



Bose Institute



Annual Report
2008 - 2009



".... I Offer My Salutation"

Fortunately there are some few men among us who can claim fellowship with the aristocracy in the realm of science, and can be expected to make splendid this ceremony with the wealth of their thoughts. I can only bless this institution from that obscure distance where the multitude of the uncared-for generations of this country have helplessly drifted to the pitiless toil of primitive land-tilling. I offer my salutation to the illustrious founder of this institute, humbly sitting by those who are deprived of a sufficiency of that knowledge which only can save them from the desolating menace of scientific devilry and from the continual drainage of the resources of life, and I appeal to this institute to bring our call to science herself to rescue the world from the clutches of the marauders who betray her noble mission into an unmitigated savagery."



J. C. Bose Memorial address by Rabindra Nath Tagore,
30th Nov. 1938

John A. Hughes

[illegible]

Facsimile of a poem from Rabinدرانath to Jagadis Chandra : 1901

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Prof. D. Home (Chairman)
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Dr. Pradip Parrack (Member)
Dr. Debabrata Basu (Member)

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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 92 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 the three original Departments of Botany, Chemistry and Physics, to which later were added the Animal Physiology Section (1930), Department of Microbiology (1942), Department of Biochemistry (1974), Plant Tissue Culture Section (1976, subsequently renamed Plant Molecular & Cellular Genetics Section in 1989), Department of Biophysics (1985), Environmental Science Section (1992) and 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. There are support and service centres like Central Instruments Facility (CIF), Distributed Information Centre (DIC), Library, Workshop, J.C. Bose Centre (comprising the Museum and the Publication sections) etc. 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 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, the 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 etc.) 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 on the plant genetic engineering towards improvement of plant productivity. Major emphasis has been given to identify the components responsible for desirable phenotypes and characterize them extensively through cellular, molecular, genomic and proteomic approaches for their further expression in target plants.

II. Protein Structure, Function and Engineering :

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

III. Bioinformatics and Computational Biology :

Bioinformatics Centre was incepted in 1988 as one of the nine nodal centres under the programme, Biotechnology Information System (BTIS) of the Department of Biotechnology, Government of India, with genetic engineering and molecular modelling as the two major thrust areas. Since then the centre is functioning as a repertoire of

(ii)

information related to bioinformatics and its dissemination in Eastern India. It provides computational facilities to carry out research in genome analysis, molecular modelling, plant genomics and proteomics, biomolecular structure determination (through NMR and X-ray crystallography), protein structure analysis, protein-protein interaction, docking and molecular recognition, protein folding and threading etc. The Bioinformatics Centre has the distinction of being designated as Centre of Excellence of the Department of Biotechnology, Government of India.

IV. Molecular Medicine :

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

V. Microbial Genomics and Infection Biology :

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

VI. Development of Systems Biology :

Scientists have taken system level approaches combining mathematical model 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.

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

The Department of Physics contributes both to fundamental knowledge as well as applications relevant to industry and society in general. The Department's current research activities are in the areas of Radiation Physics; Statistical Mechanics; Foundations of Quantum Mechanics and Quantum Entanglement; Astrophysics of Strongly Interacting Matter; Characterization of Detector Materials for Heavy Ions; Preparation and Characterization of Dielectric Materials, Condensed Matter Physics, Nuclear and High Energy Physics, Astroparticle Physics and Cosmology. Recently, intense activities have also been initiated in Millimeter Wave and Microwaves as well as atmospheric sciences.

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

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

Management of the Institute

The Bose Institute is a grant-in-aid autonomous institution under the Department of Science and Technology (DST), Ministry of Science & Technology, Government of India. It has a Governing Body consisting 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. Banerjee
5. Dr. Anutosh Chatterjee
6. Dr. Manish Chakraborty
7. Mr. D. Mandal
8. Shri Dilip Bhattacharyya
9. Prof. Parul Chakrabarti
10. Prof. Bikash Sinha
11. Director, Bose Institute - Secretary

Members of the Council

- | | |
|---|-----------------------------------|
| 1. Dr. Manish Sekhar Chakraborty | Nominees of the
Governing Body |
| 2. Shri D. Mandal | |
| 3. Prof. (Mrs.) Debi Chakravarti | |
| 4. Shri Somnath Sanyal | |
| 5. Prof. S.N. Chatterjee | |
| 6. Mr. Dilip Bhattacharyya | |
| 7. Prof. Bikash Sinha (w.e.f. 24.08.2008) | |
| 8. Secretary, Department of Science & Technology, Government of India
or his nominee | |
| 9. Director General, C.S.I.R. or his nominee | |
| 10. Joint Secretary and Financial Adviser, Department of Science and
Technology, Govt. of India or his nominee | |

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11. A Representative of the Lok Sabha
12. Principal Accountant General (A & E), West Bengal
13. Secretary, Higher Education (Nominee of the Govt. of West Bengal)
14. Municipal Commissioner, Representative of the Calcutta Municipal Corporation
15. Director, Bose Institute – Ex-officio
16. Dy. Director, Bose Institute – Ex-officio

17. Dr. Amit Roy (upto 28.10.2008) | Two Scientists from outside
18. Prof. Alope Bhattacharyya (upto 28.10.2008) | West Bengal, nominated by
19. Prof. S. S. Hasan (w.e.f. 29.10.2008) | DST, Govt. of India
20. Prof. M. Udaykumar (w.e.f. 29.10.2008) |

21. Registrar, Bose Institute - Secretary

Members of the Finance Committee

1. Principal Secretary, Higher Education Department, Govt. of W.B.
2. Shri D. Mandal – (Representative of the Governing Body)
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 [(PMCG) Coordinator], Dr. D. Basu (Botany), Dr. Sabita Bhattacharya (Botany), Dr. Gaurab Gangopadhyay (Botany), Dr. T. K. Ghose (Botany), Dr. S. Gupta Bhattacharya (Botany), Dr. P. Kundu (PMCG), Dr. Amita Pal (PMCG), Dr. A. N. Lahiri Majumder (PMCG), Dr. K. K. Mukherjee (Botany), Dr. P. K. Saha (Botany), Dr. S. Sen-Mandi (Botany), Dr. D. N. Sengupta (Botany), Dr. S. R. Sikdar (PMCG).

II. Protein Structure, Function and Engineering :

Dr. K. P. Das [Chemistry (Coordinator)], Dr. G. Basu (Biophysics), Dr. J. Basu (Chemistry), Dr. B. Bhattacharyya (Biochemistry), Dr. P. Chakrabarti (Biochemistry), Dr. R. Chattopadhyay (Biochemistry), Dr. M. Kundu (Chemistry), Dr. J. Mukhopadhyay (Chemistry), Dr. P. Parrack (Biochemistry), Dr. S. Sau (Biochemistry), Dr. P. C. Sen (Molecular Medicine), Dr. P. C. Sil (Molecular Medicine).

III. Bioinformatics and Computational Biology :

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

IV. Molecular Medicine :

Dr. P. C. Sen [Molