Bose Institute (Main Campus)

Dielectric relaxation and transport properties of perovskite oxides : ***Dr. T. P. Sinha***

The frequency dependent dielectric relaxation (a conduction process) of some perovskite oxides (such as $Gd(Ni_{1/2}Zr_{1/2})O_3$, Ho_2CuZrO_6, $Ba(Zr_{0.25}Ti_{0.75})O_3$ etc.) *have been investigated by impedance spectroscopy at various temperatures.* The conductivity spectra follow the power law. The conduction process is modelled by Cole-Cole equation. The relaxation describes the same conduction mechanism at different temperatures as confirmed by scaling behaviour of imaginary parts of dielectric parameters.

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

The density function theory is employed to investigate the optical and magnetic properties of strongly correlated systems such as $PbFe_{1/2}Ta_{1/2}O_3$, $SbTaO_4$, NiXSb (X = Ti, V, Cr and Mn), etc. considering generalized gradient approximation. A comparison of the results is made with the experimental data.

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3. Kundu S, Bhattacharya C, Rana T K, Banerjee K, Dey A, Ghosh T K, Mukherjee G, Bhattacharya S, Meena J K, Banerjee S R, Mukhopadyay S, Pandit D, Mali P, Gupta D, Shrivastava A, Kumar S, Chatterjee A, Ramachandran K, Banerjee P (2011) Dissipative collision studies in $^{11}B + ^{28}Si$, $^{12}C + ^{27}Al$, $^{12}C + ^{28}Si$, *DAE-BRNS Symposium on Nuclear Physics*, 56, 486.

4. Kundu S, Bhattacharya C, Rana T K, Banerjee K, Mukhopadyay S, Gupta D, Dey A, Saha R, Bhattacharya S (2011) Deformation in $^{28}Si^*$ produced via $^{16}O + ^{12}C$ reaction, DAE-BRNS Symposium on Nuclear Physics, 56, 562.

5. Mondal P K, Sarkar R and Chatterjee B K (2011) Effect of Surfactant on the Second Metastable State in Superheated Emulsions, *Proc. of CMDAYS-11 (Gauhati)*, 110.

Library

1. Chakraborty A K (2011) Challenges and opportunities in using open source software: A case study of Bose Institute Library. *In* Proceedings of Open Access: Gateway to open Innovation of the 27th Annual conference of the Society for Information Science (SIS) held during 24-26 November, 2010 held at Bose Institute., Kolkata, 359-370.

2. Chakraborty A K (2011). Technological Challenges : Traditional roles and skills associated with library professionals. RBU Journal of Library and Information Science, 14, 2011-2012, 9-12.

3. Chakraborty A K (2012) Knowledge organization, dissemination and management : additional innovative challenges for S&T libraries. *In* Digital libraries and knowledge organization, (Edited Book), *Macmillan Publishers India, Delhi*, 96-106.

Students Awarded with Ph.D. Degree

Name of the Student (University/Year)	Title of thesis	Supervisor
Biochemistry Department		
Mr. Arumay Pal (WBUT, 2011)	Structural studies on macromolecular interactions	Dr. P. Chakrabarti
Mr. Prabal Chakraborti (J.U., 2011)	Identifying proteins that interact with selected cell cycle proteins of Entamoeba histolytica	Dr. A. Lohia
Bioinformatic Centre		
Ms Bratati Kahali (J.U., 2011)	Studies on the evolutionary forces on codon and amino acid usages in prokaryotic and eukaryotic genomes.	Dr. T. C. Ghosh
Ms. Sangeeta Kundu (J.U., 2011)	Modeling and Molecular Dynamics Simulation of Biotechnologically Important Proteins	Dr. Debjani Roy / Dr. P. Chakrabarti
Chemistry Department		
Ms. Srabani Karmakar (J.U., 2011)	Characterization of the interactions of some bivalent metal ions and other substrate molecules with a-crystallin by biophysical, mutational and mass spectrometric approach"	Dr. K. P. Das
Ms Sanchita Basu (J.U., 2011)	Understanding the innate immune response mycobacterial infection	Dr. M.Kundu and Dr. J.Basu
Mr. Partha Mukherjee (J.U., 2011)	Antigens of *Mycobacterium tuberculosis* : their potential as diagnostic tools and their role in immune response in tuberculosis	Dr. M.Kundu
Ms. Chaitali Basak (J.U., 2011)	Host cell signaling modulated by bacterial pathogen	Dr. M.Kundu

Division of Molecular Medicine		
Mr. Gaurav Gupta (J.U., 2011)	An approach towards understanding the mechanism of $CD4^+/CD4^+CD25^+$ T regulatory cell function and involvement of chemokines in the regulation of Visceral leishmaniasis: Role of immunomodulators in regulating these T cells	Dr. Subrata Majumdar
Mr. Rajib Panchadhayee (B.H.U, 2011)	Synthesis of Complex Oligosaccharides Related to Microbial Polysaccharides	Dr. Anup Kumar Misra
Mr. Samir Ghosh (J.U., 2011)	Synthetic studies on oligosaccharides related to some bacterial polysaccharides	Dr. Anup Kumar Misra
Mr. Dewan Md. Sakib Hossain (J.U., 2011)	Molecular mechanisms of immune evasion by tumor: Role of curcumin	Dr. G. Sa and Dr. T. Das
Mr. Arghya Adhikary (J.U., 2012)	Inhibition of mammary epithelial carcinoma cell migration by curcumin: Evaluation of the molecular mechanisms:	Dr. G. Sa and Dr. T. Das
Mr. Pallab Roy (J.U., 2012)	Regulation of cancer cell apoptosis by plant polyphenols: A mechanistic study	Dr. G. Sa and Dr. T. Das
Division of Plant Biology		
Dr. Himadri Shekhar Chakraborty (JU, 2011)	Fungal aerosol monitoring over an agricultural field in greater Kolkata, West Bengal, India and their allergenic significance.	Dr. S. Gupta Bhattacharya
Nilanjana Banerjee (J.U., 2011)	Structural Characterization and Functional Studies of Some Clinically and Agronomically Potential Biomolecules	Dr. Sampa Das
Ms. Myo Ma Ma Than (C.U., 2010)	Clonal propagation, germplasm conservation and DNA fingerprinting pattern in *Bulbophyllum auricomum* Lindl.	Dr. Amita Pal (Co-supervisor)
Soumitra Maiti (J. U. 2011)	Development of functional markers for genotyping MYMIV resistance in *Vigna* and characterization of putative *R* gene/s in *Vigna mungo*.	Dr. Amita Pal

Ms. Subhra Talai (C.U. 2012)	Development of Bio-Molecular markers for vigour in rice seeds	Dr. S.Sen Mandi
Ms.Sudeshna Bhattacharya (J.U. 2012)	Cell Molecular Studies on Spontaneous Radiation namely UV stress tolerance in plants.	Dr. S.Sen Mandi
Microbiology Department		
Ms. Madhumita Roy (J.U., 2011)	Identification and functional characterization of catabolic versatilities of polycyclic aromatic hydrocarbons degrading *Sphingobium* sp strain PNB: Biochemical and molecular analyses	Dr. Tapan K. Dutta
Physics Department		
Mr. Prasanna Kumar Mondal (CU, 2011)	Investigations on the Existence of More Than One Metastable State of Superheated Liquids	Dr. Barun K. Chatterjee
Mr. Atanu Maulik (J.U., 2011)	Characterization of Solid State Nuclear Track Detectors to Search for Heavy Ions and Strangelets in Cosmic Rays	Dr. Swapan K. Saha

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- June 2010	
Schemes funded by CSIR		
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. A Bhunia	Structural Study Of *De Novo* Designed Novel Antifreeze Peptides From *Leucospordium Antarcticum* Antifreeze Protein-1 (Afp-1).	Biophysics
Dr. G. Basu	Theoretical and experimental analyses of bacterial GlxRS/tRNA-Glx/gatCAB co-evolution and the molecular basis of their interaction	Biophysics
Dr. J. Basu (PI) Dr. M Kundu (Co-PI)	Role of microRNAs in the immune response to mycobacterial infection (1.7.2011-31.6.2014)	Chemistry
Dr. A. Mandal	Function of molecular chaperone Hsp70 in quality control of protein kinases	Division of Molecular Medicine

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. S. R. Sikdar	Towards identification of aphid resistance gene(s) from wild crucifer *Rorippa indica* through differential transcriptomic approach.	Division of Plant Biology
Dr. W. Ghosh	Understanding the origin(s), evolution and interaction(s) of different molecular mechanisms of chemotrophic sulfur oxidation: Elucidating the metabolic strategies of early Life	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. Datta (Co-PI)	Studies on the repressor and its cognate operators/promoters of temperate *Staphylococcus aureus* phage 11 and development of a high expression vector for staphylococcal systems (started on 22.02.08-31.03.12)	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. S. Ghosh Dastidar	Mechanistic insight into the role of conformational Modulations in driving BC12s apoptotic network: Structural dynamics to therapeutic design	Bioinformatic Centre
Dr. T C Ghosh	Role of protein complexes and protein protein interaction network in eukaryotic protein evolution	Bioinformatics
Dr. A Bhunia / Dr. Subhrangsu Chatterjee	Biophysical and Structural Aspects of Oncogenic G-Quartets Bound to Drugs: Screening, High Resolution NMR and Low Resolution Spectroscopy.	Biophysics
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 (30.12.2008 TO 29.06.2012)	Chemistry
Dr. Jayanta Mukhopadhyay	Role of alternative sigma factors in gene regulation of *M. tuberculosis*	Chemistry

Dr. S. Majumdar	Identification of the host cell factors responsible for survival and death of leishmania Leishmaniasis	Division of Molecular
Dr. S. Majumdar	Immunomodulatory role of Arabinosylated Lipoarabinomannan Against Visceral Leishmaniasis	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. D. Basu (PI)	Understanding of correlation between "auxin homeostasis" and *Alternaria brassicicola* infection in *Brassica juncea* (04.12.2006 04.12. 2013)	Division of Plant Biology
Dr. Sampa Das (Programme Co-ordinator)	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. P. Kundu (PI) Dr. Sampa Das (Co-PI)	Regulation of microRNA transcription and biogenesis by fungal-stress in tomato	Division of Plant Biology
Dr. A. N. Lahiri Majumder (Co-ordinator and PI Project No.-I &II) Dr. D. N. Sengupta (PI Project No.-III) Dr. Shubho Chaudhuri (PI Project No.-IV)	Generation of salt-tolerant rice plants: A translational approach.	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. Amita Pal, (P.I.) Dr. Sampa Das	Identification of genetic loci for the development of MYMIV-resistance (Programme Coordinator)	Division of Plant Biology in *Vigna*.
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 2011)	CAPSS / Physics
Dr. T. P. Sinha	Transport Properties of Double Perovskite Oxides	Physics

Scheme funded by DST

Dr. P. Chakrabarti Dr. G. Basu	J.C. Bose National Fellowship Analysis and design of peptides with cis peptide bonds: Pro-Pro-Xaa sequence motifs (01/04/2009 - 31/03/2012)	Biochemistry 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. M. Kundu (PI) Dr. J. Basu (Co-PI)	Stress induced regulation of extracytoplasmic Sigma factors in mycobacteria (21.10.2010 to 20.10.2013)	Chemistry

Dr. D. Basu (PI)	Understanding of correlation between "auxin homeostasis" and *Alternaria brassicicola* infection in *Brassica juncea* (04.12.2006 04.12. 2013)	Division of Plant Biology
Dr. Nrisingha 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. W. Ghosh	Comprehensive Geomicrobiology of two High Temperature Hydrothermal Systems of India: Paradigms of Primitive Metabolisms and Biogeochemical Evolution, Prospects of Biotechnological Resource	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*	*Astroparticle Physics and Space Science - a National Facility* (April 2005-March 2011)	CAPSS / Physics

Project funded by DST, SERC

Dr. A Lohia	Identifying proteins that determine the function of novel kinesins from *Entamoeba histolytica*	Biochemistry
Dr. K. Jana	Molecular Signalling Involved in Patho-physiological Action of Common Air Pollutant Benzo(a)pyrene in Testicular DNA Damage and Apoptosis in Connection to Male Infertility: Possible Protection by Natural Aryl Hydrocarbon Receptor antagonists	Division Molecular Medicine
Dr. A. K. Misra	Synthesis of oligosaccharide antigens of the Enterohemorrhagic *Escherichia coli* (EHEC) strains for the preparation of glycoconjugates (01.09.2011 to 31.08/2014)	Division Molecular Medicine

Schemes funded by ICMR

Dr. J. Basu (PI) Dr. M Kundu	Understanding cell division in mycobacteria (1.3.2011-28.2.2014)	Chemistry
Dr. M. Kundu (PI) Dr. J. Basu	Role of secretory antigen in *Helicobacter pylori* Mediated induction of autophagy (29.3.2011-28.2.2014)	Chemistry
Dr. S. SenMandi (Research Co-Ordinator) Dr. S.R.Sikdar	Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants of Eastern and North Eastern India	Division of Plant Biology

Scheme funded by Indo-Korean collaborative programme (DST)

Dr. J. Basu (PI)	*Mycobacterium tuberculosis* infection: understanding the role of microRNAs in regulating the immune response of macrophages (23.8.2011-22.8.2014)	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 ICAR, National Fund

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

Scheme funded by Ministry of Earth Science (MoES) through OASTC, Berhampur University		
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		
Dr. D. Basu (PI) Prof. S. Das (Co-PI) Prof. S. Sikdar (Co-PI)	Molecular tools for exploitation of heterosis, yield and oil quality in sesame (Jan 2008- June 2012)	Division Plant Biology
Project guide for the Department of Library & Information Science, Kolkata		
Dr. A. K. Chakraborty	a bibliometric study of the journal 'Bibliometric analysis of Indian Library and Information Science periodical Literature' 2000-2005.	Library

Participation In Conferences/Symposia/ Workshops & Invited Talks Delivered At Various Organizations

Dr. S. K. Datta (Acharya J.C. Bose Biotechnology Innovation Centre) visited Ramakrishna Mission Vidyapith, Deoghar to explore the possibilities to develop awareness for floriculture and commercial exploitation of dehydration technique for employment generation among the students during 7-9th February 2012.

Dr. P. Chakrabarti (Biochemistry) Presented papers/talked at (i) Albany 2011: The 17th Conversation, State University of New York, June 14-18, 2011; (ii) Indo-Russian Workshop, Moscow Conference on Computational Molecular Biology (MCCMB'11), Moscow, July 21-24, 2011; (iii) XXII Congress and General Assembly of the International Union of Crystallography, Madrid, August 22-30, 2011; (iv) Mini-symposium on Macromolecular Crystallography, Hyderabad, October 16-17, 2011; (v) One-day Pfizer symposium on Organic Chemistry, IISc, Bangalore, November 4, 2011; (vi) the final meeting of the ARCUS Inde Région Ile-de-France Program held at Université Paris-Sud, Orsay, November 7, 2011; (vii) International Interdisciplinary Science Conference 2011, Jamia Millia Islamia, November 15-17, 2011; (viii) 77th Annual Meeting of the Indian Academy of Sciences, Ahmedabad, Novermber 18-20, 2011; (ix) Guha Research Conference, Khimsar Fort, December 1-5, 2011; (x) XXIII Annual BTISNet Coordinators Meeting, Shri Mata Vaishno Devi University, Katra, Febryary 3-4, 2012; (xi) Workshop on Bioinformatics (WBI'12), Indian Statistical Institute, February 15-18, 2012; (xii) INSA Award Lectures and Panel Discussion on Biomolecular Research and Informatics: Future in India, Presidency University, February 27, 2012; xiii) One-day symposium to Emerging Trends in Biological Research in India (to commemorate the National Science Day), Department of BMBB, Calcutta University, March 6, 2012. He chaired sessions at (xiv) The Conference on Informatics & Integrative Biology (CIIB-2011), Bose Institute, December 14-16, 2011; (xv) Acharya PC Ray National Young Scientists' Conference, Presidency University, February 17-18, 2012; (xvi) Recent Advances in Chemical and Physical Biology, Saha Institute of Nuclear Physics, March 5-7, 2012.

He was also invited to deliver talks at (i) Biozentrum der Universität Basel & Swiss Institute of Bioinformatics (SIB), June 20, 2011; (ii) Organic Chemistry Intergroup Seminar at the Swiss Federal Institute of Technology, Zürich, June 22, 2011; (iii) Department of Chemistry, University of Calcutta on the occasion of the 'P.C. Ray Award' giving ceremony, July 29, 2011; (iv) The Soft Computing Center, Indian Statistical Institute, Kolkata, October 25, 2011; (v) Institut de Biologie Physico-Chimique (IBPC) Paris, November 9, 2011.

Participation of conferences by Dr. P. Chakrabarti's group members : Soumyananda Chakraborti, Sucharita Dey and Devlina Chakravarty attended The Conference on Informatics & Integrative Biology (CIIB-2011), Bose Institute, December 14-16, 2011, and D. Chakravarty was awarded the best poster award; Soumyananda Chakraborti attended the International Conference on Perspective of Cell Signaling and Molecular Medicine, Bose Institute, January 7-10, 2012, and he received the best poster award.

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Dr. R. Chattopadhyaya (Biochemistry) presented a poster and participated in the Conference titled "The17th Conversation" held at SUNY, Albany, NY, USA during June 14-18, 2011 about his recent work on Fenton-reaction mediated DNA damage in the presence of *Terminalia chebula* extract.

Dr. T. C. Ghose (Bioinformatics) participated in (i) International Interdisciplinary Science Conference-2011 at Jamia Millia Islamia University, New Delhi, November 2011; (ii) Biology and Bioinformatics of Economically Important Plants and Microbes at North Bengal University, Siliguri, W.B., February 2012; (iii) BTISnet annual Coordinators meeting at Shri Mata Vaishno Devi University, katra, Jammu, February 2012.

Dr. Zhumur Ghosh *(Bioinformatics)* (i) participated "Oncogenic Potential of Stem Cell Derivatives - A Road Map towards Safer Regenerative Therapy" presented at 2nd International conference on Perspectives of cell signaling and Molecular Medicine (Jan 8-12, 2012) organized by Bose Institute, Kolkata. (ii) talk delivered at a Bioinformatics workshop at Burdwan University entitled "Bioinformatics: some of the fundamentals and their applications" on 21.12.2011 organized by the Dept. of Microbiology, B.U.

Dr. Shubhra Ghosh Dastidar *(Bioinformatics)* Delivered talk at (i) "Albany 2011: The 17th conversation" held at State University of New York at Albany, NY, USA during June 14-18, 2011; (ii) DBT sponsored work shop at North east Hill University, Shillong during September 6-7, 2011; (iii) Lecture and sessions at the *workshop "Recent trends in molecular modeling and simulation in structural biology" at B.I.F. Kalyani University, held during 14th -18th November, 2011; (vi) "National Conference on Biology and Bioinformatics" at North Bengal University, during February 12-17, 2012; (v)* 'School of Biological Science, Nanyang Technological University, Singapore on March 13, 2012.

Dr. Anirban Bhunia / Dr. Subhrangsu Chatterjee (Biophysics) Presented poster at (i) Conference on Informatics and Integrative Biology, Kar, R., Jana, J., Ghosh, A., Bhunia, A. and Chatterjee, S. Designing of Novel G-Quadruplex Stabilizing Agents and NMR Spectroscopy of Telomeric G-Quadruplex; held at Bioinformatics Center, Bose Institute, Kolkata. (ii) 2nd International conference on Perspective of cell signaling and molecular medicine; Shah, S., Kar, R., Tejo, B. A., Chatterjee, S. and Bhunia, A. Solution Structure and Activity of New Antifreeze Peptides Derived from Leucospordium antarcticum Antifreeze Protein; held at Division of Molecular Medicine, Bose Institute.

Dr. Anirban Bhunia (Biophysics) delivered invited talk at (i) Indo-Russian conference on Glycoscience, which was held at Moscow, Russia and jointly organized by DST (India) and Zelinsky Institute of Organic Chemistry, Moscow, Russia (ii) 2nd NMR Users meeting, which was held at Pennag, Malaysia and organized by Bruker Malaysia BHD and also (iii) delivered four lectures in the workshop titled, "Workshop on Application of NMR in Chemical and Biological Sciences" which was held at North Eastern Hill University (NEHU), Shillong.

Dr. Subhrangsu Chatterjee (Biophysics) Presented a poster on G-Quadruplex Stabilizing Agents and NMR Spectroscopy of Telomeric G-Quadruplex at conference on Nucleic Acids in Disease and Disorder, held at IIT Delhi.

Dr. G. Basu (Biophysics) Invited lectures in (i) Coevolution of tRNAGln and its non-cognate partner GluRS in bacteria March 30, 2012 Sixth tRNA Group Meeting Indian Institute of Science, Bangalorel; (ii) When cis peptide bonds cannot be ignored International conference on Recent Advances in Chemical and Physical Biology, SINP March 6, 2012; (iii) Electrostatic discrimination of cognate and non-cognate partners in biology An interdisciplinary approach to soft-matter and biological physics IASBP2011 IACS/SINP December 3, 2011; posters in (iv) CH-pi interaction mediated stabilization of cisPro bond: New sequence motifs American Peptide Symposium Sheraton San Diego, CA USA June 25 30, 2011; talks delivered at (v) CH···pi interaction mediated stabilization of cisPro peptide bond: New sequence motifs Johns Hopkins University Department of Biophysics July 1, 2011; (vi) My encounters with Aib May 30, 2011 Department of Chemical Science University of Padova, Padova, Italy; (vii) Co-evolution of $tRNA^{Gln}$ and its functional partners in bacteria: A post-genomic analysis Ins Institut de Biologie Physico Chimique (Paris, France) 20 June, 2011.

Dr. Joyoti Basu (Chemistry) (i) participated in the Molecular Immunology Forum held in Matheran from February 10 to 12, 2012; (ii) delivered lecture in Indo-Swedish conference on Post genomic opportunities in tuberculosis and other mycobacterial diseases held in Unchagaon Fort, Garh Mukteswar from January 29 to 31, 2012; (iii) delivered lecture in Guha Research Conference from December 1 to 5, 2011; (iv) delivered lecture in Diamond Jubilee Celebration of Indian Institute of Technology, Kharagpur from November 11 to 12, 2011; (v) visited Linkoping University, Sweden in connection with Indo-Swedish Program from August 7 to 15, 2011.

Dr. Manas Chakrabarty (Chemistry) Participated, as a Member of the Organising Committee, the Scientific Subcommittee and the Adjudication Committee for Best Poster Presentation, in Acharya P.C. Ray National Young Scientists' Conference organised by Vivekananda Vijnan Mission, Vijnana Bharati, West Bengal Unit and held at Derozio Hall, Presidency University, Kolkata during 17.2-18.2.2012, and a former student, Dr. Ajanta Mukherjee, made an oral presentation entitled "An Expedient Synthesis of 2-Alkyl/aryl-1,8-phenanthrolines using Phase Transfer Catalyst-mediated Skraup/Doebner-von Miller Reaction" at the aforesaid Conference. Delivered on 1st September, 2011 an Invited Talk entitled "Green Chemistry: Concept, Understanding and Relevance to Society" in the 25th Training Programme on "Science Communication and Media Practice" organised by the Indian Science News Association, Kolkata and held at the University College of Science, Kolkata.

Dr. K. P. Das (Chemistry) (i) presented an invited lecture entitled "Protein Protein Interaction in Eye Lens: A Biophysical & Molecular Biological Approach" at the National Conference on Surfactants, Emulsions and Biocolloids, held at the Chemistry Department of Agartala University, Tripura. He also chaired a session at the conference, December 27-30, 2011; (ii)

chaired a session at the Acharya Prafulla Chandra Ray memorial symposium on Chemistry Today (2011) and Celebration of the International Year of Chemistry held at the Calcutta University, August 2-3, 2011 (iii) attended as the Organizer one day symposium on the Trends in Surface Science and Related Areas, held at the Jadavpur University, November 9, 2011; (iv) delivered a talk entitled: "Life a Chemist's Perception" on 29th February, 2012 at the St. Xavier's College, Kolkata; (v) gave an invited talk entitled: "Substrate recognition by eye lens protein α-crystallin a biophysical and molecular biological study" on September 10, 2011 at the Heritage Institute of Technology, Kolkata.

Dr. Jayanta Mukhopadhyay (Chemistry) presented a talk at HHMI Early Career Grant Competition as a semifinalist, 6-8th Nov 2011; Janelia Farm Research Campus, Ashburn. VA, USA.

Dr. M. Kundu (Chemistry) delivered lecture in 4th Congress of European Microbiologists FEMS2011 held in Geneva, Switzerland from June 26 to 30, 2011.

Dr. Soumen Roy (Chemistry) organized a minisymposium on "Networks in Biology" at the International Conference on Theoretical and Mathematical Biology by IISER Pune and delivered *plenary talks* at: (1) "Bioinformatica Indica", University of Kerala, Trivandrum on January13'th, 2012 (2) "National Workshop on Systems Biology", Pune on April 23'rd, 2011.

He delivered invited talks at (i) CSIR-IHBT, Palampur in "Workshop on Network Biology" on March 30'th, 2012; (ii) National Seminar in the Department of Applied Mathematics, University of Calcutta on March 15'th, 2012; (iii) Saha Institute of Nuclear Physics, Kolkata on August 19'th, 2011; (iv) Department of Physics, University of Calcutta, on April 6'th, 2011; (v) Department of Physics, Jadavpur University, Kolkata on April 1'st, 2011; (vi) participated in the Young Investigator Meeting, Lonavala during January 8-12, 2012 and was an invited participant at "An Interdisciplinary approach to soft-matter and biological physics" (IASBP2011) organized by SINP, Kolkata and IACS, Kolkata during December 2-3, 2011.

Dr. Tanya Das (Division of Molecular Medicine) visited Cleveland Clinic, Ohio, USA, during August to November, 2011 for a collaborative work. She delivered a special lecture on Unveiling the mechanism of angiogenesis: Role of smooth muscle cell and endothelial cell cross-talk in the Pathobiology Department of Cleveland Clinic, Ohio, USA, in November, 2011. Prof. Das participated in the symposium on *Recent trends in healthcare science and technology* and delivered an invited lecture on *Declaring war against human papiloma virus-infected cervical cancer: A difficult battle to win* at Bengal Engineering and Science University, India, in January, 2012. She acted as Convenor and delivered invited lecture in the 2nd International symposium on perspective of cell signalling and molecular medicine on A jopurney from cancer to cancer stem cell: an approach towards "resistance to apoptosis" switchover at Bose Institute, Kolkata in January, 2012. Prof. Das delivered an invited lecture on Chemogenetic approach to regulate the functional interplay between ATM signalling network during

sensitization of resistant tumor in 16th Human Genome Meeting at Sydney, Australia, in March 2012. She was invited to deliver a special guest lecture on Multi-focal signal modulation of cancer and cancer stem cells: 'p53' or 'not p53' that is the question at A Star, Singapore, in March, 2012.

Dr. Kuladip Jana (Division of Molecular Medicine) participated an invited lecture in International Conference on Molecules to System Physiology: 100 Years of Journey, held on September 21-23, 2011 in Department of Physiology, University of Calcutta.

Dr. Nripendranath Mandal (Division of Molecular Medicine) (i) participated in the 2nd International Symposium on "Perspective of Cell Signaling and Molecular Medicine" January 8-11, 2012 organized by Division of Molecular Medicine, Bose Institute, Kolkata, India; (ii) participated in the International Symposium on "Bioresources and Human Sustenance" on October 20-22, 2011 organized by Department of Zoology, Cotton College & Zoological Society of Assam (ZSA), Guwahati, Assam; (iii) delivered a special invited Lecture on "Importance of Biotechnology based research to control disease in Aquatic animal and Human" at the National Symposium on "Research In Animal Science: Development and Evaluation", March 19- 20, 2012, organized by the Department of Zoology, University of North Bengal, Siliguri - 734013, West Bengal; (iv) delivered a Lecture on "DNA markers linked to disease resistance in shrimp (Penaeus monodon)"at the International symposium on "From innovations in nucleic acids research to regulation of Biological processes", December 17-19, 2011, organized by Department of Microbiology and Molecular Biology, Indian Institute of Science, Bangalore.

Dr. Anup Kumar Misra (Division of Molecular Medicine) (i) delivered lecture in the DST meeting held at Lucknow University on October 15, 2011; (ii) delivered invited lecture in the National Chirality Conference (NCC-2011) held at M. S. University of Baroda, Vadodara, India, during December 2-3, 2011; (iii) delivered invited lecture in the Indo-US workshop on Green Chemistry for environments and sustainable developments held at H. N. B. Garhwal University, Dehradun, India, during March 11-13, 2012; (iv) delivered invited lecture in the National seminar on emerging trends in chemical sciences held at Gauhati University, Guwahati, India, during March 30-31, 2012.

Dr. Gaurisankar Sa (Division of Molecular Medicine) visited Cleveland Clinic, Ohio, USA, during July to November, 2011 for a collaborative work. Prof. Sa delivered a special lecture on 'Cancer: Targeting the abscence" in the Pathobiology Department of Cleveland Clinic, Ohio, USA. Prof. Sa participated and delivered an invited lecture on 'Novel Gain-of-Function of Transcription Factor FoxP3 as Co-transcription Factor for STAT3 in Regulatory T Cells in Tumor Milieu' in 16th Human Genome Meeting 2012 at Sydney, Australia in March 2012. He was invited to deliver a special guest lecture on 'Oncogenic Ras as a molecular target for genotoxic injury-induced cancer cell apoptosis' at A Star, Singapore, in March, 2012. Dr. Sa participated in the symposium on Recent trends in healthcare science and technology and delivered an invited lecture on 'Immune editing strategies of tumor to evade immune system' at Bengal Engineering and

Science University, India in January, 2012. Dr. Sa was invited to deliver invited lecture in the 2nd International symposium on perspective of cell signalling and molecular medicine on "Gain-of-function of $FoxP_3$ as co-transcription factor of STAT3 in regulatory T cells in tumor millieu." at Bose Institute, Kolkata in January, 2012. Participated in the Molecular Immunology Forum held in Matheran from February 10 to 12, 2012. Delivered Lecture in Guha Research conference from December 1 to 5, 2012 at Khijar.

Dr. P. C. Sen (Division of Molecular Medicine) (i) acted as resource person cum advisor to motivate secondary students of Sikim to participate in the "Innovative Research Initiative in Science" organized by the Sikim Council of Education Research and Technology at Gangtok on March 30, 2012; (ii) delivered an invited talk on "Water and Food Security" at Bengal National Chamber of Commerce and Industries on the occasion of Water Water Day organised by BNCC&I and NASI, Kolkata Chapter on March 22, 2012; Agartala Gov't Medical College organized by DBT on November 6, 2011 and Chaired a Scientific Session; (iii) organized as Secretary the 2nd International Conference on the "Perspectives of Cell Signalling and Molecular Medicine" during January 8-11, 2012 and Chaired a Session in the Conference; (iv) delivered an invited Plenary Lecture in the 4th International Conference of Molecular Medicine, Istanbul, Turkey, June, 27-30, 2011 (v) acted as Judge in the IRIS best poster selection for INTEL competition in New Delhi, Chandigarh, Bangalore.

Dr. S. Bhattacharya (Division of Plant Biology) (i) attended a seminar on "Sustainable crop productivity through physiological intervention" organized jointly by Department of Life Science , Ramnarain Ruia College, Mumbai and Indian Society for Plant Physiology, Pusa , New Delhi, held at Ramnarain Ruia College, Mumbai, India on November 24-26, 2011 and presented a poster. (ii) attended as an invited guest in the 31st Science, Agriculture and village industry fair-2001 organised by Garalgacha Science Club, P.O. & Vill Garalgacha, Dist. Hooghly and delivered a lecture on 'Application of tissue culture technique in improvement of agriculture' on 1st January, 2012.

Dr. Sampa Das (Division of Plant Biology) (i) visited and delivered a talk in Hemipteran-Plant Interactions Symposium during July 11-14, 2011 at Piracicaba, Brazil; (ii) delivered an invited talk in a Seminar on ENVIRONMENT as a part of Celebration of the World Environment day on June 5, 2011organised by Centre for Applied Science and Technology, Kolkata; (iii) delivered invited talk in a UGC sponsored seminar at Ramakrishna Mission Vivekananda Centenary College, Rahara on "NEW CHALLENGES TO STRENGTHEN OUR FOOD AND NUTRITIONAL SECURITY" on 8th September, 2011; (iv) presented as resourse person in a mentorship workshop of *Bio-CARe* (Biotechnology Career Advancement and Re-orientation Programme) for Women Scientists at Department of Botany, University of Calcutta on 15th November, 2011 organized by Department of Biotechnology, New Delhi; (v) delivered invited talk on a topic " A Proteomic Approach To Unravel the Mechanism of Action of Insecticidal Plant Lectins" in a International Conference on OMICS Meets Disease and 3rd Annual Meeting of Proteomics society' at Saha Institute of Nuclear Physics on 17th December, 2011; (vi) delivered an invited lecture entitled "Detection of early signaling molecules in plant defense response against biotic factors : A

Genomic - Proteomic approach" in a NATIONAL SEMINAR On "Genomics and Proteomics in Plant Science" on 9th March 2012 at Centre for Advanced Study Department of Botany, University of Calcutta; (vii) delivered an invited lecture entitled new challenges to strengthen the food and nutritional security of Indian citizens in a seminar on 11th March, 2012 at Botany Department, University of Burdwan; (viii) delivered a key note address on " Utility of plant and microbial resources" in a National Seminar on above topic on 17th March, 2012 in the department of Botany , Visva Bharati University.

Dr. Gaurab Gangopadhyay (Division of Plant Biology) (i) acted as the Coordinator and Resource person of Plant Science in the North-Eastern States Students' Training on Basic Science 2011 (NESST-BASE 2011) at Mayapuri Campus of Bose Institute, Darjeeling on 22nd 24th May 2011; compiled and prepared the booklet for the trainees; (ii) Ranjana Prasad, Vivek Arora, Marufa Sultana and Gaurab Gangopadhyay presented poster entitled "Data mining and sequence analysis for future tailor made crops" in the CIIB-2011 (Conference on Informatics & Integrative Biology) organized by Bioinformatics Centre, Bose Institute, Kolkata during December 14 16, 2011; (iii) invited to act as a counselor in the Directorate of Distance Education Programme of Vidyasagar University at Jogomaya Devi College P.G. Study Centre during August 2011 (taken two theoretical classes in the Personal Contact Programme); (iv) Dr. Gaurab Gangopadhyay presented a proposed collaborative research project entitled "Genotyping of Mulberry varieties developed at CSR&TI, Berhampore and development of linkage map for the important agronomic traits" in the Research Council meeting at Central Sericultural Research & Training Institute, Berhampore on 18.08.2011; (v) invited to act as Resource Person in the UGC sponsored National Seminar "Sustainable Resource Management: Myth or Reality" held at Uluberia College, WB: Delivered talk entitled "Sustainable management of plant genetic resources" in the Technical session on 18.11.2011; (vi) delivered invited talk entitled "Development of molecular markers in Mulberry" in the UGC sponsored National Seminar on Plant Science Research in Human Welfare organized by Department of Botany, Bidhannagar College, Kolkata in collaboration with BSI, held at Bidhannagar College on 12.01.2012; (vii) delivered invited talk entitled "Exploration of genetic diversity of Sesame through Phenomic and Genomic approaches" in the UGC, CSIR & DST (WB) sponsored National Level Conference on Biodiversity: Threats and Conservation through Traditional and Biotechnological Approaches organized by Departments of Botany, Zoology & Microbiology, Dum Dum Motizheel College (DMC), Kolkata in collaboration with Bose Institute and BSI, held at DMC on 05.02.2012.

Dr. Amita Pal (Division of Plant Biology) gave a lead lecture on "Applications of molecular markers in plant genomics" in the National Seminar on Emerging trend in Plant Science, held at the Barasat Government College at Barasat, North 24-Paraganas, West-Bengal on 15th July, 2011. She gave an invited talk on "Genomic and proteomic approaches to understand yellow mosaic disease related pathogenesis in *Vigna mungo*" in the 15th All India Congress of Cytology and genetics", held at the Department of Botany, Magadth University, Bodhgaya, Bihar on 22nd November, 2011 and chaired a technical session. Served as one of the resource persons in the

First Mentorship Workshop in the Eastern India, sponsored by DBT, New-Delhi on "How to Write a Project" held in the Department of Botany, University of Calcutta, Kolkata on 16th November, 2011 and give a talk entitled "Remember 5 Cs While Writing a Project". She gave an invited lead lecture on "Screening of superior genetic resources of *Bambusa balcooa* and identification of genes involved in fiber development" in the National Symposium on "Assessment & Conservation of Forest Genetic Resources through Biotechnological Interventions", held in the Institute of Forest Productivity (ICFRE), Aranyodaya, Lalgutwa, Ranchi on 19th and 20th December, 2011 and chaired a technical session. She gave an invited lead lecture on "Current understanding of molecular mechanisms of defense in *Vigna mungo* upon MYMIV infection" in the 3rd global conference on Plant Pathology for Food Security: Dr. Norman E. Borlaug Memorial Celebrations, held at Udaipur, from January 10-13, 2012 also chaired a technical session to conduct "Guman Devi Verma Best Women Scientist Award".

Participation of conference by Dr. Amita Pal's group member (Division of Plant Biology) Jayadri Sekhar Ghosh presented a paper on "Genetical and structural variations of ribosomal spacers: Useful molecular tool for bamboo systematics" In Plant Genome Evolution: A *Current Opinion* Conference at the Amsterdam, The Netherlands from 4th to 6th September 2011, Sponsored by Elsevier.

Dr. P. K. Saha (Division of Plant Biology) Visiting Professor at University of Burdwan for one month.

Mr. Bodhisattwa Saha (Division of Plant Biology) attended and gave Oral presentation at 45th Annual conference of the Indian college of allergy, Asthma and applied Immunology from 16th to 18th December 2011 at Aurangabad. Mr. Saha gave a Poster presentation at 2nd International conference in Perspectives of Cell Signaling and Molecular Medicine held during 8-11 January 2012 at Bose Institute, Kolkata.

Dr. Swati Sen-Mandi (Division of Plant Biology) delivered (i) invited lecture as resource person on "Medicinal Plant Genetic Resource: Molecular Documentation and Evaluation" at Centre for Advanced Studies, Dept. of Botany, Burdwan University on 1st March 2012 (ii) As guest speaker on "DNA profiling for authentication of drug plants" at St. Xavier's College, Kolkata on November 2011.

Dr. S.R. Sikdar (Division of Plant Biology) participated in the training programme on "Paradigm Shift in Science & Technology" organized by National Institute of Advanced Studies, Bangalore, Indian Institute of Science Campus, Bangalore 560 012 during 12-16 December 2011. Dr. Sikdar chaired a technical session on Microbial Biotechnology in the National Symposium on Frontlines of Microbiological Research: Concepts and applications, held during 2nd to 4th February, 2012 at University of Calcutta, organized by 'Indian Mycological Society' in collaboration with Department of Botany, University of Calcutta, Kolkata and in the same session a paper of his group entitled "Production and characterization of somatic hybrids

between edible mushroom strains *Pleurotus florida* and *Lentinula edodes*" was presented by his Ph.D. student Mr. Pijush Mallick.

Mr. Gaurab Sircar (Division of Plant Biology**)** attended and gave Oral presentation at 45th Annual conference of the Indian college of allergy, Asthma and applied Immunology from 16th to 18th December 2011 at Aurangabad.

Dr. Abhijit Chatterjee (Environmental Science**)** Served as resource person in NESST-BASE 2011 program held at Bose Institute, Darjeeling, India, in May 2011.

Dr. S. Bandyopadhyay (Physics/CAPSS) invited talk in (i) Workshop on Information and Security in Quantum World, ISI, Kolkata, March 2012, (ii) IWQI-2012, HRI, Allahabad, February 2012, (iii) UGC sponsored National Symposium on Quantum Information theory and Computer Science, J.C.C College, Kolkata, February 2012***, (iv)*** ISCQI-2011, IOP Bhubaneshwar, December 2011, (v) Workshop on Quantum Foundations in the light of Quantum Information III, Montreal, Canada, December 2011.

Dr. Bandyopadhyay acted as a resource person (i) "North-Eastern Students Summer Training Program" held at Bose Institute, Mayapuri campus, Darjeeling, May 2011, (ii) "DST-BASE" held at Bose Institute, Mayapuri campus, Darjeeling, August 2011.

He also visited (i) Department of Computer Science and Operational Research, University of Montreal, Montreal, Canada during October 2011 (two weeks) (ii) Department of Computer Science and Operational Research, University of Montreal, Montreal, Canada during December 2011 (1 week).

Dr. I. Bose (Physics) delivered on invitation a talk on " Mathematical analysis of a mycobacterial survival strategy under stress" at the International Conference on Mathematical Biology held in the Indian Institute of Science, Bangalore (July 4-7, 2011), delivered Keynote address on " Study of Condensed Matter Systems via Quantum Information Theory at CMDAYS 2011 organised by Gauhati University (August 24-26, 2011), delivered Keynote address on " Challenging prospects in condensed matter physics" at UGC sponsored National Level Seminar on Some recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions held at Susil Kar College, Champahati, West Bengal (September 2, 2011), a talk on " Routes to Binary Gene Expression" at UGC Sponsored National Seminar on Emerging trends in Biophysical Researches at Ramananda College, Bishnupur (September 12-13, 2011), a talk on " Magnetism: A Quantum Journey" at UGC sponsored National Level Seminar on Quantum Mechanics at Narasinha Dutt College, Howrah (November 24-26, 2011), a talk on "MicroRNA-mediated regulation of Gene Expression: Functional flexibility and noise-resistance at International Conference on Mathematical and Theoretical Biology at Pune (January 23-27, 2012), a talk on " How microorganisms cope with stress: role of gene expression noise in survival and adaptation" at 6th International Conference on Unsolved Problems on Noise and Fluctuations 2012 at SINP, Kolkata February 20-24, 2012), a talk on "Binary Gene Expression: Origins and Consequences" in Conference on Nonlinear Dynamics and Statistical Physics at the S. N. Bose National Centre for Basic Sciences, Kolkata (March 12-16, 2012); She also delivered on invitation

six lectures on Introduction to Mathematical Biology at the Department of Applied Mathematics, Calcutta University (February 6, 13, 14, 2012).

Dr. B. K. Chatterjee (Physics) attended and chaired a session at the seminar on "Some Recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions" held at Sushil Kar College, Champahati, on September 2, 2011.

Dr. Supriya Das (Physics) Delivered a lecture on "Pulse and Pulse Processing in Particle Detection" at WAPP 2011 in December 2011. Delivered the status report (on behalf of CBM-India Collaboration) on "GEM Developments at VECC" at CBM Collaboration Meeting at GSI, Darmstadt in March 2012. Participated in FAIR Physics meeting at NIAS during Dec 6-7, 2011.

Dr. Sanjay Kr. Ghosh (Physics) (i) served as resource person in the WAPP 2011 program held at Bose Institute, Darjeeling, India, in December 2011. (ii) delivered a talk on "Compressed baryonic matter" at the conference "Exploring the Cosmos" held at North Bengal University, December 15-16, 2011; (iii) delivered a talk on "QCD phase transition inside Neutron stars: effect of magnetic field" at the Winter Workshop on Astroparticle Physics held at Bose Institute, Darjeeling in December 15-16, 2011.

Dr. Dhruba Gupta (Physics) served as a member of the organizing committee of the Workshop and Winter School on Astroparticle Physics (WAPP 2011) held at Bose Institute, Darjeeling, December 17-29, 2011; delivered an invited talk on "Interaction of Radiation with Matter" at WAPP 2011; delivered an invited talk on "Astrophysical S-factor from nuclear reactions with a rare isotope beam of 7Be" at the ISRO Respond Review Meeting, Physical Research Laboratory, Ahmedabad, February 28-29, 2012.

Dr. R. Ray (Physics/CAPSS) participated in (i) NESST-BASE program organized by Bose Institute, at Darjeeling in May, 2012: Resource person in teaching advanced mathematics to school students of N-E India. (ii) Satellite meeting to (WHEPP 2012) held at VECC Kolkata, India, in January, 2012: "Mimicking QCD Phase diagrams through Models"; (iii) Workshop on High Energy Physics Phenomenology (WHEPP) held at Mahabaleswar, India, in January, 2012: Working group discussions on applications of QCD inspired models;

Dr. Ray also delivered lectures in (i) Winter School on Astroparticle physics (WAPP) organized by Bose Institute and Tata Institute of Fundamental Research, at Darjeeling in December, 2011: Lectures on elementary Astroparticle physics to selected college students; (2) DST-BASE program organized by Bose Institute, at Darjeeling in August, 2011: Lectures on advanced mathematics to school students of N-E India; (3) NESST-BASE program organized by Bose Institute, at Darjeeling in May, 2011: Lectures on advanced mathematics to school students of N-E India.

Dr. Swapan K. Saha (Physics/CAPSS) served as a member of the organizing committee of the Workshop and Winter School on Astroparticle Physics (WAPP 2011) held at Bose Institute, Darjeeling, December 17-29, 2011; delivered an invited talk on "Errors of observation" at WAPP 2011.

Dr. Rupa Sarkar (Physics) attended the seminar on "Some Recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions" held at Sushil Kar College, Champahati, on September 2, 2011. She also attended and presented a poster on "Effect of Surfactant on the Second Metastable State in Superheated Emulsions" at Condensed Matter Days 2011 (CMDAYS-11) held at Gauhati University, Gauhati, during August 24-26, 2011.

Dr. Achintya Singha (Physics) delivered (i) Invited talk in 4th International workshop on Emergent phenomena in Quantum Hall (EPQH4) during June 23-26, 2011 at ICQM, Peking University, Beijing, Chine; (ii) invited talk in Prof. C. K. Majumdar Memorial workshop on Condensed Matter Physics in the Department of Theoretical Physics, Indian Association for the Cultivation of Science, Jadavpur, Kolkata held on November 11, 2011; (iii) invited talk in India-Australia International Workshop on Nanotechnology in Materials and Energy Application at Jadavpur University, Kolkata, during December 29-31, 2011; (iv) oral presentation in International Conference on Theoretical and Applied Physics (ICTAP) in the Department of Physics and Meteorology Indian Institute of Technology, Kharagpur, during December 1-2, 2011; (v) attended UGC sponsored National level seminar on Some recent developments in Condensed Matter Physics: Cross-Disciplinary Contributions held at Sushil Kar College, Champahati, on September 2, 2011; (vi) served as resource person in the WAPP2011 program held at Bose Institute, Mayapuri, Darjeeling during December 17 - 29, 2011.

Dr. T. P. Sinha (Physics) delivered an invited talk on "Electronic structure and optical properties of perovskite oxides" in Optics'11: A Conference on Light held at National Institute of Technology, Calicut (Kerala) during May 23-25, 2011. He also delivered an invited talk on "Optical properties of Perovskite Oxides" in the National Conference on Recent Trends in Materials Science held at Jaypee University of Information Technology, Solan (H.P.) during October 8-10.

Dr. Arun Kumar Chakraborty (Librarian) Invited to participate in (i) Fulbright Alumni Workshop on "Understanding your Personality type" on 14-15 July, 2011 organized by USEFI at American Center, Kolkata; (ii) Alumni workshop on "Experiential Leadership" on 23-24 September, 2011 at NEHU, Shillong; (iii) the 6th NASI SCOPUS YOUNG SCIENTIST AWARDS 2011 at New Delhi on 2nd February, 2012.

He also Invited to deliver lecture (i) as a resource person on 5th May, 2011 on "Responsibilities of Library Staff" at Administrative Staff College, University of Calcutta, Kolkata; (ii) External Practical Examiner for P. G. Even Semester Examination, May 2011 at Assam University, Silchar on 11th July, 2011 and also delivered lecture; (iii) resource person on 3rd August, 2011 at UGC Sponsored Refresher Course on "Resource Management in Academic Library : Systems and Tools" at Department of Library and Information Science, College Street Campus, University of Calcutta, Kolkata; (iv) resource person on 29th August, 2011 at UGC Sponsored Refresher Course on "Recent Trends in Library and Information Services" at Department of Library and Information Science, Jadavpur University, Kolkata; (v) act as an examiner of the thesis of MLIS in Digital Library Examination, 2011 and corresponding oral examination of the same on 12th

September, 2011 at Jadavpur University; (vi) keynote address on seminar on "E-Resources: Enhancing Learning and Research on 21st September, 2011 at Hotel ITC Sonar, Kolkata organized by Lippincott Williams & Wilkins; (vii) talk on Library Marketing in the Seminar "Library Connect: Partnering with the Library Community" organized by Elsevier and AICTE on 18th November, 2011; (viii) External Practical Examiner of Assam University, Silchar on 25th November, 2011; (ix) resource person on 14th December, 2011 at 4th Refresher Course in Library and Information Science being organized by the UGC Academic Staff College, Banaras Hindu University for College and University Teachers during 1-21 December, 2011; (x) Chair the Session on 3rd February, 2012 in the National Seminar on the theme "A Century of LIS education in India : past, present and future" to commemorate the centenary of LIS Education in India held during 02-04 February, 2012 at Bardwan University and also invited to deliver lecture on "Open Source Software teaching in LIS" on 3rd February, 2012; (xi) lecture on 24th February, 2012 in technical session of the National Seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata; (xii) Chair Technical Session on 2nd March, 2012 at a National Conference on "Digital Rights Management in Library" during 1-2 March, 2012 at Indian Statistical Institute, Kolkata; (xiii) special Guest and deliver lecture on "One day Seminar of INFLIBNET- N-LIST, Ahmedabad on User education" at Sudhiranjan Lahiri Mahavidyalaya, Nadia, West Bengal on 6th March, 2012; (xiv) expert member of different Assessment Committee(s) such as Satyendra Nath Bose National Centre for Basic Sciences, Indian Institute of Chemical Biology etc; (xv) Guest faculty in the IGNOU, Kolkata Centre for PGDLAN course; Rabindra Bharati University, Kolkata for MLISc. and BLISc.; Calcutta University for M.Phil Course; and external examiner for Assam University, Silchar, Jadavpur University and other Universities In Kolkata. (xvi) Supervised the M.Phil. dissertation entitled "a bibliometric study of the journal 'Bibliometric analysis of Indian Library and Information Science periodical Literature' 2000-2005" submitted at Department of Library and Information Science, University of Calcutta, Kolkata.

Sri Pradip Kumar Sarkar (Library) participated in the national seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata.

Dr. (Mrs.) Banhi Sikha Chaudhuri (Library) participated in the Half day Training cum demonstration programme on SciFinder cum by American Chemical Society, USA on 15th December, 2011 organised at Hotel Stadel, Saltlake, Kolkata.

Ms. Ananya Raha (Library) participated in the national seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata.

Ms. Sumita Dey (Library) participated in the Half day Training cum demonstration programme on SciFinder cum by American Chemical Society, USA on 15th December, 2011 organised at Hotel Stadel, Saltlake, Kolkata.

Honours Received

Dr. P. Chakrabarti (Biochemistry) (i) received the Bires Chandra Guha Memorial Lecture Award of INSA in 2011; (ii) elected Fellow of TWAS (The Academy of Sciences for the Developing World) in 2011.

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) (a) nominated as Associate Fellow, Indian Academy of Science (2011-2014), (b) nominated as the Editorial Board Member, *Current Bioinformatics*

Dr. Joyoti Basu (Chemistry) (i) Associate Editor for The Journal of Immunology (July, 2010 to June, 2014); (ii) Member, Editorial Board, PLoS One; (iii) Member of the Scientific Advisory Committee of the Centre for DNA Fingerprinting and Diagnostics, Hyderabad; (vi) Member of the DBT Expert Committee on Systems Biology of *Mycobacterium tuberculosis*

Dr. Manas Chakraborty (Chemistry) acted as a Member of the Two-man Advisory Committee attached to the SAP-DRS programme of the Department of Chemistry, University of North Bengal, Darjeeling in its meeting held at the Department of Chemistry on March 20, 2012.

Dr. Soumen Roy (Chemistry) (i) served as a member of the Planning Commission Task Force on "Synthetic and Systems Biology Resource Network" for India's 12'th Five year plan (2012 2017); (ii) invited to be an Honorary Associate Editor at the Indian Journal of Physics (Springer).

Dr. Tanya Das (Division of Molecular Medicine) (i) Sananda Nihar Samman, India, for Academic Excellence, 2012; (ii) elected "Fellow of West Bengal Academy of Science", India, 2011.

Dr. Kuladip Jana (Division of Molecular Medicine) received "Young Investigator Research Award" 2011 from Parsemus Foundation (San Francisco, California, U.S.A.), and serving as a Member of the Editorial Board: Translational Medicine: Current Research, and International Journal of Plant Physiology & Biochemistry.

Dr. N. Mandal (Division of Molecular Medicine) felicitated and presided over as Chairman of a session at International Symposium on Bioresources and Human Sustenance on October 20-22, 2011 organized by Department of Zoology, Cotton College & Zoological Society of Assam (ZSA), Guwahati, Assam.

Dr. Gaurisankar Sa (Division of Molecular Medicine) invited to be the Member of the Editorial Board of Scientific Journals: *Int. J. Cancer Res., J Pharmacology & Toxicology, Asian J Biochemistry, Asian J Cell Biology, World J Biological Science.*

Dr. Parimal C. Sen (Division of Molecular Medicine) (i) elected Editorial Board Member of the "International Journal of Biochemistry and Biotechnology" (ii) elected Editorial Board Member of the "International Journal of Pharmacology".

Dr. Swati Gupta Bhattacharjee (Division of Plant Biology) elected Fellow of the West Bengal Academy of Science and Technology in Plant Science, 2011.

Dr. Sampa Das (Division of Plant Biology) has been elected as Fellow of West Bengal Academy of Science and Technology in 2011.

Dr. D. Home (Physics) elected Fellow of the National Academy of Sciences, India.

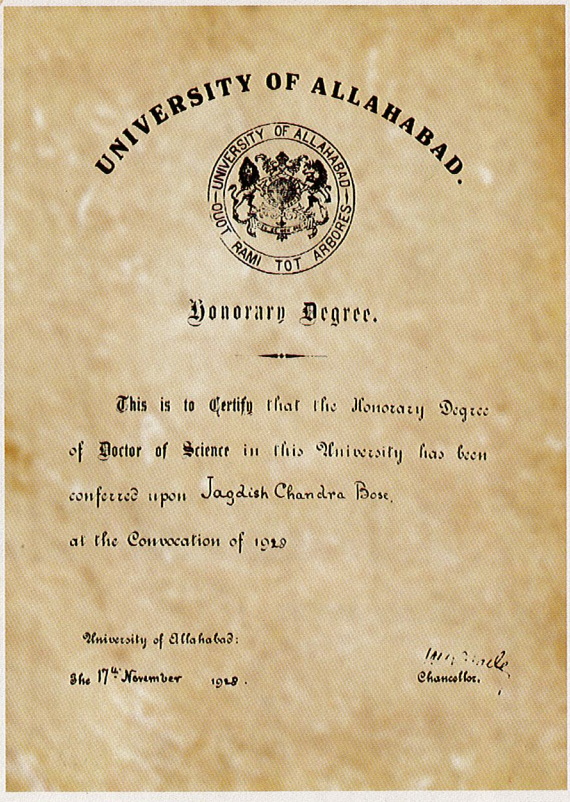
Dr. Arun Kr. Chakraborty (Librarian) (i) Member of National Editorial Advisory Board of KLA Bulletin: A Trilingual Peer- Reviewed Quarterly Bulletin of Library & Information Science Published by Khandesh Library Association, Kerala. (ii) Member of Editorial Board of IASLIC Bulletin: A Peer- Reviewed Quarterly Journal of Library & Information Science Published by Indian Association of Special Libraries and Information Centres (IASLIC), Kolkata. (iii) one of the member of the Editorial Board of IASLIC Special Publication No. 51. IASLIC Seminar Conference Volume 2011 --- Theme :"Library Vision 2020" held at University of Kashmir, Srinagar during 10-13, October, 2011.

Patents

Dr. Debabrata Basu (Division of Plant Biology) Identified a 'Small auxin up RNA' (SAUR) gene from resistant *Sinapis alba*. Overexpression of the gene in susceptible *Brassica juncea* shows altered morphology and more susceptibility against fungal pathogen *Alternaria brassicicola*. Since, no direct evidence for the involvement of the gene with the susceptibility of oil seed mustard against this important pathogen is available, one patent application has been submitted. Patent Application No. 76/KOL/2012, Dated 27.01.2012.

Dr. Swapan Kr. Saha (Physics) A patent application was filed by Bose Institute with title "A novel solid state nuclear track detector for charged particles" and inventors Atanu Maulik, Sibaji Raha and Swapan K. Saha on 18/11/2011. This work was sponsored by DST under IRHPA scheme (Indian Patent Application No. 1473/KOL/2011).

FROM ARCHIVE BI



UNIVERSITY OF ALLAHABAD.

UNIVERSITY OF ALLAHABAD — QUOT RAMI TOT ARBORES

Honorary Degree.

This is to Certify that the Honorary Degree of Doctor of Science in this University has been conferred upon Jagdish Chandra Bose at the Convocation of 1929

University of Allahabad:
the 17th November 1929.

Chancellor.

Participation In Conferences/Symposia/ Workshops & Invited Talks Delivered At Various Organizations

Dr. S. K. Datta (Acharya J.C. Bose Biotechnology Innovation Centre) visited Ramakrishna Mission Vidyapith, Deoghar to explore the possibilities to develop awareness for floriculture and commercial exploitation of dehydration technique for employment generation among the students during 7-9th February 2012.

Dr. P. Chakrabarti (Biochemistry) Presented papers/talked at (i) Albany 2011: The 17th Conversation, State University of New York, June 14-18, 2011; (ii) Indo-Russian Workshop, Moscow Conference on Computational Molecular Biology (MCCMB'11), Moscow, July 21-24, 2011; (iii) XXII Congress and General Assembly of the International Union of Crystallography, Madrid, August 22-30, 2011; (iv) Mini-symposium on Macromolecular Crystallography, Hyderabad, October 16-17, 2011; (v) One-day Pfizer symposium on Organic Chemistry, IISc, Bangalore, November 4, 2011; (vi) the final meeting of the ARCUS Inde Région Ile-de-France Program held at Université Paris-Sud, Orsay, November 7, 2011; (vii) International Interdisciplinary Science Conference 2011, Jamia Millia Islamia, November 15-17, 2011; (viii) 77th Annual Meeting of the Indian Academy of Sciences, Ahmedabad, Novermber 18-20, 2011; (ix) Guha Research Conference, Khimsar Fort, December 1-5, 2011; (x) XXIII Annual BTISNet Coordinators Meeting, Shri Mata Vaishno Devi University, Katra, Febryary 3-4, 2012; (xi) Workshop on Bioinformatics (WBI'12), Indian Statistical Institute, February 15-18, 2012; (xii) INSA Award Lectures and Panel Discussion on Biomolecular Research and Informatics: Future in India, Presidency University, February 27, 2012; xiii) One-day symposium to Emerging Trends in Biological Research in India (to commemorate the National Science Day), Department of BMBB, Calcutta University, March 6, 2012. He chaired sessions at (xiv) The Conference on Informatics & Integrative Biology (CIIB-2011), Bose Institute, December 14-16, 2011; (xv) Acharya PC Ray National Young Scientists' Conference, Presidency University, February 17-18, 2012; (xvi) Recent Advances in Chemical and Physical Biology, Saha Institute of Nuclear Physics, March 5-7, 2012.

He was also invited to deliver talks at (i) Biozentrum der Universität Basel & Swiss Institute of Bioinformatics (SIB), June 20, 2011; (ii) Organic Chemistry Intergroup Seminar at the Swiss Federal Institute of Technology, Zürich, June 22, 2011; (iii) Department of Chemistry, University of Calcutta on the occasion of the 'P.C. Ray Award' giving ceremony, July 29, 2011; (iv) The Soft Computing Center, Indian Statistical Institute, Kolkata, October 25, 2011; (v) Institut de Biologie Physico-Chimique (IBPC) Paris, November 9, 2011.

Participation of conferences by Dr. P. Chakrabarti's group members : Soumyananda Chakraborti, Sucharita Dey and Devlina Chakravarty attended The Conference on Informatics & Integrative Biology (CIIB-2011), Bose Institute, December 14-16, 2011, and D. Chakravarty was awarded the best poster award; Soumyananda Chakraborti attended the International Conference on Perspective of Cell Signaling and Molecular Medicine, Bose Institute, January 7-10, 2012, and he received the best poster award.

Dr. R. Chattopadhyaya (Biochemistry) presented a poster and participated in the Conference titled "The17th Conversation" held at SUNY, Albany, NY, USA during June 14-18, 2011 about his recent work on Fenton-reaction mediated DNA damage in the presence of *Terminalia chebula* extract.

Dr. T. C. Ghose (Bioinformatics) participated in (i) International Interdisciplinary Science Conference-2011 at Jamia Millia Islamia University, New Delhi, November 2011; (ii) Biology and Bioinformatics of Economically Important Plants and Microbes at North Bengal University, Siliguri, W.B., February 2012; (iii) BTISnet annual Coordinators meeting at Shri Mata Vaishno Devi University, katra, Jammu, February 2012.

Dr. Zhumur Ghosh *(Bioinformatics)* (i) participated "Oncogenic Potential of Stem Cell Derivatives - A Road Map towards Safer Regenerative Therapy" presented at 2nd International conference on Perspectives of cell signaling and Molecular Medicine (Jan 8-12, 2012) organized by Bose Institute, Kolkata. (ii) talk delivered at a Bioinformatics workshop at Burdwan University entitled "Bioinformatics: some of the fundamentals and their applications" on 21.12.2011 organized by the Dept. of Microbiology, B.U.

Dr. Shubhra Ghosh Dastidar *(Bioinformatics)* Delivered talk at (i) "Albany 2011: The 17th conversation" held at State University of New York at Albany, NY, USA during June 14-18, 2011; (ii) DBT sponsored work shop at North east Hill University, Shillong during September 6-7, 2011; (iii) Lecture and sessions at the *workshop "Recent trends in molecular modeling and simulation in structural biology" at B.I.F. Kalyani University, held during 14th -18th November, 2011; (vi) "National Conference on Biology and Bioinformatics" at North Bengal University, during February 12-17, 2012; (v)* 'School of Biological Science, Nanyang Technological University, Singapore on March 13, 2012.

Dr. Anirban Bhunia / Dr. Subhrangsu Chatterjee (Biophysics) Presented poster at (i) Conference on Informatics and Integrative Biology, Kar, R., Jana, J., Ghosh, A., Bhunia, A. and Chatterjee, S. Designing of Novel G-Quadruplex Stabilizing Agents and NMR Spectroscopy of Telomeric G-Quadruplex; held at Bioinformatics Center, Bose Institute, Kolkata. (ii) 2nd International conference on Perspective of cell signaling and molecular medicine; Shah, S., Kar, R., Tejo, B. A., Chatterjee, S. and Bhunia, A. Solution Structure and Activity of New Antifreeze Peptides Derived from Leucospordium antarcticum Antifreeze Protein; held at Division of Molecular Medicine, Bose Institute.

Dr. Anirban Bhunia (Biophysics) delivered invited talk at (i) Indo-Russian conference on Glycoscience, which was held at Moscow, Russia and jointly organized by DST (India) and Zelinsky Institute of Organic Chemistry, Moscow, Russia (ii) 2nd NMR Users meeting, which was held at Pennag, Malaysia and organized by Bruker Malaysia BHD and also (iii) delivered four lectures in the workshop titled, "Workshop on Application of NMR in Chemical and Biological Sciences" which was held at North Eastern Hill University (NEHU), Shillong.

Dr. Subhrangsu Chatterjee (Biophysics) Presented a poster on G-Quadruplex Stabilizing Agents and NMR Spectroscopy of Telomeric G-Quadruplex at conference on Nucleic Acids in Disease and Disorder, held at IIT Delhi.

Dr. G. Basu (Biophysics) Invited lectures in (i) Coevolution of tRNAGln and its non-cognate partner GluRS in bacteria March 30, 2012 Sixth tRNA Group Meeting Indian Institute of Science, Bangalorel; (ii) When cis peptide bonds cannot be ignored International conference on Recent Advances in Chemical and Physical Biology, SINP March 6, 2012; (iii) Electrostatic discrimination of cognate and non-cognate partners in biology An interdisciplinary approach to soft-matter and biological physics IASBP2011 IACS/SINP December 3, 2011; posters in (iv) CH-pi interaction mediated stabilization of cisPro bond: New sequence motifs American Peptide Symposium Sheraton San Diego, CA USA June 25 30, 2011; talks delivered at (v) CH···pi interaction mediated stabilization of cisPro peptide bond: New sequence motifs Johns Hopkins University Department of Biophysics July 1, 2011; (vi) My encounters with Aib May 30, 2011 Department of Chemical Science University of Padova, Padova, Italy; (vii) Co-evolution of $tRNA^{Gln}$ and its functional partners in bacteria: A post-genomic analysis Ins Institut de Biologie Physico Chimique (Paris, France) 20 June, 2011.

Dr. Joyoti Basu (Chemistry) (i) participated in the Molecular Immunology Forum held in Matheran from February 10 to 12, 2012; (ii) delivered lecture in Indo-Swedish conference on Post genomic opportunities in tuberculosis and other mycobacterial diseases held in Unchagaon Fort, Garh Mukteswar from January 29 to 31, 2012; (iii) delivered lecture in Guha Research Conference from December 1 to 5, 2011; (iv) delivered lecture in Diamond Jubilee Celebration of Indian Institute of Technology, Kharagpur from November 11 to 12, 2011; (v) visited Linkoping University, Sweden in connection with Indo-Swedish Program from August 7 to 15, 2011.

Dr. Manas Chakrabarty (Chemistry) Participated, as a Member of the Organising Committee, the Scientific Subcommittee and the Adjudication Committee for Best Poster Presentation, in Acharya P.C. Ray National Young Scientists' Conference organised by Vivekananda Vijnan Mission, Vijnana Bharati, West Bengal Unit and held at Derozio Hall, Presidency University, Kolkata during 17.2-18.2.2012, and a former student, Dr. Ajanta Mukherjee, made an oral presentation entitled "An Expedient Synthesis of 2-Alkyl/aryl-1,8-phenanthrolines using Phase Transfer Catalyst-mediated Skraup/Doebner-von Miller Reaction" at the aforesaid Conference. Delivered on 1st September, 2011 an Invited Talk entitled "Green Chemistry: Concept, Understanding and Relevance to Society" in the 25th Training Programme on "Science Communication and Media Practice" organised by the Indian Science News Association, Kolkata and held at the University College of Science, Kolkata.

Dr. K. P. Das (Chemistry) (i) presented an invited lecture entitled "Protein Protein Interaction in Eye Lens: A Biophysical & Molecular Biological Approach" at the National Conference on Surfactants, Emulsions and Biocolloids, held at the Chemistry Department of Agartala University, Tripura. He also chaired a session at the conference, December 27-30, 2011; (ii)

chaired a session at the Acharya Prafulla Chandra Ray memorial symposium on Chemistry Today (2011) and Celebration of the International Year of Chemistry held at the Calcutta University, August 2-3, 2011 (iii) attended as the Organizer one day symposium on the Trends in Surface Science and Related Areas, held at the Jadavpur University, November 9, 2011; (iv) delivered a talk entitled: "Life a Chemist's Perception" on 29th February, 2012 at the St. Xavier's College, Kolkata; (v) gave an invited talk entitled: "Substrate recognition by eye lens protein α-crystallin a biophysical and molecular biological study" on September 10, 2011 at the Heritage Institute of Technology, Kolkata.

Dr. Jayanta Mukhopadhyay (Chemistry) presented a talk at HHMI Early Career Grant Competition as a semifinalist, 6-8th Nov 2011; Janelia Farm Research Campus, Ashburn. VA, USA.

Dr. M. Kundu (Chemistry) delivered lecture in 4th Congress of European Microbiologists FEMS2011 held in Geneva, Switzerland from June 26 to 30, 2011.

Dr. Soumen Roy (Chemistry) organized a minisymposium on "Networks in Biology" at the International Conference on Theoretical and Mathematical Biology by IISER Pune and delivered *plenary talks* at: (1) "Bioinformatica Indica", University of Kerala, Trivandrum on January13'th, 2012 (2) "National Workshop on Systems Biology", Pune on April 23'rd, 2011.

He delivered invited talks at (i) CSIR-IHBT, Palampur in "Workshop on Network Biology" on March 30'th, 2012; (ii) National Seminar in the Department of Applied Mathematics, University of Calcutta on March 15'th, 2012; (iii) Saha Institute of Nuclear Physics, Kolkata on August 19'th, 2011; (iv) Department of Physics, University of Calcutta, on April 6'th, 2011; (v) Department of Physics, Jadavpur University, Kolkata on April 1'st, 2011; (vi) participated in the Young Investigator Meeting, Lonavala during January 8-12, 2012 and was an invited participant at "An Interdisciplinary approach to soft-matter and biological physics" (IASBP2011) organized by SINP, Kolkata and IACS, Kolkata during December 2-3, 2011.

Dr. Tanya Das (Division of Molecular Medicine) visited Cleveland Clinic, Ohio, USA, during August to November, 2011 for a collaborative work. She delivered a special lecture on Unveiling the mechanism of angiogenesis: Role of smooth muscle cell and endothelial cell cross-talk in the Pathobiology Department of Cleveland Clinic, Ohio, USA, in November, 2011. Prof. Das participated in the symposium on *Recent trends in healthcare science and technology* and delivered an invited lecture on *Declaring war against human papiloma virus-infected cervical cancer: A difficult battle to win* at Bengal Engineering and Science University, India, in January, 2012. She acted as Convenor and delivered invited lecture in the 2nd International symposium on perspective of cell signalling and molecular medicine on A jopurney from cancer to cancer stem cell: an approach towards "resistance to apoptosis" switchover at Bose Institute, Kolkata in January, 2012. Prof. Das delivered an invited lecture on Chemogenetic approach to regulate the functional interplay between ATM signalling network during

sensitization of resistant tumor in 16th Human Genome Meeting at Sydney, Australia, in March 2012. She was invited to deliver a special guest lecture on Multi-focal signal modulation of cancer and cancer stem cells: 'p53' or 'not p53' that is the question at A Star, Singapore, in March, 2012.

Dr. Kuladip Jana (Division of Molecular Medicine) participated an invited lecture in International Conference on Molecules to System Physiology: 100 Years of Journey, held on September 21-23, 2011 in Department of Physiology, University of Calcutta.

Dr. Nripendranath Mandal (Division of Molecular Medicine) (i) participated in the 2nd International Symposium on "Perspective of Cell Signaling and Molecular Medicine" January 8-11, 2012 organized by Division of Molecular Medicine, Bose Institute, Kolkata, India; (ii) participated in the International Symposium on "Bioresources and Human Sustenance" on October 20-22, 2011 organized by Department of Zoology, Cotton College & Zoological Society of Assam (ZSA), Guwahati, Assam; (iii) delivered a special invited Lecture on "Importance of Biotechnology based research to control disease in Aquatic animal and Human" at the National Symposium on "Research In Animal Science: Development and Evaluation", March 19- 20, 2012, organized by the Department of Zoology, University of North Bengal, Siliguri - 734013, West Bengal; (iv) delivered a Lecture on "DNA markers linked to disease resistance in shrimp (Penaeus monodon)"at the International symposium on "From innovations in nucleic acids research to regulation of Biological processes", December 17-19, 2011, organized by Department of Microbiology and Molecular Biology, Indian Institute of Science, Bangalore.

Dr. Anup Kumar Misra (Division of Molecular Medicine) (i) delivered lecture in the DST meeting held at Lucknow University on October 15, 2011; (ii) delivered invited lecture in the National Chirality Conference (NCC-2011) held at M. S. University of Baroda, Vadodara, India, during December 2-3, 2011; (iii) delivered invited lecture in the Indo-US workshop on Green Chemistry for environments and sustainable developments held at H. N. B. Garhwal University, Dehradun, India, during March 11-13, 2012; (iv) delivered invited lecture in the National seminar on emerging trends in chemical sciences held at Gauhati University, Guwahati, India, during March 30-31, 2012.

Dr. Gaurisankar Sa (Division of Molecular Medicine) visited Cleveland Clinic, Ohio, USA, during July to November, 2011 for a collaborative work. Prof. Sa delivered a special lecture on 'Cancer: Targeting the abscence" in the Pathobiology Department of Cleveland Clinic, Ohio, USA. Prof. Sa participated and delivered an invited lecture on 'Novel Gain-of-Function of Transcription Factor FoxP3 as Co-transcription Factor for STAT3 in Regulatory T Cells in Tumor Milieu' in 16th Human Genome Meeting 2012 at Sydney, Australia in March 2012. He was invited to deliver a special guest lecture on 'Oncogenic Ras as a molecular target for genotoxic injury-induced cancer cell apoptosis' at A Star, Singapore, in March, 2012. Dr. Sa participated in the symposium on Recent trends in healthcare science and technology and delivered an invited lecture on 'Immune editing strategies of tumor to evade immune system' at Bengal Engineering and

Science University, India in January, 2012. Dr. Sa was invited to deliver invited lecture in the 2nd International symposium on perspective of cell signalling and molecular medicine on "Gain-of-function of $FoxP_3$ as co-transcription factor of STAT3 in regulatory T cells in tumor millieu." at Bose Institute, Kolkata in January, 2012. Participated in the Molecular Immunology Forum held in Matheran from February 10 to 12, 2012. Delivered Lecture in Guha Research conference from December 1 to 5, 2012 at Khijar.

Dr. P. C. Sen (Division of Molecular Medicine) (i) acted as resource person cum advisor to motivate secondary students of Sikim to participate in the "Innovative Research Initiative in Science" organized by the Sikim Council of Education Research and Technology at Gangtok on March 30, 2012; (ii) delivered an invited talk on "Water and Food Security" at Bengal National Chamber of Commerce and Industries on the occasion of Water Water Day organised by BNCC&I and NASI, Kolkata Chapter on March 22, 2012; Agartala Gov't Medical College organized by DBT on November 6, 2011 and Chaired a Scientific Session; (iii) organized as Secretary the 2nd International Conference on the "Perspectives of Cell Signalling and Molecular Medicine" during January 8-11, 2012 and Chaired a Session in the Conference; (iv) delivered an invited Plenary Lecture in the 4th International Conference of Molecular Medicine, Istanbul, Turkey, June, 27-30, 2011 (v) acted as Judge in the IRIS best poster selection for INTEL competition in New Delhi, Chandigarh, Bangalore.

Dr. S. Bhattacharya (Division of Plant Biology) (i) attended a seminar on "Sustainable crop productivity through physiological intervention" organized jointly by Department of Life Science , Ramnarain Ruia College, Mumbai and Indian Society for Plant Physiology, Pusa , New Delhi, held at Ramnarain Ruia College, Mumbai, India on November 24-26, 2011 and presented a poster. (ii) attended as an invited guest in the 31st Science, Agriculture and village industry fair-2001 organised by Garalgacha Science Club, P.O. & Vill Garalgacha, Dist. Hooghly and delivered a lecture on 'Application of tissue culture technique in improvement of agriculture' on 1st January, 2012.

Dr. Sampa Das (Division of Plant Biology) (i) visited and delivered a talk in Hemipteran-Plant Interactions Symposium during July 11-14, 2011 at Piracicaba, Brazil; (ii) delivered an invited talk in a Seminar on ENVIRONMENT as a part of Celebration of the World Environment day on June 5, 2011organised by Centre for Applied Science and Technology, Kolkata; (iii) delivered invited talk in a UGC sponsored seminar at Ramakrishna Mission Vivekananda Centenary College, Rahara on "NEW CHALLENGES TO STRENGTHEN OUR FOOD AND NUTRITIONAL SECURITY" on 8th September, 2011; (iv) presented as resourse person in a mentorship workshop of *Bio-CARe* (Biotechnology Career Advancement and Re-orientation Programme) for Women Scientists at Department of Botany, University of Calcutta on 15th November, 2011 organized by Department of Biotechnology, New Delhi; (v) delivered invited talk on a topic " A Proteomic Approach To Unravel the Mechanism of Action of Insecticidal Plant Lectins" in a International Conference on OMICS Meets Disease and 3rd Annual Meeting of Proteomics society' at Saha Institute of Nuclear Physics on 17th December, 2011; (vi) delivered an invited lecture entitled "Detection of early signaling molecules in plant defense response against biotic factors : A

Genomic - Proteomic approach" in a NATIONAL SEMINAR On "Genomics and Proteomics in Plant Science" on 9th March 2012 at Centre for Advanced Study Department of Botany, University of Calcutta; (vii) delivered an invited lecture entitled new challenges to strengthen the food and nutritional security of Indian citizens in a seminar on 11th March, 2012 at Botany Department, University of Burdwan; (viii) delivered a key note address on " Utility of plant and microbial resources" in a National Seminar on above topic on 17th March, 2012 in the department of Botany , Visva Bharati University.

Dr. Gaurab Gangopadhyay (Division of Plant Biology) (i) acted as the Coordinator and Resource person of Plant Science in the North-Eastern States Students' Training on Basic Science 2011 (NESST-BASE 2011) at Mayapuri Campus of Bose Institute, Darjeeling on 22nd 24th May 2011; compiled and prepared the booklet for the trainees; (ii) Ranjana Prasad, Vivek Arora, Marufa Sultana and Gaurab Gangopadhyay presented poster entitled "Data mining and sequence analysis for future tailor made crops" in the CIIB-2011 (Conference on Informatics & Integrative Biology) organized by Bioinformatics Centre, Bose Institute, Kolkata during December 14 16, 2011; (iii) invited to act as a counselor in the Directorate of Distance Education Programme of Vidyasagar University at Jogomaya Devi College P.G. Study Centre during August 2011 (taken two theoretical classes in the Personal Contact Programme); (iv) Dr. Gaurab Gangopadhyay presented a proposed collaborative research project entitled "Genotyping of Mulberry varieties developed at CSR&TI, Berhampore and development of linkage map for the important agronomic traits" in the Research Council meeting at Central Sericultural Research & Training Institute, Berhampore on 18.08.2011; (v) invited to act as Resource Person in the UGC sponsored National Seminar "Sustainable Resource Management: Myth or Reality" held at Uluberia College, WB: Delivered talk entitled "Sustainable management of plant genetic resources" in the Technical session on 18.11.2011; (vi) delivered invited talk entitled "Development of molecular markers in Mulberry" in the UGC sponsored National Seminar on Plant Science Research in Human Welfare organized by Department of Botany, Bidhannagar College, Kolkata in collaboration with BSI, held at Bidhannagar College on 12.01.2012; (vii) delivered invited talk entitled "Exploration of genetic diversity of Sesame through Phenomic and Genomic approaches" in the UGC, CSIR & DST (WB) sponsored National Level Conference on Biodiversity: Threats and Conservation through Traditional and Biotechnological Approaches organized by Departments of Botany, Zoology & Microbiology, Dum Dum Motizheel College (DMC), Kolkata in collaboration with Bose Institute and BSI, held at DMC on 05.02.2012.

Dr. Amita Pal (Division of Plant Biology) gave a lead lecture on "Applications of molecular markers in plant genomics" in the National Seminar on Emerging trend in Plant Science, held at the Barasat Government College at Barasat, North 24-Paraganas, West-Bengal on 15th July, 2011. She gave an invited talk on "Genomic and proteomic approaches to understand yellow mosaic disease related pathogenesis in *Vigna mungo*" in the 15th All India Congress of Cytology and genetics", held at the Department of Botany, Magadth University, Bodhgaya, Bihar on 22nd November, 2011 and chaired a technical session. Served as one of the resource persons in the

First Mentorship Workshop in the Eastern India, sponsored by DBT, New-Delhi on "How to Write a Project" held in the Department of Botany, University of Calcutta, Kolkata on 16th November, 2011 and give a talk entitled "Remember 5 Cs While Writing a Project". She gave an invited lead lecture on "Screening of superior genetic resources of *Bambusa balcooa* and identification of genes involved in fiber development" in the National Symposium on "Assessment & Conservation of Forest Genetic Resources through Biotechnological Interventions", held in the Institute of Forest Productivity (ICFRE), Aranyodaya, Lalgutwa, Ranchi on 19th and 20th December, 2011 and chaired a technical session. She gave an invited lead lecture on "Current understanding of molecular mechanisms of defense in *Vigna mungo* upon MYMIV infection" in the 3rd global conference on Plant Pathology for Food Security: Dr. Norman E. Borlaug Memorial Celebrations, held at Udaipur, from January 10-13, 2012 also chaired a technical session to conduct "Guman Devi Verma Best Women Scientist Award".

Participation of conference by Dr. Amita Pal's group member (Division of Plant Biology) Jayadri Sekhar Ghosh presented a paper on "Genetical and structural variations of ribosomal spacers: Useful molecular tool for bamboo systematics" In Plant Genome Evolution: A *Current Opinion* Conference at the Amsterdam, The Netherlands from 4th to 6th September 2011, Sponsored by Elsevier.

Dr. P. K. Saha (Division of Plant Biology) Visiting Professor at University of Burdwan for one month.

Mr. Bodhisattwa Saha (Division of Plant Biology) attended and gave Oral presentation at 45th Annual conference of the Indian college of allergy, Asthma and applied Immunology from 16th to 18th December 2011 at Aurangabad. Mr. Saha gave a Poster presentation at 2nd International conference in Perspectives of Cell Signaling and Molecular Medicine held during 8-11 January 2012 at Bose Institute, Kolkata.

Dr. Swati Sen-Mandi (Division of Plant Biology) delivered (i) invited lecture as resource person on "Medicinal Plant Genetic Resource: Molecular Documentation and Evaluation" at Centre for Advanced Studies, Dept. of Botany, Burdwan University on 1st March 2012 (ii) As guest speaker on "DNA profiling for authentication of drug plants" at St. Xavier's College, Kolkata on November 2011.

Dr. S.R. Sikdar (Division of Plant Biology) participated in the training programme on "Paradigm Shift in Science & Technology" organized by National Institute of Advanced Studies, Bangalore, Indian Institute of Science Campus, Bangalore 560 012 during 12-16 December 2011. Dr. Sikdar chaired a technical session on Microbial Biotechnology in the National Symposium on Frontlines of Microbiological Research: Concepts and applications, held during 2nd to 4th February, 2012 at University of Calcutta, organized by 'Indian Mycological Society' in collaboration with Department of Botany, University of Calcutta, Kolkata and in the same session a paper of his group entitled "Production and characterization of somatic hybrids

between edible mushroom strains *Pleurotus florida* and *Lentinula edodes*" was presented by his Ph.D. student Mr. Pijush Mallick.

Mr. Gaurab Sircar (Division of Plant Biology**)** attended and gave Oral presentation at 45th Annual conference of the Indian college of allergy, Asthma and applied Immunology from 16th to 18th December 2011 at Aurangabad.

Dr. Abhijit Chatterjee (Environmental Science**)** Served as resource person in NESST-BASE 2011 program held at Bose Institute, Darjeeling, India, in May 2011.

Dr. S. Bandyopadhyay (Physics/CAPSS) invited talk in (i) Workshop on Information and Security in Quantum World, ISI, Kolkata, March 2012, (ii) IWQI-2012, HRI, Allahabad, February 2012, (iii) UGC sponsored National Symposium on Quantum Information theory and Computer Science, J.C.C College, Kolkata, February 2012***, (iv)*** ISCQI-2011, IOP Bhubaneshwar, December 2011, (v) Workshop on Quantum Foundations in the light of Quantum Information III, Montreal, Canada, December 2011.

Dr. Bandyopadhyay acted as a resource person (i) "North-Eastern Students Summer Training Program" held at Bose Institute, Mayapuri campus, Darjeeling, May 2011, (ii) "DST-BASE" held at Bose Institute, Mayapuri campus, Darjeeling, August 2011.

He also visited (i) Department of Computer Science and Operational Research, University of Montreal, Montreal, Canada during October 2011 (two weeks) (ii) Department of Computer Science and Operational Research, University of Montreal, Montreal, Canada during December 2011 (1 week).

Dr. I. Bose (Physics) delivered on invitation a talk on " Mathematical analysis of a mycobacterial survival strategy under stress" at the International Conference on Mathematical Biology held in the Indian Institute of Science, Bangalore (July 4-7, 2011), delivered Keynote address on " Study of Condensed Matter Systems via Quantum Information Theory at CMDAYS 2011 organised by Gauhati University (August 24-26, 2011), delivered Keynote address on " Challenging prospects in condensed matter physics" at UGC sponsored National Level Seminar on Some recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions held at Susil Kar College, Champahati, West Bengal (September 2, 2011), a talk on " Routes to Binary Gene Expression" at UGC Sponsored National Seminar on Emerging trends in Biophysical Researches at Ramananda College, Bishnupur (September 12-13, 2011), a talk on " Magnetism: A Quantum Journey" at UGC sponsored National Level Seminar on Quantum Mechanics at Narasinha Dutt College, Howrah (November 24-26, 2011), a talk on "MicroRNA-mediated regulation of Gene Expression: Functional flexibility and noise-resistance at International Conference on Mathematical and Theoretical Biology at Pune (January 23-27, 2012), a talk on " How microorganisms cope with stress: role of gene expression noise in survival and adaptation" at 6th International Conference on Unsolved Problems on Noise and Fluctuations 2012 at SINP, Kolkata February 20-24, 2012), a talk on "Binary Gene Expression: Origins and Consequences" in Conference on Nonlinear Dynamics and Statistical Physics at the S. N. Bose National Centre for Basic Sciences, Kolkata (March 12-16, 2012); She also delivered on invitation

six lectures on Introduction to Mathematical Biology at the Department of Applied Mathematics, Calcutta University (February 6, 13, 14, 2012).

Dr. B. K. Chatterjee (Physics) attended and chaired a session at the seminar on "Some Recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions" held at Sushil Kar College, Champahati, on September 2, 2011.

Dr. Supriya Das (Physics) Delivered a lecture on "Pulse and Pulse Processing in Particle Detection" at WAPP 2011 in December 2011. Delivered the status report (on behalf of CBM-India Collaboration) on "GEM Developments at VECC" at CBM Collaboration Meeting at GSI, Darmstadt in March 2012. Participated in FAIR Physics meeting at NIAS during Dec 6-7, 2011.

Dr. Sanjay Kr. Ghosh (Physics) (i) served as resource person in the WAPP 2011 program held at Bose Institute, Darjeeling, India, in December 2011. (ii) delivered a talk on "Compressed baryonic matter" at the conference "Exploring the Cosmos" held at North Bengal University, December 15-16, 2011; (iii) delivered a talk on "QCD phase transition inside Neutron stars: effect of magnetic field" at the Winter Workshop on Astroparticle Physics held at Bose Institute, Darjeeling in December 15-16, 2011.

Dr. Dhruba Gupta (Physics) served as a member of the organizing committee of the Workshop and Winter School on Astroparticle Physics (WAPP 2011) held at Bose Institute, Darjeeling, December 17-29, 2011; delivered an invited talk on "Interaction of Radiation with Matter" at WAPP 2011; delivered an invited talk on "Astrophysical S-factor from nuclear reactions with a rare isotope beam of 7Be" at the ISRO Respond Review Meeting, Physical Research Laboratory, Ahmedabad, February 28-29, 2012.

Dr. R. Ray (Physics/CAPSS) participated in (i) NESST-BASE program organized by Bose Institute, at Darjeeling in May, 2012: Resource person in teaching advanced mathematics to school students of N-E India. (ii) Satellite meeting to (WHEPP 2012) held at VECC Kolkata, India, in January, 2012: "Mimicking QCD Phase diagrams through Models"; (iii) Workshop on High Energy Physics Phenomenology (WHEPP) held at Mahabaleswar, India, in January, 2012: Working group discussions on applications of QCD inspired models;

Dr. Ray also delivered lectures in (i) Winter School on Astroparticle physics (WAPP) organized by Bose Institute and Tata Institute of Fundamental Research, at Darjeeling in December, 2011: Lectures on elementary Astroparticle physics to selected college students; (2) DST-BASE program organized by Bose Institute, at Darjeeling in August, 2011: Lectures on advanced mathematics to school students of N-E India; (3) NESST-BASE program organized by Bose Institute, at Darjeeling in May, 2011: Lectures on advanced mathematics to school students of N-E India.

Dr. Swapan K. Saha (Physics/CAPSS) served as a member of the organizing committee of the Workshop and Winter School on Astroparticle Physics (WAPP 2011) held at Bose Institute, Darjeeling, December 17-29, 2011; delivered an invited talk on "Errors of observation" at WAPP 2011.

Dr. Rupa Sarkar (Physics) attended the seminar on "Some Recent Developments in Condensed Matter Physics: Cross-disciplinary Contributions" held at Sushil Kar College, Champahati, on September 2, 2011. She also attended and presented a poster on "Effect of Surfactant on the Second Metastable State in Superheated Emulsions" at Condensed Matter Days 2011 (CMDAYS-11) held at Gauhati University, Gauhati, during August 24-26, 2011.

Dr. Achintya Singha (Physics) delivered (i) Invited talk in 4th International workshop on Emergent phenomena in Quantum Hall (EPQH4) during June 23-26, 2011 at ICQM, Peking University, Beijing, Chine; (ii) invited talk in Prof. C. K. Majumdar Memorial workshop on Condensed Matter Physics in the Department of Theoretical Physics, Indian Association for the Cultivation of Science, Jadavpur, Kolkata held on November 11, 2011; (iii) invited talk in India-Australia International Workshop on Nanotechnology in Materials and Energy Application at Jadavpur University, Kolkata, during December 29-31, 2011; (iv) oral presentation in International Conference on Theoretical and Applied Physics (ICTAP) in the Department of Physics and Meteorology Indian Institute of Technology, Kharagpur, during December 1-2, 2011; (v) attended UGC sponsored National level seminar on Some recent developments in Condensed Matter Physics: Cross-Disciplinary Contributions held at Sushil Kar College, Champahati, on September 2, 2011; (vi) served as resource person in the WAPP2011 program held at Bose Institute, Mayapuri, Darjeeling during December 17 - 29, 2011.

Dr. T. P. Sinha (Physics) delivered an invited talk on "Electronic structure and optical properties of perovskite oxides" in Optics'11: A Conference on Light held at National Institute of Technology, Calicut (Kerala) during May 23-25, 2011. He also delivered an invited talk on "Optical properties of Perovskite Oxides" in the National Conference on Recent Trends in Materials Science held at Jaypee University of Information Technology, Solan (H.P.) during October 8-10.

Dr. Arun Kumar Chakraborty (Librarian) Invited to participate in (i) Fulbright Alumni Workshop on "Understanding your Personality type" on 14-15 July, 2011 organized by USEFI at American Center, Kolkata; (ii) Alumni workshop on "Experiential Leadership" on 23-24 September, 2011 at NEHU, Shillong; (iii) the 6th NASI SCOPUS YOUNG SCIENTIST AWARDS 2011 at New Delhi on 2nd February, 2012.

He also Invited to deliver lecture (i) as a resource person on 5th May, 2011 on "Responsibilities of Library Staff" at Administrative Staff College, University of Calcutta, Kolkata; (ii) External Practical Examiner for P. G. Even Semester Examination, May 2011 at Assam University, Silchar on 11th July, 2011 and also delivered lecture; (iii) resource person on 3rd August, 2011 at UGC Sponsored Refresher Course on "Resource Management in Academic Library : Systems and Tools" at Department of Library and Information Science, College Street Campus, University of Calcutta, Kolkata; (iv) resource person on 29th August, 2011 at UGC Sponsored Refresher Course on "Recent Trends in Library and Information Services" at Department of Library and Information Science, Jadavpur University, Kolkata; (v) act as an examiner of the thesis of MLIS in Digital Library Examination, 2011 and corresponding oral examination of the same on 12th

September, 2011 at Jadavpur University; (vi) keynote address on seminar on "E-Resources: Enhancing Learning and Research on 21st September, 2011 at Hotel ITC Sonar, Kolkata organized by Lippincott Williams & Wilkins; (vii) talk on Library Marketing in the Seminar "Library Connect: Partnering with the Library Community" organized by Elsevier and AICTE on 18th November, 2011; (viii) External Practical Examiner of Assam University, Silchar on 25th November, 2011; (ix) resource person on 14th December, 2011 at 4th Refresher Course in Library and Information Science being organized by the UGC Academic Staff College, Banaras Hindu University for College and University Teachers during 1-21 December, 2011; (x) Chair the Session on 3rd February, 2012 in the National Seminar on the theme "A Century of LIS education in India : past, present and future" to commemorate the centenary of LIS Education in India held during 02-04 February, 2012 at Bardwan University and also invited to deliver lecture on "Open Source Software teaching in LIS" on 3rd February, 2012; (xi) lecture on 24th February, 2012 in technical session of the National Seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata; (xii) Chair Technical Session on 2nd March, 2012 at a National Conference on "Digital Rights Management in Library" during 1-2 March, 2012 at Indian Statistical Institute, Kolkata; (xiii) special Guest and deliver lecture on "One day Seminar of INFLIBNET- N-LIST, Ahmedabad on User education" at Sudhiranjan Lahiri Mahavidyalaya, Nadia, West Bengal on 6th March, 2012; (xiv) expert member of different Assessment Committee(s) such as Satyendra Nath Bose National Centre for Basic Sciences, Indian Institute of Chemical Biology etc; (xv) Guest faculty in the IGNOU, Kolkata Centre for PGDLAN course; Rabindra Bharati University, Kolkata for MLISc. and BLISc.; Calcutta University for M.Phil Course; and external examiner for Assam University, Silchar, Jadavpur University and other Universities In Kolkata. (xvi) Supervised the M.Phil. dissertation entitled "a bibliometric study of the journal 'Bibliometric analysis of Indian Library and Information Science periodical Literature' 2000-2005" submitted at Department of Library and Information Science, University of Calcutta, Kolkata.

Sri Pradip Kumar Sarkar (Library) participated in the national seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata.

Dr. (Mrs.) Banhi Sikha Chaudhuri (Library) participated in the Half day Training cum demonstration programme on SciFinder cum by American Chemical Society, USA on 15th December, 2011 organised at Hotel Stadel, Saltlake, Kolkata.

Ms. Ananya Raha (Library) participated in the national seminar on 'Challenges in Library Management System' (CLMS 2012) during February 24 - 25, 2012 organized by IACS, Kolkata.

Ms. Sumita Dey (Library) participated in the Half day Training cum demonstration programme on SciFinder cum by American Chemical Society, USA on 15th December, 2011 organised at Hotel Stadel, Saltlake, Kolkata.

Service Departments

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

Acharya J. C. Bose Biotechnology Innovation Centre is being developed since 2006 at the Madhyamgram Experimental Farm with a view to provide proof of concept for developing new technologies emanating out of the work done at different laboratories.

In addition to provide facilities for field experimentation of conventional plant types, facilities have also been developed for carrying out transgenic plant development research work with biosafe green houses.

The following scientists utilized the facilities of the farm for growing their crops.

Name of the Scientists	Name of the crops grown / facility availed by the Scientist
1. Prof. P. K. Saha	Sesame
2. Prof. Sampa Das	Mustard, Chickpea, Rice, *Pigeon pea*, Garlic, Cotton
3. Prof. Amita Pal	*Vigna mungo, Vigna radiata*
4. Prof. D. N. Sengupta	Rice, Maize
5. Prof. S. R. Sikder	Mustard, Sesame
6. Prof. Debabrata Basu	Mustard, Tomato, *Sinapis alba*, *Chickpea*
7. Prof. A. N. Lahiri Majumder	Rice, Sorghum
8. Prof. T. K. Ghose	Rice
9. Dr. Subho Chowdhury	Rice
10. Dr. Pallob Kundu	Tomato
11. Prof. S. Gupta Bhattacharya	Pollen trapper

The following scientists utilized the facilities of the Transgenic Green Houses for growing their crops.

Name of the Scientists	Name of the crops grown by the Scientist
1. Prof. A. N. Lahiri Majumder	Rice, Porteresia
2. Prof. Sampa Das	Mustard, Tobacco, Cotton
3. Prof. Debabrata Basu	Mustard
4. Dr. Pallob Kundu	Tomato

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

Objectives : 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

Work done

Preparation of value added products : The main objective during the period was to utilize pressed dried flowers and leaves and embedded dehydrated flowers for preparation of different types of 'Floral Craft'. Dehydrated flowers and foliage have multipurpose application for preparation of 'Floral Craft'. 'Floral Craft' means skilful and artistic use of floral materials for making saleable articles for decoration purpose.

Utilization of Pressed dried flowers and leaves

Press dried materials were used for preparation of wide range value added products : artistic greeting cards, get well cards, wall hanging, wall plates, calender, pictures, landscape, table mats, costers, page markers etc.

Utilization of embedded dried flowers

Dried flowers were used for three dimensional arrangements in glass container for interior decoration, bouquets, gift boxes, pot pourries, flower baskets etc..



Table mats



Page marker



Three dimensional arrangements of dry flowers in glass containers



Land scape

Floral craft prepared from dehydrated pressed and embedded dehydrated leaves, flower petals and flowers.

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

Training

The main work during the period was to organize series of training programmes on "Dehydration of Flowers and Foliage and Floral Craft". The main objective of the training was to develop awareness about the dehydration technique and how the seasonal cultivated flowers and unutilized road side, hill side and rural flora can be converted into value added products. The training was very helpful to set up small scale cottage industry for dry flowers in rural areas. Rural women can earn money by making dehydrated raw materials, the demand of which is increasing day-by-day and/or dehydrated materials can be utilized to prepare saleable interior decorative items. This will increase the economic status of rural people.

Following trainings were organized :

1. Ramakrishna Mission, Sargachi, 02.11.11 03.11.11. [**No. of candidate 33**].



Preparation of Floral craft and Distribution of certificate

2-3 November 2011, Ramakrishna Mission, Sargachi, Murshidabad

2. In collaboration with Sreema Mahila Samity, Duttapulia, Nadia, 07.12.11 08.12.11. [**No. of candidate 33**].
3. In collaboration with Kautala Friends' Sporting Club, Kautala, Raidighi, 24-Parganas, 15.11.11 16.11.11. [**No. of candidate 40**].
4. In collaboration with Plassey Women and Human development Society, Jisu Bhavan, Plassey, Nadia, W.B., 04.01.12 05.01.12. [**No. of candidate 31**].
5. In collaboration with Bose Institute, at Falta Experimental Farm, Falta, 21-22, February, 2012 [**No. of candidate 12**].
6. In collaboration with North Sundarban Sandeshkhali Development Centre, Dhamakhali, Sandeshkhali, 24-Parganas (N), 27-28th February 2012 [**No. of candidate 75**].
7. In collaboration with Subash Nagar Creative Awareness Development Association, 2nd March, 2012 [**No. of candidate 36**].
8. In collaboration with Nalkora Pally Unnayan Samity, Nalkora, Sandeshkhali, 24-Parganas (N), 6th March 2012 [**No. of candidate 46**].

Total Candidate trained : 306



7-8th December 2011, Sreema Mahila Samity, Duttapulia, Nadia, West Bengal



Pressing, Embedding and Preparation of Floral Craft by trainees
Subhas Nagar Creative Awareness and Development Society, Kolkata, 2nd Feb. 2012

Central Instruments facility

The Central Instruments facility (CIF) of Bose Institute has been playing an important role to provide the infrastructural support to the researchers. Currently CIF is located partly in the Centenary Building (CB) and partly in the Main campus (MC). In the CIF (CB), several sophisticated equipments are available which are mainly required for Genomics, Proteomics and Materials Science related research. These include, MALDI-TOF/TOF, GC-MS, HPLC, Proteomics Work station, NMR, CD spectrometer, Confocal Microscope and FACS. In the Main Campus, the major equipments include SEM, EDAX, XRD, LS-Counter, Raman Spectrometer, AAS, DLS, Phosphoimager and FPLC.

Some of the equipments such as SEM, DNA sequencer and MALDI-TOF/TOF are particularly in high demand. Both in-house and external users use these facilities extensively. Recently the CIF provided DNA sequencing support to Prof. S. K. Ghosh, Department of Biotechnology, Assam (central) University, under whose leadership a barcoding campaign has been initiated to study the Biodiversity in North Eastern India.

Centre for Astroparticle Physics & Space Science : Darjeeling & Calcutta

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

- Study has been made on the dispersion of pollutants mainly respirable particulate matter over Darjeeling collected during October 2004 - September 2005. Atmospheric dispersion model has been applied to understand the annual behavior of the dispersion of aerosols. Several dispersion parameters have been estimated to determine the source strength of the pollutants. 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). 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.

- Study has been made on the optical attenuation of solar radiation (aerosol optical depth) due to the columnar loading of aerosols over different seasons over Darjeeling. The variation in AOD shows higher values during premonsoon and winter compared to other seasons over Darjeeling. The loading of transported dust particles during premonsoon could enhance the AOD whereas the high AOD during winter was due to the high loading of anthropogenic aerosols generated locally. However these two combined effect shows that natural aerosols are quite efficient as anthropogenic aerosols to attenuate the incoming solar radiation during respective seasons.

- Study has been made on the **seasonal and diurnal variation Black Carbon (BC) aerosols** over Darjeeling. Higher concentration was observed during premonsoon and winter. The premonsoon loading of BC was due to the locally generated as well as long-range transported aerosols. On the other hand, massive biomass burning during winter enhanced the loading of BC aerosols. The diurnal variation of BC shows that, the concentrations of BC peaked up during morning hours and remained higher till early afternoon. During evening, 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 to night.

- Study has been made on the **interaction between aerosol and rain** over Darjeeling. It was observed that Black Carbon aerosols were washed out more by light rain which occurs for longer duration compared to the heavier rain which occurs for shorter duration. We have applied the radiative transfer model to find out the effect of washing out of BC on the optical attenuation of aerosol before and after the rain. It was observed that light rain was more efficient to lower the radiative heating rate of the atmosphere and hence cool the atmosphere compared to a heavier rain with longer duration.

Collaboration between Bose Institute and Massachusetts Institute of Technology, USA for real-time monitoring of Green House Gases over Darjeeling.

A MoU has been signed between Bose Institute and MIT, USA for the collaborative study on the continuous and real-time monitoring of Green House Gases over Darjeeling and the study has already been initiated since November, 2011. The primary objective of this study is to find out the formation, transformation and transportation of several Green House Gases over eastern Himalaya at seasonal scale. The impact of loading of these GHGs on the atmospheric heating rate, radiative forcing and hence on the net increase in temperature are being studied. The physical and chemical interaction of these GHGs with other trace gases and particulate pollutants will also be studied.

Manpower Development

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

Prof. Sanjay K. Ghosh : Coordinator

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

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. In the year 2011, 18 students (two more than the previous years) have been admitted through written test and interview.

Outreach Programme

NESST-BASE 2011:

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, 2011. 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. One day popular lecture was arranged on 25th May 2011. The school children from Darjeeling were also invited on this occasion. The lectures were delivered by Prof. A. K. Patra from National Atmospheric Research laboratory, Gadanki, Tirupati on "Ionosphere in the near earth space environment", Prof. A. R. Sinha from National Institute of

Advanced Studies, Bangalore on "On monkeys and men: Studying primates in India" and Prof. A. Kembhabi, Director, Inter University Centre for Astronomy and Astrophysics on "Astronomy in Present day India.

DST-BASE 2011

This year we have started a programme "Darjeeling Students Training on Basic SciEnces (DST-BASE), a hands- on training on basic sciences exclusively for the school students (class XI mainly) of Darjeeling. This year progremme was held during August 18- 22, 2011. 27 and students and 9 teachers participated in this programme.

Manpower development

As a part of our commitment to develop trained manpower, we organize each year, alternatively at Ooty and Darjeeling, a winter workshop followed by a Winter school on AstroParticle Physics (WAPP). This year school was held at Bose Institute Darjeeling. 24 students (mainly pursuing their masters) from all over India participated in this school. The main objective of this school was to give hands-on training to these students on state-of art instrumentation used in the persent day Astroparticle Physics research and to make them aware of the research challenges in this area. Several eminent physisicts from USA as well as Europe participated in this programme as resource persons.

Environmental Sciences Section

Studies on Atmospheric Particulate Matter and Trace Gases over Darjeeling : Dr. Abhijit Chatterjee and Dr. S. Raha

Study has been made on the **dispersion of pollutants mainly respirable particulate matter** over Darjeeling. Atmospheric dispersion model has been applied to understand the annual behavior of the dispersion of aerosols. Several dispersion parameters have been estimated to determine the source strength of the pollutants. 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). 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.

Study has been made on the **optical attenuation of solar radiation (aerosol optical depth) due to the columnar loading of aerosols** over different seasons over Darjeeling. The variation in AOD shows higher values during premonsoon and winter compared to other seasons over Darjeeling. The loading of transported dust particles during premonsoon could enhance the AOD whereas the high AOD during winter was due to the high loading of anthropogenic

aerosols generated locally. However these two combined effect shows that natural aerosols are quite efficient as anthropogenic aerosols to attenuate the incoming solar radiation during respective seasons.

Study has been made on the **seasonal and diurnal variation Black Carbon (BC) aerosols** over Darjeeling. Higher concentration was observed during premonsoon and winter. The premonsoon loading of BC was due to the locally generated as well as long-range transported aerosols. On the other hand, massive biomass burning during winter enhanced the loading of BC aerosols. The diurnal variation of BC shows that, the concentrations of BC peaked up during morning hours and remained higher till early afternoon. During evening, 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 to night.

Study has been made on the **interaction between aerosol and rain** over Darjeeling. It was observed that Black Carbon aerosols were washed out more by light rain which occurs for longer duration compared to the heavier rain which occurs for shorter duration. We have applied the radiative transfer model to find out the effect of washing out of BC on the optical attenuation of aerosol before and after the rain. It was observed that light rain was more efficient to lower the radiative heating rate of the atmosphere and hence cool the atmosphere compared to a heavier rain with longer duration.

Studies on Atmospheric Particulate Matter over Kolkata

The effect of firework activities on air quality was assessed from the ambient concentrations of PM10, water soluble ionic species, metals and SO_2 over Kolkata metropolis, India during Diwali festival in November 2010. PM10 concentrations on Diwali night were found to be ~ 5 times higher than the normal day night-time average concentration. The increase in night-time concentrations of the metals on Diwali spanned over a wide range (Al, Zn, Pb and Cd showed 5-12 times, Cu, Fe and Mn showed 25-40 times and Co and V showed 70-80 times increase in concentrations) compared to night-time concentrations on normal day. The water soluble ionic species showed 1.5-6 times higher concentrations on Diwali night than normal day. The remarkable increases were found for K^+, Ca^{2+}, Mg^{2+} and SO_4^{2-}. The diurnal variation of PM10 and SO_2 was also studied in one of the sites which showed their maximum concentrations on Diwali night during 8 PM 3 AM indicating maximum firework activities during this period. PM10 and SO_4^{2-} concentrations increased by ~ 5 times than normal day during this period at this site. The extensive use of firecrackers during Diwali festival was found to have significant effect on the high increase of these air pollutants which could be associated with the serious health impacts and thus use of firecrackers in this kind of festival in a highly populated metro-city like Kolkata, India needs to be controlled where air pollution is an acute problem throughout the year.

Aerosol of different sizes has been collected over Kolkata using several aerosol samplers. On an average, samples are being collected thrice a week day and night-time basis. This would help us to get the idea of diurnal variation of aerosol particles over Kolkata. We have observed a strong seasonal dependence of aerosols with the maximum concentration during winter followed by summer. Monsoon shows minimum concentration due to wash out of aerosols from the atmosphere due to heavy rain. Continuous monitoring of atmospheric black carbon particles has also been started over Kolkata. The data is being collected at an interval of 5 mins.

Studies on Atmospheric Particulate Matter over Falta

Aerosol particulate matter has been collected over Falta using high volume and fine dust samplers. On an average, samples have been collected twice a week. The aerosol concentration shows significant differences from Kolkata. It shows much lower concentration in all the seasons compared to Kolkata. After the analysis of several ionic components of aerosols we observed that the effect of various anthropogenic components like nitrate, sulphate etc is minimum whereas the sea-salt particles contributed a lot in the loading of total aerosols over Kolkata. This could be due to its close proximity to the Bay of Bengal.

Campaign study on aerosol over Darjeeling, Kolkata and Falta

A campaign study has been conducted during February-March over three stations, Darjeeling, Kolkata and Falta for measuring aerosol concentrations and aerosol optical properties. Aerosols have also been collected at different size bins over all the stations. We observed a significant variatioin in aerosol concentrations between the stations. It was highest in Kolkata and comparable to Darjeeling followed by Falta where we found the minimum concentration. Chemical characterization of aerosol particulate matter for all the stations show clearer signature of sea-salt particles over Falta whereas anthropogenic activities were found to be reflected more in Kolkata and Darjeeling.

Analysis of various samples from other Institutions and Universities

ESS has served for other institutions and universities towards the analysis of several samples using Ion Chromatograph, HPLC and AAS. This includes the analysis of water soluble ionic species, water insoluble species, biogenic compounds, toxic heavy metals etc.

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" and "Mushroom Cultivation, Vermicompost Production, Apiculture, Sericulture and Commercial Exploitation of Dry Flowers" during September 8-20, 2011 and February 18-March 2, 2012 respectively. Total thirty-two trainees were trained in the above two training programmes.



Trainees along with Mr. Hirak Ghosh, Chairman of the Advisory Committee, Rural Biotechnology Programme, Prof. Sibaji Raha, Director Bose Institute other resource persons and supporting staffs of Falta Experimental Farm during the inauguration of training programme on "Mushroom cultivation, Vermicompost production, Apiculture and Sericulture" held during 8-20 September, 2011.



Mr. Hirak Ghosh, Chairman of the Advisory Committee, Rural Biotechnology Programme, Falta Experimental Farm, Bose Institute was distributing certificates to the trainees in the valedictory session of the training programme on "Mushroom cultivation, Vermicompost production, Apiculture, Sericulture and Commercial Exploitation of Dry Flowers" held during 18th February 2nd March, 2012.



Mr. L.C. Porel (extreme right), the resource person for vermicompost programme was demonstrating a portable vermicompost bed to the trainees during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture, Sericulture and Commercial Exploitation of Dry Flowers" held during 18th February 2nd March, 2012



The trainees along with silkworm cocoons on "Chandraki", they produced during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture, Sericulture and Commercial Exploitation of Dry Flowers" held during 18th February 2nd March, 2012.



The trainees were getting hands on training on apiculture during the training programme on "Mushroom cultivation, Vermicompost production, Apiculture, Sericulture and Commercial Exploitation of Dry Flowers" held during 18th February 2nd March, 2012.

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 puboications are now available for sale : J. C. Bose and Microwaves A collection : Rs.200.00; Science and Society Reeflections : 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 to the BI faculty, researchers and staff members and students of an 'Integrated M.Sc.-Ph.D. Programme on Life Sciences and Physical Sciences" (duration approximately 6-years) which has been introduced at the Bose Institute, Kolkata, in collaboration with the University of Calcutta in 2011 for their day-to-day research and development work. Library also extend its Physical Library also facilities to other Institutions / universities / R&D organisations in and around Kolkata. Library also regularly provides document delivery services and other services to Faculty / researchers. Library also extends their services to all DST and CSIR Institutes in India.

The library has total collection of 41,782 reading materials out of which 27,597 Bound journals, 13704 Books, 481 Theses as on 31.03.2012. Library also having a huge collection of other materials including Sir J. C. Bose collection. Library has subscribed to more than 5000 online journals in different packages. Library also subscribed to online-only full-text journals / databases of different academic societies such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier, 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 e-books packages such as : E-Books of E-brary, E-Books of Cambridge University, Physics E-Books package, E-Books package of Elsevier: Agricultural and Biological Sciences; Biochemistry, Genetics and Molecular Biology; Environmental Science. Current Protocols.

Bose Institute Library Activities:

Collection Development:

Collection	*Total as on 31 .03.2011*	*Added during 2011-12*	*Total as on 31 March 2012*
Books	13169	535 nos.	13704
Theses	472	9	481
Online Journals	300	25	325
E-Journals Packages	5000	500	5500
New Journals	25	42	NA
Bound Volumes of Journals	27198	399	27597

Other Collection

Sir J.C. Bose Collection

Reports, Newsletters, Annual Reports of other Institute(s), Publication of Bose Institute etc.

Back Volume Journals (online)

Scientific Software (s)

Access Management of Resources

All Library resources can be accessed by Bose Institute Library faculty / scholar from any campuses of Bose Institute as well as all campus. 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.

Resources of Bose Institute Library

A. Journals Resources

Items
E-journals are accessable from bose Institute Library Website (www.boseinst.ernet.in/library)
Library subscribed to major publishers journals such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier, John Wiley & Sons, Inc, IOP, AIP, APS, Adenine Press , Cambridge Jorurals Online, The Company of Biologists. EDP Sciences, Emerald Publishing Group /MCB University Press, Genetics Society of America, IEEE, Indian Academy of Sciences, Informa Healthcare, Japan Institute of Heterocyclic Chemistry, Japan Publications Trading Co. Ltd., Japanese Society of Allergology, Kluwer Academic Publishers Group (KAPG))/Springerlink, Landes Bioscience, Microbiology Research Foundations, National Academy of Sciences, Physical Society of Japan, Polish Academy of Sciences, Portland Press, Reed Business, Rinton Press, Rockefeller University Press, Royal Society of Chemistry journals/ Turpin Distribution UK, Thieme, Landes Bioscience, Karger. Library also subscribed to Science@direct of Elsevier and all Nature Group Journals online.

B. Databases

Items
Library also subscribed to different databases such as :
Century of Science - Science Citation Index Expanded and
ENDNOTE Web of ISI Web of Science, Thompson, USA.
SCOPUS the largest abstract and citation database of research literature and quality web sources of Elsevier.
SCIFINDER of ACS.
The library has also full-text databases of H.W.WILSON.
Blackwell / John Wiley Journal's Premier Online.
Current Protocols (Online) of John Wiley / Blackwell.
Annual Reviews Online (Back volume).
Methods in Enzymology (Online).
Science of Synthesis The Electronic Version

C. Open Access Membership

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

D. New Addition(s) in 2011-2012:

During the year 2011-2012 Library subscribed to a good number of new back volume journals, E-Books and software(s) such as:

E. New journals :

Journal Title	Journal Title
Science Signaling	Nanomedicine
Journal of Organic Chemistry	Personalized Medicine
Journal of biomedical nanotechnology	Expert Review of Clinical Immunology
Journal of nanoscience and nanotechnology	Expert Review of Endocrinology & Metabolism
Blood	Expert Review of Molecular Diagnostics
Down to Earth Magazine	Expert Review of Proteomics
Biochemical Pharmacology	Indian Journal of Theoretical Physics **Print only** (ISSN:0019-5693)
Fertility and Sterility	Heterocycles (OL)
Free Radical Biology & Medicine	RNA Biology
Journal of Theoretical Biology	Evolutionary Bioinformatics
Molecular Cellular Endocrinology	Clinical Infectious Diseases
Reproductive Toxicology	Human Reproduction
The Lancet	Journal of Infectious Diseases
Endocrinology	Molecular Plant
Biomarkers in Medicine	Nanoscale
Clinical Lipidology	Organic and Bimolecular Chemistry
Diabetes Management	Biology Reproduction
Epigenomics	The Journal of Parasitology
Future Medicinal Chemistry	Helicobacter
Future Microbiology	International Journal of Andrology
Future Virology	

F. Back Volume Journals

Elsevier Backfiles on ScienceDirect	Wiley Blackwell Journal Back files
1. Biochemistry, Genetics and Molecular Biology	1. Biotechnology, Biochemistry and Biophysics
2. High Energy Physics	2. Physics
3. Cell Press	3. Immunology
	4. Microbiology

G. e-Books :

E-Books

Oxford Scholarship Online Physics 6 Module

1. Atomic Leasor and Optical Physics
2. Codensed Mater Physics/Material
3. Nuclear & Plasma Physics
4. Partical physics / Astrophysics / Cosmology
5. Soft matter/Biological Physics
6. Theoretical. Computational and Statistical Physics

H. Book(s) added. : 535 nos.

I. Thesis added : 9 Nos.

J. Scientific Software(s)

Name of Software
Metamorph (Molecular Devices), Multiuser subscription.
Genomatix software subscription:
MatInspector and MatBase Individual Online Account 12 months license ---Quantity-2
Gaussian09 for (Multiprocessor) Windows Version for 2 Users,
Gauss VIEW 5 Windows Version for 2 users
Sigma Plot 12- Five user perpetual license1 Set
Vector NTI static non-expiring academic license A13786 X 2
Vector NTI advance academic 1 year license 12605099 X 2
Vector NTI advance academic 3 year license 12605103 X 2.

K. iThenticate : - A Plagiarism checking software:

iThenticate is the leading provider of professional plagiarism detection and prevention

technology used worldwide by scholarly publishers and research departments to ensure the originality of written work before publication. iThenticate helps editors, authors and researchers prevent misconduct by comparing manuscripts against its database of over 20 billion web pages and 116 million content items, including 30 million published works from nearly 300 scholarly publisher participants of CrossCheck.

L. Resources through NKRC

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 to all faculty/ scholars of DST / CSIR Institutes and also other institutes in India. It is expected to have more journal purchase through consortia from next year. Library is also member of FORSA Consortia.

Services and Management

Collection	Total as on 31 March 2012
Books Issued	119
Bound Volume Journal Issued	214
Loose Journal Issued	121
No. of Readers	2532
Internet Accessed (in hours)	7549
Scans	36801
Photocopies	117493

Services :

Reader's Service

The library is open to faculty member and scholars for reading and consultation during working hours from 9.45 AM to 6.15 PM (Monday to Friday).

Faculty members / scholars can access E-resources from any of the seven campuses of Bose Institute.

Faculty members also can access E-resources from off campuses/ home access.

Technical Query Service	Bose Institute Library responds to any query related to information regarding research insights, reference management, database(s) access or any access related issues of Bose Institute Library collection or using Library OPAC.
Document Delivery Service	Bose Institute Library also provides article resources to all faculty/ scholars of DST / CSIR Institutes and also other institutes in India.
Inter Library Loan Service	The library issues out its publications on 'Inter Library Loan' to the users of other libraries mostly research institutes who have Inter Library Loan arrangement(s) with Bose Institute Library.
Institutional Membership	The library is member of various International and national organization(s) Biomed Central (BMC), Public Library of Science (PLoS), ***International Federation of Library Associations*** and Institutions (***IFLA),*** International Society of Tea Science (ISTS), ***Indian Association of Special Libraries And Information Centres (IASLIC) etc.***
e - Journals Access	The library has started providing access to electronic journals subscribed by Bose Institute Library as well as subscribed through National Knowledge Resource Consortia (NKRC).
User Awareness Programme	Library conducts user orientation programmes time to time for the benefit of users and optimal utilization of subscribed resources. User orientation programme also includes Reference management for publications, citing references in thesis, using databases, citation report, h-index compilation, using different scientific software, using of anti-plagiarism software etc.
Reprographic Service	The library provides reprography services to its users.Photocopy services are provided to all research workers of the institution. A total 4,62,990 pages of photocopies were given to our faculty and outside users. Library also provides scanning services to its user.

Workshop

The Workshop of Bose Institute has been functioning as a full fledged Section, catering the various job requirements of different departments of Bose Institute. The Workshop of Bose Institute consists of the following units of maintenance, repair and fabrication of different instruments.

Units	Requisitions receipts	Job discharged	Continuing job
Electrical	890 (M.C. & C.B.)	100%	Nil
Mechanical	72	95%	5%
Carpentry	59	97%	3%
Refrigeration	15	100%	Nil
Drafting	20	100%	Nil
Lecture, Seminars & course work class attended	200	100%	Nil

The Mechanical Section has fabricated various types of Gel Electrophoresis apparatus such as Submarine Gel, Perspex combs, Eppendrop holder for ultrasonicator bath, "L" shaped Guard & Perspex shield, cover of Incubator, Replica of Photosynthetic bubbler, different types of Perspex box, Trolly, Tray for A.C. machines, a special Perspex box for cosmic ray Scintillator detector with stand etc.

Electrical renovation work and new power line arrangements have been carried out in various campus & departments of Institute, CAPSS, Madhyamgram Experimental Farm, Darjeeling Campus (Mayapuri) & Falta Experimental Farm. The Fire Alarm System & Fire fighting equipments at various premises of Bose Institute are also under the supervision of Workshop. The transport system of the Institute including the allotment of Institute vehicles and their maintenance are also under the direct supervision of Workshop.

The Carpentry unit is an very essential unit of Institute. This unit has done various type of wooden furniture, projector stand, locking arrangement of door, door closures fitting and any kind of repairing work of furniture of various laboratories etc.

The Store unit purchased building, electric & carpentry materials through process against departmental requisitions and issued various materials which were recorded in Cardex system and also processed bills of all purchased items.

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Socially Relevant

Dr. Manas Chakrabarty (Chemistry) The synthetic method developed is likely to be utilised for preparing lead molecules for their screening as antitumour compounds.

Dr. Kuladip Jana (Division of Molecular Medicine) *Non-surgical Contraception of Male Dogs with a Calcium Chloride Based Drug Chemisterisol: Clinical Evaluation and its Mechanism of Action. (Dr. Kuladip Jana, Molecular Medicine)*

Sterilization has long been recognized as the most effective means of controlling pet populations. However, with the enormous number of owned and un-owned dogs in India, the sterilization programs currently available are not enough. Mostly the population control for male dogs has been accomplished through surgical sterilization, i.e. orchidectomy. However, it carries the risks that inherent in any surgical procedures. Furthermore, many people are unwilling to subject their pets to what they perceive to be a painful and invasive procedure. In addition, when considering dog populations where permanent sterilization is desired, surgical methods can be expensive to be performed on a large scale. Presently a viable alternative to surgical sterilization is being intensively investigated. Although, a variety of compounds have been tested, some of which were either safe but not effective or vice versa. Moreover, we have evolved a new sterilizing preparation where calcium chloride (dehydrate) dissolved in normal saline with lignocaine hydrochloride; local anesthetic, a preservative, and several minor ingredients (Chemisterisol), to sterilize dogs. Now we have already been established that Chemisterisol is the potential drug for androgenesis-eliminating nonsurgical contraception of male dogs in addition to its proven efficacy in cats and other domestic mammals.

Dr. Nripendranath Mandal (Division of Molecular Medicine) The major theme of research program from Dr. N. Mandal's laboratory, has been classified in two major fields of **Marine** and **Medical Biotechnology** to address the basic socio-economic problems due to some important diseases in the area of disease management in aquatic organism as well as human system.

Shrimp aquaculture industry with *Penaeus monodon* is one of the most important industries throughout world including India. But, the White spot disease caused by WSSV is a major threat which continues huge economic destruction to this industry. For the first time, some DNA markers have been developed from Dr. N. Mandal's laboratory marine biotechnology research, which will play an important role in overcoming this disease related problem. Distribution of disease resistant shrimp and WSSV prevalence among entire coastal area of India is very important for the same purpose. This technology can be very useful to identify disease resistant broodstock for generation of disease free shrimp aquaculture as well as to understand the molecular pathogenesis of viral diseases in shrimp system. Finally, 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.

From the prevention point of view, early prediction of CHD using various newly developed biomarkers from study of biochemical, immunological and genetic parameters in the field of medical biotechnology from Dr. N. Mandal's laboratory, will be very important to control the disease. Research outcome from this arena will be useful to develop biometric chip for screening the risk of CHD among Asian Indians from Eastern part of India within very short period of time.

Major outcome from another medical biotechnology research program from Dr. N. Mandal's laboratory, will play a major role to develop alternative better and safer medicine for non communicable diseases, including cancer where existing therapeutic approaches have not been successful due to lack of specificity between normal and cancerous cells, leaving apart the detrimental side effects. For the first time, active principles isolated from *Spondias pinnata* have been screened for their potential antioxidant and anticancer activities which will hopefully serve the purpose. The findings will also cause building up of large industries that will help the government in mass employment.

Dr. S. Sen Mandi (Division of Plant Biology) In recent years focus on alternative medicine involving a wide range of medicinal plants call for Documentation and Evaluation of the rich diversity of plant genetic resource available in the country, particularly in the NE region. Research in this laboratory focuses on a) authentication of plant identity through development of Species Specific DNA markers for supplementing conventional drug assessment protocol and b) development of medicinal/nutraceutical-Trait Related DNA markers for use in germplasm screening for exploring wild germplasm towards identification of non-conventional source of medicinal compounds.

In addition to molecular characterization of medicinal plants, cash crops that play a major role in the socio-economic development of North-East India viz. bamboo also constitute our study material. In this context DNA fingerprinting of bamboo genotypes and development of trait related DNA markers have been established *for cyanogen (a poisonous compound that restricts use of bamboo in production of fermented foods) and antioxidant.* Such studies cater to the need of bamboo based industry for fermented food and neutraceuticals.

Bearing in mind the effect of environment in availability of medicinal compounds in plants our studies have focused on plants collected from different altitudes with variation in UV irradiation. Using, tea plants, our studies have established positive effects of UV irradiation as different from the generally perceived damaging effect of UV. Under the HRD activity of this programme Hands-on-training on DNA Fingerprinting have been provided to:

- One Junior Research Fellow, Karimganj College, Silchar, Assam on RAPD analysis of different species of orchids.
- One Post Graduate student, Dept. of Biotehnology, St. Xavier's College on RAPD analysis of accessions of Vinca rosea.
- One Post graduate student, NEHU, Shillong on RAPD analysis of accessions of Acorus calamus.

List of Personnel

Administration

Dr. Sibaji Raha	*Sr. Professor & Director*
Sri Tushar Kanti Ghorui	*Registrar (till 31.05.2011)& Officer on Special Duty (from 01.06.2011)*

Centenary Campus: Debidas Saha (Retd. on31.3.2012), Parimal Ch. Das, Tapan Datta, Arup Kr. Sengupta (Retd. on 29.12.2012), Sankar Nath Sinha, Subir Sen, Ashis Chakraborty, Noreen Bhattacharjee, Sougata Banerjee, Umesh, Sisir Chakraborty, Bidyut Kr. Mandal, Manick Ch. Das, Ankur Dutta, Nikhilesh Roy Ghatak, Amit Kr. Ghosh, Baladeb Goswami, Rina Roy, Amitabha Bhattacharjee, Ram Raj Pandey (Retd. on31.1.2012), Elizabeth Pal, Dhrubajyoti Sen, Mantu Bhattacharjee, Achintya Mukherjee, Supriyo Das, Narender Chauhan (Joined on 2.12.11), Vineet Kr. Tandon (Joined on 01.12.11), Rubi Sarkar, Sudam Jana, Bably Marick, Rina Das, Somnath Das, Prodip Kr. Mullick, Sanjoy Krishna Chaki, Debasis Kaley, Angshuman Bhowmik, Sanjib Kr. Das. Biplab Malakar, Satyabrata Chatterjee, Ramesh Chandra Sarkar, Dipak Dutta, Chotelal Rangwa, Tapan Kr. Banerjee, Jubaraj Paul, Krishna Turi, Sudhir Turi, Khoirul Basar Malla, Nagnarayan Yadav, Kanai Hazra, Prafulla Bhunya, Kanak Baran Hazra, Duryodhan Nayak, Bablu Mandal, Sukanta Chakraborty, Subrata Banerjee, Ranjit Das, Sarada Devi, Sukumar Mandal, Bulaki Das, Jagabandhu Nayak, Jagannath Das.

Main Campus: Tarun Kumar Maji, Rabindra Nath Karmakar, Chandra Kanta Sasmal, Sanat Kr. Dey, Mahendra Nath Shee, Madhusudhan Marick, Sanat Kr. Dhara, Kalicharan Turi, Munna Turi. Kodan Das, Rajbrat Ram, Rajkumari Balmiki, Tapas Chakraborty.

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

Faculty: Dr. S. K. Dutta (CSIR-ES), Dr. S. Raha, Director & Chairman, Dr. P. K. Saha, Scientist & Executive Chairman

Students/RA/Project Assistant : Dr. Supriya Roy (Resigned on 20.03.12), Dr. Gargi Biswas, Dr. Saurav Bhattacharya, Mr. Asis Kumar Dalal, Mr. Atanu Deb, Mr. Sudipta Roy (Terminated on 31.03.12), Mr. Prabir Banerjee (Resigned on 20.06.11), Mr. Debraj Chakraborty (Joined on 22.08.11 & Terminated on 31.03.12), Mr. Bapi Dey;

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Administration

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Supporting Staff: (Field): Mr. Pulak Kumar Roy, Mr. Rakhal Chandra Jana (Retired on 30.04.11), Mr. Sukumar Das (Retired on 31.01.12), 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, Dr. Rajagopal Chattopadhyaya, Professor, Dr. Ajit Bikram Datta, Assistant Professor and Wellcome Trust-DBT India Alliance Intermediate Fellow, Dr. Pradip Kumar Parrack, Professor, Dr. Anuradha Lohia, Sr. Professor, Dr. Srimonti Sarkar, Associate Professor (From 01.09.11), Dr. Subrata Sau, Associate Professor, Dr. Pratima Sinha, Sr. Professor.

Students/RA/Project Assistant : Dr. Subhash Haldar (upto 21.03.12), Dr. Tanaya Chatterjee, Dr. Snehasish Basu, Mr. Soumyananda Chakraborty, Mr. Himadri Biswas, Mr. Rajkrishna Mondal (upto 15.12.10), Mr. Jaspreet Singh Grewal, Ms. Debadrita Mukherjee (30.08.11), Mr. Amitava Bandhu (30.09.10), Mr. Abinit Saha, Mr. Avisek Mondal, Ms. Aditi Ghosh, Ms. Aritrika Pal, Ms. Subhanwita Sarkar (13.01.12), Ms. Devlina Chakraborty, Mr. Prabal Chakraborty (05.07.11), Mr. Biswanath Jana, Mr. Sandeepan Sengupta, Ms. Indrani Kar Ms. Gopa Dhar, Mr. Chanchal Mallick (Upto 14.11.11). Ms. Priyadarshini Saha (From 23.03.11), Mr. Anindya Biswas (From 16.06.11), Ms. Sayani Sarkar (From 22.08.11), Ms. Prerana Agarwal (From 27.08.11), Dr. Uttam Kr. Samanta (From 01.08.11 to 30.11.11), Mr. Somnath Datta (From 01.09.11), Ms. Sumana Banerjee (01.09.11).

Supporting Staff : Mr. Durga Charan Das, Mr. Swapan Kumar. Das (Retd. on 29.02.12), Mr. Ashim Kumar. Banerjee, Mr. Subhash Chakraborty, Mr. Asim Kumar Poddar, Ms. Debarati Kanjilal, Md. Asrafali Molla, Mr. Sudhanshu S. Maity (VRS. on 31.10.11), Mr. Basudev Ghorui, Mr. Dulal Chandra Mondal, Ms. Ranubala Das, Mr. Atanu Pramanik.

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/RA/Project Assistant : 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)

Supporting Staff : Tushar Bhattacharyya, Sujata Roy, Sanjib Gupta, Jibananda Mondal.

Biophysics Department

Faculty : Dr. Gautam Basu, Professor, Dr. Anirban Bhunia, Assistant Professor, Dr. Subhrangsu Chatterjee, Ramanujan Fellow, Dr. Debjani Roy, Assistant Professor

Students/RA/Project Assistant : Mr. Saumya Dasgupta, Mr. Himal kanti Ganguly, Ms. Nipa Chongdar, Ms. Sarbani Chatterjee, Ms. Madhurima Das, Mr. Anirban Ghosh, Mr. Jagannath Jana, Mr. Rajiv Kumar Kar, Ms. Aritreyee Datta

Supporting Staff : Mr. Basudeb Marick, Mr. Barun Majumdar, Mr. Tanmay Debnath, Mr. Swapan Joghsharma, Mr. Bijoy Munshi

Chemistry Department

Faculty : Dr. Suman Kr. Banik, Asstt. Professor, Dr. Joyoti Basu, Sr. Professor & Chairperson (from 1.3.12), Dr. Manas Charkarbarty (CSIR Emeritus Scientist), Dr. K. P. Das, Sr. Professor & Chairman (upto 29.2.12), Dr. Pradip Das, Assoc. Professor, Dr. Manikuntala Kundu, Sr. Professor, Dr. Jayanta Mukhopadhyay, Asstt. Professor, Dr. Anupam Pal (Joined on 4.7.11 and resigned on 13.3.12), Dr. Soumen Roy, Asstt. Professor

Students/RA/Project Assistant : Joyes De, Priyanka Halder, Victor Banerjee, Dr. Sujit Ray (upto June 2011), 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 (upto 13.4.11), Ayan Chatterjee, Sanjoy Kr. Sahoo, Ushasi Roy (joined on 19.12.11), Chandreyee Datta (Joined on 27.12.11), Soumyo Joyoti Banerjee (joined on 1.7.11), Manish Kumar (joined on 4.7.11), Arindam Gupta (joined on 20.7.11), Siddhartha Mukherjee (joined on 1.12.11), Rajdeep Kaur Grewal (joined 2.1.12), Shyam Sundar Pal China (resigned on 6.7.11), Vinod Kumar Pandey (joned on 28.6.11), Namrata Singh (joined on 7.7.11), Sankhadeep Banerjee (joined on 27.6.11), Ananya Chatterjee (joined 29.6.11), Dr. Sangita Banerjee (joined on 1.7.11), Dr. Mandavi Kumari (joined on 2.1.12), Sujoy Kumar Barik (joined on 1.2.12)

Supporting Staff: Dr. Aniruddha Aich, Pranab Kr. Dey, Bhabani Prasad Banerjee, Tapas Ghosh, Dipak Chandra Konar, Shyamal Kumar Ghosh (redeployed on 12.12.12), 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 (Cent. Bldg.), Dr. T. P. Sinha, Professor & In-charge (Main Campus)

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

Supporting Staff (Main Campus) : Gobinda Das, Arup Kumar Sen, Subhas Chandra Maikap, Samir Mukherjee, Prodip Kumar Karmakar, Tanima Modak Dhar, Ranjit Ghosh, Debabrata Polley, Shankar Santra, Sarwasati Sarkar

Division of Molecular Medicine

Faculty : Dr. Kaushik Biswas, Assistant Professor, Dr. Tanya Das, 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. Arun Kr. Ray, Emeritus Scientist, Dr. Manju Ray, Emeritus Scientist, Dr. Gaurisankar Sa, Professor, Dr. Parimal C. Sen, Senior Professor & Head, Dr. Parames Ch. Sil, Professor.

Students/RA/Project Assistant : Santanu Biswas (Upto 01.6.2011), Pinki Nandi, Gaurav Gupta (upto 26.06.2011), Swatilekha Ghosh, Argha Adhikari, Abhijit Sarkar, Parna Bhattacharya, Kirti Kajal, Argha Manna, Nikhil Baban Ghate, Supriya Chakraborty, Joyita Hazra, Joydeep Roy, Manjari Kundu, Dr. Anamika Bose, Suchismita Mohanty (upto 29.11.11), Ritajit Sarkar (from 01.06.11), Anupam Adhikari, Bibhabasu Hazra, Jyotirmoy Ghosh, Joydeep Das, Saikat Majumdar, Dewan M.S. Hossain (upto 29.11.11), Shravanti Mukherjee, Gautam Guchhait, Abhishek Santra, Pabitra Bikas Pal, Sayantan Banerjee, Abhijit Sau, Poulami Khan, Monoranjan Ghosh, Kuntal Halder, Shibali Das, Barun Mahata, Sudip Bhattacharya (upto 24.05.11), Subhadeep Das(From 17.08.11 to 20.12.11), Tamashree Ghosh (from 01.01.12), Samik Chakraborty, Samir Ghosh (upto 17.11.11), Abir Kr. Panda, Amrita Bhattachajee, Sreeparna Chakraborty, Taniya Saha, Deblina Guha, Soumyadip Paul, Shahana Mitra, Kahkashan Rashid (from 23.02.12), Somanjana Khatua, Bidisha Paul Chowdhury, Dipankar Chaudhuri (from 24.06.11), Saurav Dutta, Usri Chakraborty, Ajoy Mallik, Shilpi Saha, Dr. Minakshi Mazumdar, Dr. Santanu Kar Mahapatra, Dr. Amrita Dutta, Dr. Pushpak Bhattacharjee, Dr. Anindita Roy, Dr. Nivedita Roy (from 01.07.11), Dr.Aparajita Ghosh (from 01.01.12), Sankhadeep Pal, Krishnendu Sinha (from 16.12.11), Nihar Ranjan Biswal (from 23.12.11) & Shabina Parveen (from 23.12.11).

Supporting Staff : Pransanta Pal, Indrajit Ray, Sukumar Maitra, Barindra Nath Mandal, Prabal Kr. Gupta, Uttam Kumar Ghosh, Arindam Basu, Debasish Majumdar, Shanghamitra Das (Sahu),

Sourav Samanta, Kalyan Das, Amartya Sen, Ranjit Das, Purnendu Manna, Shankar Prasad Bari, Kanan Singh, Sudhir Turi, Pradip Kr. Mallick (LA-MoES Project).

Division of Plant Biology

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

Staff Scientist :- Dr. Sonali Sengupta (DBT Project)

Faculty (Main Campus) : Dr. Sabita Bhattacharya, Professor (Retd. on 31.03.2012), Dr. Gourab Gangopadhyay, Asstt. Professor , Dr. T.K. Ghose, Assoc. Professor , Dr. P. K. Saha, Consultant Scientist, Dr. D.N. Sengupta, Sr. Professor, Dr. Swati Sen-Mandi, Consultant Scientist, Dr. Swati Gupta-Bhattacharya, Professor

Students/RA/Project Assistant : (Cent. Campus) : Dr. Sanjukta Dey, Dr. Saswati Sengupta, Dr. Sujoy Paul, Dr. Srirupa Das, Dr. Rajeswari Mukherjee, Dr. Sumanti Gupta, Dr. Niranjana Behura, Dr. Nilanjana Banerjee, Dr. Shiny Ch. Sangma, Dr. Sourav Bhattacharya, Dr. Gargi Biswas (Saha), Ms. Lekha Bandopadhyay, Mrs. Rumdeep K. Grewal, Ms. Madhubanti Chatterjee, Mr. Subrata Kundu, Mr. Anirban Kundu, Ms. Anindita Sengupta, Mr. Mrinmoy Majunder, Mr. Amit Roy, Mr. Pijush Mullick, Ms. Suparna Ghosh, Ms. Arpita Bala, Ms. Sritama Mukherjee, Mr. Ayan Das, Mr. Anirban J. Debnath, Ms. Monia Chatterjee, Mr. Anirban Bhar, Mr. Prithwi Ghosh, Mr. Ritesh Ghosh, Mr. Arunava Mondal, Mr. Anindya Bhattacharya, Ms. Upala Saha, Ms. Deepti Sarkar, Ms. Jayanti Joddar, Mr. Dipan Roy, Ms. Aindrila Chatterjee, Ms. Adrita Roy, Mr. Amit Paul, Ms. Senjuti Sen, Mr. Joydeep Chakraborty, Ms. Papri Basak, Ms. Anju Patel, Mr. Sourav Bose, Ms. Payel Bhattacharya, Ms. Sayani Dey, Ms. Payel Ganguli, Ms. Amrita Mukherjee Ganguli.

Students/RA/Project Assistant : (Main Campus) : Dr. Sangita Dey, Dr. Harshata Pal, Mrs. Suranjana Sarkar (terminated on 24.10.11), Ms. Basabdatta Das, Mr. Supratim Basu (resigned on 30.9.11), Mr. Himadri S. Chakraborty, Mr. Bodhisattwa Saha, Mr. Tathagata Nath, Mr. Vivek Arora, Ms. Priyanka Pal (resigned on 31.10.11), Mr. Sankar Bakshi, Ms. Sayantani Sihi, Ms. Marufa Sultana, Ms. Debarati Dey, Ms. Kavita Ghosal, Ms. Bipasha Roy, Mr. Gaurab Sircar, Ms. Saptadwipa Sanyal, Mr. Subhobrata Ghosh, Mr. Shekhar Ghosh, Ms. Priyanka Chakraborty, Ms. Shreyasi Pal, Ms. Ranjana Prasad.

Staff members (Cent. Campus) : Mrs. Puspita Mukherjee, Mr. Ashim K. Nath, Mr. Subal Basak, Mr. Binoy K. Modak, Mr. Jayasish Ghosh, Mr. Motilal Singh, Mr. Arup K. Dey, Mr. Nadiram Kayal, Mr. Birendra K. Bari, Mr. Sashanka S. Bera, Mr. Sudipta Basu, Mr. Uttam Das, Mr. Swarnava Das, Mr. Abhishek Mukherjee, Ms. Srabani Sen, Mr. Bapi Dey and Mr. Niladri S. Roy.

Staff members (Main Campus) : Dr. Ramit Poddar, Mr. Sukumar Majumdar, Mr. Chanchal Chakraborty, Mr. Jadab Kr. Ghosh, Mrs. Kaberi Ghosh, Ms. Chaitali Roy, Mr. Bipul Kr. Nag, Mr.

Siddhartha Roy, Mrs. Sarama Pradhan, Mrs. Moumita Mondal, Mr. Debmalya Dasgupta (ICMR Project), Ms. Anandita Bandyopadhyay (resigned on 29.2.12, ICMR Project), Mr. Susanta Chatterjee (ICMR Project).

Environmental Science Section

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

Students : Chirantar Sarkar

Supporting Staff : Anandamay Adak, Saral Chandra Das, Bhaskar Roy (IRHPA Project), Miss Debolina Seal (IRHPA project)

Falta Experimental Farm

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

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

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/RA/Project Assistant : Arnab Basu, (upto 14/03/12), Sri Boudhyan Bandhopadhyay, Sm. Joyita Sarkar, Sri Debajyoti Ghosal, Sm. Priyanka Bhowmick, Pratick Khara, Sri Prithwiraj Kirtania, Sm. Piyali Pal Chowdhury, Sm. Soumita Dutta, Masrure Alam , Sm. Shreya Ghosh, Sri Soumik Basu, Sri Arindam Dutta, Sri Prasenjit Pyne, Sri Sourav Samaddar, Sm. Soniya Chatterjee, Dr. Joydeep Chakrabarty, Sri Chayan Roy (from 24.11.11), Sm. Niketa Bhawinghka (from 21.03.12),

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, Asstt. Professor, Dr. Indrani Bose, Sr. Professor & Chairperson, till 31.01.2012, Dr. Barun Kumar Chatterjee, Sr. Professor, Dr. Supriya Das, Asstt.

Professor, Dr. Sanjay Kumar Ghosh, Professor, Dr. Dhruba Gupta, Asstt. Professor, Dr. Dipankar Home, Sr. Professor & Chairman w.e.f. 01.02.2012, Dr. Amitabha Mitra, Associate Professor, Dr. Sibaji Raha, Sr. Professor, Director, Dr. Rajarshi Ray, Asstt. Professor, Dr. Swapan Kr. Saha, Professor, Dr. Tripurari Prasad Sinha, Professor, Dr. Achintya Singha, Asstt. Professor.

Students/RA/Project Assistant: Dr. Partha Sarathy Ghose, Dr. Alo Dutta, Dr. Rupa Sarkar, Dr. Binita Ghosh, Dr. Anindita Banerjee, Amit Kr. Pal, Sayantri Ghosh, Anirban Lahiri, Sarbani Majumder, Sadhan Chanda, Dipanwita Majumder, Sayan Biswas, Sudipa Upadhyay, Dyutima Das, Soumitra Maity, Subhasis Samanta, Kinkar Saha, Saronath Halder, Sujoy Saha, Mainak Pal, Rama Prasad Adak, Anup Pradhan Sakhya, Prasenjit Deb

IRHPA Project: Dr. Partha Sarathy Joarder, Research Scientist, Dr. Ajay Kumar Singh, Research Scientist, Dr. Sandhya Dey (Mandal), Research Scientist, Mr. Atanu Maulik, Mr. Rupamoy Bhattacharyya, Mr. Shyam Bihari Mehta, Mr. Avik Banerjee, JRF. Tech. Asstt.: Sumana Singh, Bhaskar Roy, Bivek Gurung, Sabyasachi Majee, Debolina Seal.

Supporting Staff: Sankar Prasad Singha, Shyamsundar Mallick, Subhasis Banerjee, Manas Dutta, Subrata Das, Rita Chakraborty, Sujit Basu, Kaushik Maiti, Bonshi Dutta, Rajkumar Mourya, Amar Nath Hela, Dayakanta Thakur (Died. on 5.7.2011).

DRDO Project SMS: Mr. Soumendra Singh, Scientist-B, Mr. Vineet Surana, Scientist-B, Mrs. Ayona Chakraborty, Scientist-B, Shri Arun K. Dasgupta, Consultant (Administration), Mrs. Sarmistha Saha, Technical Assistant, Mr. Abhirup Biswas, Technical Assistant, Mr. Bikram Mahatha, Technical Assistant.

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 : Mr. Samir Kumar Pal, Mr. Pradip Kumar Sarkar, Dr.(Mrs.) Banhisikha Chaudhuri, Mrs. Gopa Dasgupta, Ms. Ananya Raha, Ms. Sumita Dey, Mr. Gautam Mukherjee, Mr. Sarat Chandra Bhuiyan, Mr. Mrityunjoy Jogsharma, Mr. Arun Nandi, Mr. Dinanath Das.

Workshop

A.K. Mukherjee, *Engineer–B* (Retd. on 30.11.11), Sougato Banerjee, Assistant Registrar, In-charge Workshop.

Main Campus : Ashutosh Sarkar, Samar Dutta, Sisir Ghosal,(Retd.on 31.3.2012)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 & Kissan Das

Centenary Campus : Ramprasad Ray (Consultant Electrical Engineer), Tapan Mondal,(Retd.on 31.3.2012) Ashit Bsnrejee, Md. Raffick, Murari Mohan Shee, Baidya Nath Murmu

Statement of Accounts for the year 2011-2012

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, 2012 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 we 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 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 & Payments Account dealt with by this report have been prepared in the specified form as 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) 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 1 to 17

enclosed thereto and subject to our comments in Audit Observations 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, 2012; and

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

For M. Saha & Co.

Chartered Accountants

Place : Kolkata

Date : 8th November, 2012

Partner

CA. Debarshi Saha
(Mem No : 061398, FRN : 305135E)

Audit Observations

Annexure-1

1.0 The Financial Statements of the reporting Institute 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. 8,62,14,666.90 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 nonrecurring expenses and hence the entire grant has been recognised as income and credited to Income and Expenditure Account and correspondingly the capital expenses met 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 has 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. 6,74,09,019/- 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 (SCHEDULE-8) of the prescribed form accounts applicable for Central Autonomous Bodies (Non-profit organizations and similar Institutions) 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".

2.0 Fixed Assets Register

Physical Verification of non-consumable stock of Plant Biology Division, Main Campus, Workshop, Main campus, Biophysics Department and Bio-informatics Centre were carried out on 05.07.2011, 24.06.2011, 07.07.2011 and 28.07.2011 and the matter was informed to

the Officer on Special Duty (Registrar) by their letter dated 13.10.2011 informing that physical verification of non-consumable stock procured between the financial year 2009-2010 and 2010-2011 has been carried out. No other physical verification sheet was made available to us for our verification. A sum of Rs. 6,66,57,578.15 has been shown as Institute Development and Modernization Fund Investment in Fixed Assets under Schedule 05 of "Investment from Earmarked Funds" and we have been told by the management that Fixed Assets were purchased during the year 1991-92 and subsequent years out of Grant received from Planning Commission, Government of India and since then the said amount has been carried forward as Investment. We have been further told by the management that many of the items of such fixed assets have either reached their salvage value or might have been disposed off. In the absence of Fixed Assets Register and identification marks on the fixed assets, these assets could not be identified and hence could not be capitalized. Moreover in the absence of proper identifications, physical verification and valuation by approved valuer of the Fixed Assets in hand, provision for impairment could not be estimated and hence not accounted for. According to management's written representation, the preparation of Fixed Assets Register is under progress and that it will be completed within a reasonable period of time. The management of the reporting institution is advised to take effective steps and complete the preparation of the Fixed Assets Register expeditiously and thereby capitalize the Fixed Assets identified to respective heads at their current value. Moreover, 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.

3. Contingent Liability

The Institute has incurred legal expenses of Rs. 5,94,560/- (previous year Rs. 7,01,280/-) which was paid to Sri Surajit Das, Advocate, for attending 2 suit filed cases during the financial year 2010-11 and 2011-12. Payments were released without obtaining details of cases attended with reasons of adjournments and the progress thereof. In the absence of lawyer's opinion and progress report from the lawyer, the contingent liability of the Institute could not be ascertained. The management of the institute is advised to make a Cost-Benefit Analysis of the year-wise expenditure and the amount of settlement, if any, payable to the plaintiffs. Moreover a second opinion can be obtained regarding the point of law in each case.

4. Stale Cheques

A sum of Rs. 5,06,263.75 is being carried forward since 2010-11. The management requested to review the expenses and find out which are not payable at all and necessary reversal entries need to be passed.

5. Unascertained & Unpaid Statutory Liabilities

In cases of the following statutory liabilities out of the ledger balances as on 31st March 2012 some amounts still remain unpaid for which the management is yet to produce year-wise details –

Sl. No.	Nature of Libilities	Balance as on 30.03.2012 (Rs)	Paid during the F.Y. 2012-13 Rs)	Unpaid / Unascertained Balance (Rs)
I	Party Income Tex Deducted at Source	8,45,451	8,02,470	42.981
II	Profession Tax	4,280	0	4,280

The management of the reporting institution is advised 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 Plant 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. 1,28,76,771/- as on 31.03.2012, Rs. 15,76,628/- involves import of equipment in progress. Again out of such Rs. 15,76,628/- :

I. Rs. 3,64,182/- 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.

ii. Rs. 12,12,446/- 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/ Euro/Yen	Price in Indian Currency (₹)	L/C No.	L/C date	Date of actual receipt by Bose Inst.
M/s C.A.E.N.S.P.A., Italy	VME 648 UCRATE	ε 6,109	4,16,177/-	Wire Transfer	28.03.12	02.07.12
M/s CA.E.N.S.P.A., Italy	8 Channel Leading Edge	ε 2,626	1,79,851/-	Wire Transfer	27.03.12	02.07.12
M/s ESPO Micro Pte Ltd	Cell Culture Microprocessor	$ 3,720	1,90,233/-	Wire Transfer	28.03.12	16.05.12
M/s Thermo Electron LED Germany	Non-Refrigerated Tabletop Centrifuge	ε 1,635	1,12,157/-	Wire Transfer	26.03.12	16.05.12
M/s Tokyo Rikakikai Co. Ltd.	Vaccum Pump with low temperature controller	□ 4,92,000	3,14,028/-	Wire Transfer	07.03.12	02.07.12
Total			**12,12,446/-**			

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 Instituting consistently over the years.

9. Advances:

Out of total advances of Rs. 17,20,740/- a sum of Rs 41,048/- 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 and Other Funds of Rs. 35,52,87,781/- as on 31.03.2012, Governing Body Funds Rs. 46,27,079/-, 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 2012 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. 62,00,024.04 (Sch-7) and Rs. 6,04,388 (Cr.) included in Total other liabilities of Rs. 57,84,392.35 (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 years. The management is advised to take expeditious measures and adjust the same at the earliest.

For M. Saha & Co.

Chartered Accountants

Place: Kolkata

Date: 8th November, 2012

Partner

CA. Debarshi Saha
(Mem No: 061398, FRN: 305135E)

BOSE INSTITUTE
KOLKATA

BALANCE SHEET AS AT 31ST MARCH, 2012

(Amount in ₹)

	Schedules	As At 31.03.2012	As At 31.03.2011
CAPITAL FUND AND LIABILITIES			
CAPITAL FUND	1	432,238,760.01	412,915,986.17
EARMARKED FUNDS	2	15,178,032.54	14,569,870.13
OTHER FUNDS	2A	340,109,748.21	291,822,079.29
CURRENT LIABILITIES	3	241,284,922.41	415,150,505.94
TOTAL		**1,028,811,463.17**	**1,134,458,441.53**
ASSETS			
FIXED ASSETS	4	450,958,548.85	432,201,209.95
INVESTMENTS-FROM EARMARKED FUNDS	5	103,039,550.15	100,485,197.15
INVESTMENTS- OTHERS	6	200,602,183.51	168,377,394.24
CURRENT ASSETS, LOANS, ADVANCES ETC.	7	274,211,180.66	433,394,640.19
TOTAL		**1,028,811,463.17**	**1,134,458,441.53**
SIGNIFICANT ACCOUNTING POLICIES	16		
NOTES ON ACCOUNTS	17		

Place : Kolkata
Date :

Signed in terms of our separate Report of even date.

Sd/-
(S.Panigrahi)
Registrar

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

BOSE INSTITUTE

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2012

(Amount in ₹)

	Schedules	For the year ended 31.03.2012	For the year ended 31.03.2011
INCOME			
Income from Services	8	7,858,633.00	3,569,051.00
Grants	9	517,000,000.00	440,000,000.00
Interest Earned	10	7,719,026.88	5,318,240.79
Other Income	11	359,933.00	2,306,242.85
TOTAL (A)		**532,937,592.88**	**451,193,534.64**
EXPENDITURE			
Establishment Expenses	12	295,904,606.76	244,183,688.54
Other Administrative Expenses	13	63,404,989.59	55,312,357.40
Laboratory Expenses.	14	52,994,883.46	50,823,033.64
Fund for Capital Expenditure	15	86,214,666.90	95,954,598.00
TOTAL (B)		**498,519,146.71**	**446,273,677.58**
BALANCE (A-B) BEING SURPLUS/ DEFICIT (-) FOR THE CURRENT YEAR		34,418,446.17	4,919,857.06
TRANSFER TO FUND FOR OTHER DEVELOPMENT		–13,000,589.00	00.00
CARRIED FORWARD FROM PREVIOUS YEAR: DEFICIT (-)		-2,417,194.53	-7,337,051.59
CARRIED TO CURRENT LIABILITIES UNDER THE HEAD PAYABLE AS UNSPENT GRANT		19,000,662.64	-2,417,194.53
SIGNIFICANT ACCOUNTING POLICES	16		
NOTES ON ACCOUNTS	17		

Place : Kolkata
Date :

Signed in terms of our separate Report of even date.

Sd/-
(S.Panigrahi)
Registrar

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

Significant Accounting Policy

Annexure-16

1.0 General:

The accompanying financial statements have been prepared on historical cost convention and conform to the fundamental accounting assumptions.

2.0 Fixed Assets:

The fixed assets of the Council are valued at cost of acquisition with the directly attributable expenses for putting the assets into use for operation of the Institute. The fixed assets of Terminated Projects are also valued at cost.

3.0 Depreciation:

3.1 Depreciation on Councils fixed assets has been incorporated in accumulated net balances as on 1990-91 and subsequent additions till 2011-12. The total depreciation upto 31st March 2012 has been deducted from the Capital fund of the Institute.

3.2 The depreciation is calculated on Written Down Value Method as per the following rates irrespective of dates of putting the same in use:

i. Building – 10%
ii. Equipment – 15%
iii. Books & Journals – 10%
iv. Furniture – 10%
v. Vehicles – 15%
vi. Air Conditioner – 10%
vii. Electric Installation – 10%
viii. Internet – 60%

4.0 Revenue Recognition:

4.1 All incomes other than Government Grant and Bank Interest are accounted for on cash basis. Govt. Grants are accounted for on accrual basis provided the order sanctioning the Grant is received before the end of the financial year.

4.2 The Institute has a system of accounting in respect of expenses for items like Salary, Gratuity, Leave Salary, Rates & Taxes etc. on cash basis. Liabilities for amount payable to suppliers for materials and services are accounted for on accrual basis.

4.3 The funds required for acquisition of assets and its process of acquisition (inclusive of depreciation for the current year) totalling Rs. 8,62,14,666.90 have been set aside under Fund for Capital Expenditure (Schedule No. 15) in absence of non-recurring grants.

4.4 Consumable Stores are charged to expenditure for purchases.

4.5 Revenue expenditure on Scheme/Project and the specific grant therefore are recognised in the accounting period in which the corresponding expenditure and grant arise.

4.6 Government Grants received during the year are shown in the Income & Expenditure Account and surplus/deficit during the current year is reflected in the Balance Sheet.

5.0 Retirement/Post Retirement Benefits :

5.1 The Institute has General Provident Fund, Contributory Provident Fund and Pension Schemes.

5.2 Leave encashment, Gratuity, Provident Fund Contribution and Pension are accounted for on cash basis.

6.0 Earmarked Funds :

Earmarked Funds shall be treated as a liability on their creation.

Income on investments out of Earmarked Fund is recognised and credited to Earmarked Fund wherever accrued. Any expenditure of a revenue nature which is incurred specifically on selected Scheme/Project it charged to the relevant Earmarked Fund.

7.0 Foreign Currency Transactions :

Transactions in foreign currency are recorded at the exchange rate applicable on the date of transaction.

8.0 Research and Development Costs :

Research and Development costs are charged to the income & Expenditure Account for the year in which these are incurred.

Sd/-	Sd/-	For M Saha & Co.
(Umesh) Accounts Officer	(A. Mukherjee) Accountant	Chartered Accountants

Notes on Accounts

Schedule: 17

1.0 Accounting System

The Statement of Accounts has been drawn in the specified form applicable to Central Autonomous Bodies (NPOs) and Similar Institutions. The Balance Sheet has been drawn by consolidating Statement of Account Council and the Governing Body with schedules thereon without incorporating the consolidated transactions in the books of the Institute.

2.0 Fixed Assets

2.1 Land at Madhyamgram

The Institute got possession of 18.73 acres out of 40.99 acres land allotted for Experimental Farm by Govt. of West Bengal. The Governing Body of the Institute decided on 31.07.1989 not to claim the balance land in dispute from the government considering other related factors.

2.2 Fixed Asset Register

Preparation of Fixed Asset Register is in progress except the assets acquired from the Institute Development and Modernisation Fund (provided by Planning Commission). Depreciation on such asset has not been provided. Efforts have already been initiated to identify and classify the assets under appropriate heads and complete the Register at the earliest.

2.3 Work-in-Progress

The particulars of fixed assets, under construction/installation are given in Schedule:04.

2.4 Import in Progress

Import in Progress has been amounted for on the basis of bank advice on the date of actual payment.

2.5 Valuation of assets

a. The valuation of Fixed Assets has been made at cost less depreciation for the years 1990-91 till date.

b. The assets related to terminated projects have been identified up to 2005-06. Further identification of the assets relating to the years 2006-07 to 2011-12 is in progress.

c. The identification of assets, impaired if any, as required in AS-28 issued by ICAI, has not been done.

3.0 Grants-in-Aid

3.1. Stipend payable to Research Scholars under Sponsored Project Account is treated on Cash basis, while other expenses are treated on accrual basis.

3.2 Net excess of receipts over expenditure of grants-in-aid schemes, sponsored by various agencies are represented in bank balances.

4.0 Staff Benefits

The interest on loans, being recoverable after realisation of principal amount is accounted for as and when it becomes receivable. This is done as per Central Govt. Guidelines.

5.0 System of Fund Accounts

5.1 The suggestion of Jt. Secretary and F.A. Dept. of Science and Technology, Govt. of India in the Finance Committee meeting held on 24.09.1996 for managing the Provident Fund through Trust Committee is yet to be implemented.

5.2 Although by virtue of the provision 9 of the Bose Institute Employees Pension Scheme Regulations approved by the Dept. of Science and Technology, Govt. of India and Rule 3.3 of the Bose Institute Contributory Provident Fund Rules, the Pension Fund, General Provident Fund and Contributory Provident Fund vest with the Bose Institute, separate Statement of Account with Income and Expenditure Account prepared in respect of these three funds are annexed herewith.

6.0 Unreconciled Items

6.1 Rs. 8,45,451/- has been shown as liability in respect of Income Tax deducted on source out of which Rs.8,02,470/- have been paid in subsequent year.

6.2 A sum of Rs.46,035/- (Debit) and Rs.6,04,388/- (Credit) have been shown under the head "Bank Suspense Account" and "Bank Suspense Project Account" which is long pending for reconciliation.

7.0 Advances

A sum of Rs. 17,20,740/- is shown in the Balance Sheet under the head Advances which include a sum of Rs.9,38,436/- pending recovery/adjustment prior to 2009-10.

8.0 Prior Period Adjustments

Adjustments for the transactions completed during the previous years but not recorded then and accounting entry effected in the current financial year:

1. Electricity Expenses (Bill for March 2011 paid in April 2011, liability not provided in 2010-11)	Rs. 9,19,360/-
2. Equipment and Apparatus (Material received in March 2011 but liability was not provided and booked on payment basis)	Rs. 1,36,200/-
3. Security Expenses (Bill pertaining to financial year 2010-11 but no liability was provided and booked on payment basis)	Rs. 1,17,738/-
4. Security Deposit with WBSEDCL pertaining to previous financial years which was adjusted against the electricity expenses not booked earlier in the absence of records, has been booked in the current financial year upon receipt of details from WBSEDCL.	Rs. 11,40,968/-
5. Interest on Security Deposit with WBSEDCL pertaining to previous financial years which was adjusted against the security deposit not booked earlier in the absence of records, has been booked in the current financial year upon receipt of details from WBSEDCL.	Rs. 88,825/-
6. Amount received from DST towards expenditure for Seminar & Symposium was not adjusted in the previous year, now rectified.	Rs. 1,75,000/-
7. Interest on the unutilised grant of previous years pertaining to project SMS/DRDO/Prof. Amitabha Mitra was booked as income of the Institute, now on demand and payment it has been deducted from the interest earned during the current financial year	Rs. 28,74,786/-

9.0 Contingent Liability

Legal expenses include the cost to defend the court cases lodged against the Institute; contingent liability for such cases is not ascertained.

10.0 Change in Accounting Policy

Contribution received from the members of Contributory Medical Scheme of the Institute was being shown as other income in the previous years. In the financial year 2011-12 an amount of Rs. 16,06,375/- received as contribution from the member has been deducted from the expenses of medical benefit provided to the members.

11.0 Governing Body Accounts

The accounts of the Governing Body of the Institute which are separately maintained and audited have been consolidated in the Annual Accounts of the Council for the year ended 31.03.2011.

12. New Pension Scheme Fund

A separate account and Balance Sheet for New Pension Scheme Fund was being maintained in the previous years. The account was opened to keep the amount deducted from the employees governed by New Pension Scheme but not having Permanent Retirement Account Number (PRAN). Once the PRAN has been taken by the employees, the deductions were deposited with Central Record keeping Agency as per rules. The arrears remained in the New Pension Scheme Fund Account. In the current financial year all the arrears were identified and deposited with Central Record keeping Agency as per rules and the bank account of the Fund has been closed.

13.0 Previous year's Figures

The previous year's figures have been re-grouped and re-arranged in conformity with the figures of current year.

Sd/-	Sd/-	For M Saha & Co.
(Umesh)	(A. Mukherjee)	Chartered Accountants
Accounts Officer	Accountant	

BOSE INSTITUTE
KOLKATA

Receipt and Payment accounts for the year ended 31-03-2012 (COUNCIL A/C)

Particulars	Sch. No.	Amount (₹)	Particulars	Sch. No.	Amount (₹)
Opening Balance	1	79,711,048.71	Establishment Expenses	9	295,904,606.76
Grant in aid	2	517,000,000.00	Laboratory Expenses	10	52,994,883.46
Income From Services	3	7,858,633.00	Other Adminstrative Expenses	11	63,404,989.59
Interest Earned	4	7,719,026.88	Unified Campus Work in Progress		4,500,731.00
Other Income	5	359,933.00	Advances	6	14,768,028.00
Advances	6	13,966,907.00	Building	12	19,390,320.00
			Other Assets	13	93,880,585.50
Import of Equip. Work in Progress		13,405,508.60	Import of Equip. Work in Progress		1,212,446.00
Employees Welfare Fund		176,426.59	Employees Welfare Fund		22,470.00
Intellectual Property Dev. Fund		1,631,913.00	Intellectual Property Dev. Fund		828,050.00
House Building Advance Fund		460,651.00	House Building Advance Fund		6,897.00
Interest on HBL		460,651.00	Interest on HBL		460,651.00
Depreciation on Building	12	12,022,489.00	Depreciation on Fixed Asset (Fund)		67,409,019.00
Depreciation on Other Assets	13	55,408,426.00	BI/MIT COLLABORATION		186,790.00
Receivable From Security Staff		82,500.00	Other TDS Receivable		182,689.00
Receivable From Party		19,900.00	TDS on Interest (Receivable)		30,433.00
Bose Institute Modernization Fund		19,390,320.00	Director's Discretionary Fund		22,500.00
Fund for other Development		2,554,353.00	Fund for other Development Investment		2,554,353.00
Prof. S.M.Sarkar Lecture Fund		2,632.82	Prof. S.M.Sarkar Lecture Fund Investment		2,632.82
			Employees Welfare Fund Investment		19,131.59
			Co-operative		17,068,915.00
			Group Insurance		216,079.75
Inter Unit Account			Inter Unit Account		
Scheme/Project		565,688,030.63	Scheme/Project		573,239,443.00
IRHPA (Prof. S. Raha)		40,320.00	IRHPA (Prof. S. Raha)		6,358,691.00
			FAIR		28,692.04
			Governing Body		41,124.00
Outstanding Liability		8,080,264.00	Outstanding Liability		17,734,471.00
Statutory Liabilities	7	52,765,260.70	Statutory Liabilities	7	52,136,508.50
Other Liability	8	1,931,211.75	Other Liability	8	1,808,427.00
			Closing Balance	1	91,570,444.42
		1,377,985,002.43			1,377,985,002.43

BOSE INSTITUTE
KOLKATA

Receipt and Payment accounts for the year ended 31.03.2012 (Projects)

Particulars	Sch. No.	Amount (₹)	Particulars	Sch. No.	Amount (₹)
OPENING BALANCE	1	312,061,976.48			
RECEIPT OF PROJECTS	2	155,249,907.45	PAYMENTS OF PROJECTS	2	169,363,351.65
RECEIPT OF IRHPA-S RAHA	3	9,903,671.46	PAYMENTS OF IRHPA-S RAHA	4	9,901,143.46
RECEIPT OF IRHPA-A LOHIA	5	656.00	PAYMENTS OF IRHPA-A LOHIA	6	100.00
RECEIPT OF FAIR (IFCC)	7	727,723,324.00	PAYMENTS OF FAIR (IFCC)	8	619,325,103.04
CMS		1,950.00	CMS		1,950.00
CPF EMPLOYEE CONTRIBUTION		8,544.00	CPF EMPLOYEE CONTRIBUTION		8,544.00
CPF EMPLOYER CONTRIBUTION		8,544.00	CPF EMPLOYER CONTRIBUTION		8,544.00
CPFV		27,180.00	CPFV		27,180.00
GENERAL SUSPENSE		13,782.00	GENERAL SUSPENSE		13,782.00
I TAX (PARTY)		74,637.00	I TAX (PARTY)		74,637.00
I TAX (SALARY)		312,209.00	I TAX (SALARY)		312,209.00
LABOUR WELFARE CESS		25,442.00	LABOUR WELFARE CESS		25,442.00
LIABILITY (11-12)		505,517.00	LIABILITY (11-12)		557,515.00
LIABILITY (TAPAN DATTA)		104,150.00			
OVER HEAD		6,670,263.00	OVER HEAD		6,670,263.00
P TAX		49,785.00	P TAX		49,785.00
SALES TAX		50,884.00	SALES TAX		50,884.00
SECURITY DEPOSIT		254,422.00			
SERVICE CHARGES		800.00	SERVICE CHARGES		800.00
SUSPENSE		336.00	SUSPENSE		336.00
STALE CHEQUE		157,896.00	STALE CHEQUE		132,200.00
PICKUP SERVICE		8,900.00	PICKUP SERVICE		8,900.00
BANK CHARGES		452.00	BANK CHARGES		452.00
			RECEIVABLE FROM SCHOLARS		82,380.00
FAIR (IFCC)		224,854,361.00	FAIR		500,010,843.96
Inter Unit Account			**Inter Unit Account**		
BOSE INSTITUTE (COUNCIL)		573,266,785.00	BOSE INSTITUTE (COUNCIL)		565,715,372.63
IRHPA DR A LOHIA		–	IRHPA DR A LOHIA		–
IRHPA PROF.SIBAJI RAHA		1,528,494.00	IRHPA PROF.SIBAJI RAHA		5,110,266.46
			Closing Balance	1	135,412,884.19
		2,012,864,868.39			**2,012,864,868.39**

Auditors' Report Governing Body

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, 2012 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 –

1.0 Fixed Assets

Fixed Assets Register showing full particulars including quantitative details and situations of Fixed Assets has not been maintained. 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.

2.0 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. A list of Term Deposits 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. where not available for verification. Dividend on Preference Shares has not been accounted for.

3. **Advances**

The detail list of Festival Advance Rs. 9,300.00/- and Advance to Staff Rs. 16,820/- were not available. In the absence of list of advances we are unable to ascertain the realisability of the aforesaid advances. The management is advised to act expeditiously in this respect and take appropriate steps for recovery of these advances or take necessary steps for write off if irrecoverable.

4. **Cash In Hand**

The case in hand balance as on 31st March 2012 of the Governing Body of Rs. 8,150.05 is same as the cash balance as on 31st March 2011 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, 2012 ;

and

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

Place : Kolkata
Date : 8th November, 2012

For M Saha & Co.
Chartered Accountants

Partner
CA. Debarshi Saha
Mem No. 061398, FRN : 305135E)

BOSE INSTITUTE (GOVERNING BODY)

93/1, ACHARYA PRAFULLA CHANDRA ROAD, KOLKATA - 700009

BALANCE SHEET AS AT 31ST MARCH 2012

	Schedule No.	As on 31/03/2012	As on 31/03/2011
FUNDS & LIABLITIES		(₹)	(₹)
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	1	3,047,629.96	3,027,310.96
DEPOSITS & OTHER LIABILITIES	2	1,161,552.66	1,120,273.66
TOTAL		**8,126,784.38**	**8,065,186.38**
PROPERTIES & ASSETS			
FIXED ASSETS			
AS PER LAST ACCOUNT	3	2,374,712.85	2,374,712.85
INVESTMENTS			
AS PER LAST ACCOUNT	4	4,050,528.67	3,776,367.73
RECEIVABLE & DEPOSITS			
AS PER LAST ACCOUNT	5	32,795.00	32,795.00
CASH & BANK BALANCES	6	1,083,770.37	779,207.37
INCOME & EXPENDITURE A/C			
EXCESS OF EXPENDITURE OVER INCOME		584,977.49	1,102,103.43
TOTAL		**8,126,784.38**	**8,065,186.38**

INCOME & EXPENDITURE STATEMENT FOR THE YEAR ENDED 31ST MARCH 2012

Particulars	2011-12 (₹)	2010-11 (₹)
INCOME		
INTEREST ON TERM DEPOSIT	546,568.94	137,884.00
INTEREST ON SAVINGS BANK	1,894.00	848.00
TOTAL	**548,462.94**	**138,732.00**
EXPENDITURE		
SALARY & WAGES	22,800.00	71,200.00
ACCOUNTING CHARGES	-	5,000.00
AUDIT FEES	8,427.00	8,272.00
BANK CHARGES	110.00	
EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR	517,125.94	54,260.00
TOTAL	**548,462.94**	**138,732.00**
INCOME BROUGHT DOWN AND ADJUSTED WITH LAST YEAR	517,125.94	54,260.00
BALANCE BROUGHT DOWN FROM LAST A/C (DEBIT)	1,102,103.43	1,156,363.43
BALANCE TAKEN TO BALANCE SHEET (DEBIT)	584,977.49	1,102,103.43

Signed in terms of our separate report of even date

Auditors' Report

We have audited the attached Balance Sheet of the Bose Institute, Indo – FAIR Coordination Centre of P-1/12, C.I.T. Scheme VII M. Kolkata-700 054 as at 31st March, 2012 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, Indo – FAIR Coordination Centre'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.

On the basis of our audit as indicated in earlier paragraph 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 appears from our examination of those books;

iii. The Balance Sheet and Income & Expenditure Account dealt with by this report are in agreement with the books of account;

iv. In our opinion and to the best of our information and according to the explanations given to us, the said accounts read with the schedules 1 to 3 enclosed thereto, give the information in the manner so required and give a true and fair view in comormity with the accounting principles generally accepted in India.:

a) In the case of Balance Sheet, of the state of affairs of Bose Institute, Indo – FAIR Coordination Centre as at 31st March, 2012;

and

b) 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.
Chattered Accountants

Place : Kolkata
Date : 8th November, 2012

Partner
CA. Debarshi Saha
(Mem No : 061398, FRN : 305135E)

BOSE INSTITUTE (IFCC)
KOLKATA

BALANCE SHEET AS AT 31ST MARCH 2012

As on 31st March 2011 (₹)	Liabilities	As on 31st March 2012 (₹)	As on 31st March 2011 (₹)	Assets	As on 31st March 2012 (₹)
54,732.00	Fund for Creation of Asset	54,732.00	54,732.00	Shares in FAIR GmbH	54,732.00
	Unspent Grant				
184,350,000.00	Grant from Department of Science and Technology (Schedule-1)	96,856,723.96	275,018,454.00	Receivable from Bose Institute	
90,000,000.00	Grant from Department of Atomic Energy (Schedule-2)	6,352,825.00			
668,454.00	Interest Earned (Schedule-3)	5,005,200.00		**Bank Balances** S.B. A/c Union Bank	
	Audit Fees Payable	16,751.00	–	of India	2,259,670.96
	Payable to Bose Institute	166,721.00	–	Fixed Deposits	106,138,550.00
275,073,186.00		**108,452,952.96**	**275,073,186,00**		**108,452,952.96**

INCOME & EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2012

As on 31st March 2011 (₹)	Liabilities	As on 31st March 2012 (₹)	As on 31st March 2011 (₹)	Assets	As on 31st March 2012 (₹)
	Accommodation Charges	25,000.00		Grant received from DST	11,000,000.00
	Advertisement Expenses	544,672.00			
	Bank Charges	32,630.00			
	Honorarium Expenses	10,000.00			
	Meeting Expenses	4,742.00			
	Salary	107,355.00			
	Conveyance	32,000.00			
	Telephone Expenses	1,969.04			
	Travelling Expenses	1,027,932.00			
	Audit Fees	16,751.00			
	Excess of Income over Expenditure	9,196,948.96			
		11,000,000.00			**11,000,000.00**

Place : Kolkata
Date : 8th November, 2012

Signed in terms of our separate Report of even date.

For M Saha & Co.
Chartered Accountants

Sd/-
(Umesh)
Accounts Officer

Sd/-
Administrative/Accounts Office
Bose Institute (IFCC)

Sd/-
(Prof. S.Raha)
Director

BOSE INSTITUTE (IFCC)

KOLKATA

Receipt and Payment Accounts for the year ended 31.03.2012 (FAIR)

Particulars	(₹)	Particulars	(₹)
Opening Balance			
Grant From D.A.E.	112,748,050.00	Accommodation Charges	25,000.00
Grant From D.S.T.	110,705,000.00	Advertisement Expenses	544,672.00
Interest on SB A/c	196,419.00	Bank Charges	32,630.00
Interest on term deposits	4,140,327.00	Honorarium Expenses	10,000.00
		Meeting Expenses	4,742.00
		Salary	107,355.00
		Conveyance	32,000.00
		Telephone Expenses	1,969.04
		Travelling Expenses	1,027,932.00
		Audit Fees	16,751.00
Liability for Audit Fees	16,751.00	Remittence to FAIR Germany	392,790,450.00
Profession Tax	750.00	Profession Tax	750.00
TDS	21,231.00	TDS	21,231.00
Inter Unit Account		Inter Unit Account	
Bose Institute (council)	28,692.04	Bose Institute (Council)	
Scheme/Project	499,866,103.96	Scheme/Project	224,709,621.00
		Closing Balance	
		S.B. A/c Union Bank of India	2,259,670.96
		Fixed Deposits	106,138,550.00
	727,723,324.00		**727,723,324.00**

Place : Kolkata
Date : 8th November, 2012

Signed in terms of our separate
Report of even date.

For M Saha & Co.
Chartered Accountants

Sd/-
(Umesh)
Accounts Officer

Sd/-
Administrative/Accounts Office
Bose Institute (IFCC)

Sd/-
(Prof. S.Raha)
Director

Compilation Report of the Institute

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

COMPLIANCE REPORT OF THE INSTITUTE ON THE AUDIT OBSERVATIONS FINANCIAL YEAR 2011-12

Sl.No.	Audit Observations	Replies
1 (i)	The management of the Institution has charged Rs. 8,62,14,666.90 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 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, hence no comment.
(ii)	Depreciation on fixed assets has 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. 6,74,09,019.00 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 2012-13 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	Noted for compliance during 2012-13 and will be segregated

	been done and purchases of Computers are shown under "Apparatus & Equipment".	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 2012-13 as suggested.
2	**Fixed Assets Register:**	
	Physical Verification of non-consumable stock of Plant Biology Division, Main Campus, Workshop -main campus, Biophysics Department and Bio-informatics Centre were carried out on 05.07.2011, 24.06.2011, 07.07.2011 and 28.07.2011 and the matter was informed to the Officer on Special Duty (Registrar) by their letter dated 13.10.2011 informing that physical verification of non-consumable stock procured between the financial year 2009-2010 and 2010-2011 has been carried out. No other physical verification sheet was made available to us for our verification. A sum of Rs. 6,66,57,578.15 has been shown as Institute Development and Modernization Fund Investment in Fixed Assets under Schedule 05 of "Investment from Earmarked Funds" and we have been told by the management that Fixed Assets were purchased during the year 1991-92 and subsequent years out of Grant received from Planning Commission, Government of India and since then the said amount has been carried forward as Investment. We have been further told by the management that many of the items of such fixed assets have either reached their salvage value or might have been disposed off. In the absence of Fixed Assets Register and identification marks on the fixed assets, these assets could not be identified and hence could not be capitalized. Moreover, in the absence of proper identification, physical verification and valuation by approved valuer of the Fixed Assets in hand, provision for impairment could not be estimated and hence not accounted for. According to management's written representation, the preparation of Fixed Assets Register is under progress and that it will be completed within a reasonable period of time. The management of the reporting institution is advised to take effective steps and complete the preparation of the Fixed Assets Register expeditiously and thereby capitalize the Fixed Assets identified to respective heads at the current value. Moreover, Assets purchased out of grants for different Projects were shown under the head "Projects"	Physical Verification of non-consumable stock is done every year. The papers for the current year will be made available during the next year's audit. Preparation of Fixed asset register is in progress and it is expected to be completed within a reasonable span of time.

and not taken in total Fixed Assets Schedule on the plea that those Fixed Assets do not belong to 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.

3 Contingent Liabilities :

The Institute has incurred legal expenses of Rs. 5,94,560/- (previous year Rs. 7,01,280/-) which was paid to Sri Surajit Das, Advocate, for attending 2 suit filed cases during the financial year 2010-11 and 2011-12. Payments were released without obtaining details of cases attended with reasons of adjournments and the progress thereof. In the absence of lawyer's opinion and progress report from the lawyer, the contingent liability of the Institute could not be ascertained. The management of the institute is advised to make a Cost-Benefit Analysis of the year-wise expenditure and the amount of settlement, if any, payable to the plaintiffs. Moreover a second opinion can be obtained regarding the point of law in each case.

Noted for future compliance.

4 Stale Cheques

A sum of Rs. 5,06,263.75 is being carried forward since 2010-11. The management is requested to review the expenses and find out which are not payable at all and necessary reversal entries need to be passed.

As per Rule 189 (1) of Central Government Account Receipt and Payment Rules, all deposits and balance in the books unclaimed for three year shall be credited to Government under Consolidated Fund, keeping a note in the register of deposits. Similar action will be taken at appropriate time.

5 Unascertained & Unpaid Statutory Liabilities:

In cases of the following statutory liabilities out of the ledger balances as on 31st March 2012 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 31.03.2012	Paid during the F.Y. 2012-13	Unpaid / Unascertained Balance
I	Party Income Tax Deducted at Source	8,45,451	8,02,470	42,981
III	Profession Tax	4,280	0	4,280

The management of the reporting Institution is advised 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.

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. 1,28,76,771/- as on 31.03.2012, Rs. 15,76,628/- involves import of equipment in progress. Again out of such Rs. 15,76,628/:

a) Rs. 3,64,182/- 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.

a) Administrative exercise has aleardy been initiated to identify the equipments for capitalization. An amount of Rs. 3,90,512.60 has already been identified out of Rs. 7,56,694.60 of previous years balance and necessary accounting entries has already been given effect to. Balance will be ready for production before the next audit.

b) Rs. 12,12,446/- was shown as addition in Import of Equipment in Progress for the year under audit for which the necessary details are enlisted below:

b) The observation is self explanatory, hence no comment.

Name of the Supplier	Description of Equipment	Price in US Dollars/ Euro/ Yen	Price in Indian Currency (Rs)	L/C No.	L/C date	Date of actual receipt by Bose Institute
M/s C.A.E.N.S.P.A., Italy	VME 648 U CRATE	€ 6109	4,16,177/-	Wire Transfer	28-03-2012	02-07-2012
M/s C.A.E.N.S.P.A., Italy	8 Channel Leading Edge	€ 2626	1,79,851/-	Wire Transfer	27-03-2012	02-07-2012
M/s ESCO Micro Pte Ltd.	Cell Culture Micro-processor	$ 3720	1,90,233/-	Wire Transfer	28-03-2012	19-06-2012
M/s Thermo Electron LED Gmbh, Germany	Non-Refrigerated Tabletop Centrifuge	€ 1635	1,12,157/-	Wire Transfer	26-03-2012	16-05-2012
M/s Tokyo Rikakikai Co. Ltd.	Vaccum Pump with low temperature controller	¥ 4,92,000	3,14,028/-	Wire Transfer	07-03-2012	02-07-2012
TOTAL			**12,12,446/-**			

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. 17,20,740/-, a sum of Rs 41,048/- 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 and Other Funds of Rs. 35,52,87,781/- as on 31.03.2012, Governing Body Funds Rs. 46,27,079/-, 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 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 2012 could not be ascertained.	Institute follows the policy of treating the expenditure on Gratuity on Cash Basis and is being followed consistently year after year.
12	**Unreconciled Bank Balances:**	
	A sum of Rs.46,029.90 (Dr.) included in Loans, Advances and other assets of Rs.62,00,024.04(Sch-7) and Rs.6,04,388 (Cr.) included in Total other liabilities of Rs.57,84,392.35 (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 years. The management is advised to take expeditious measures and adjust the same at the earliest.	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.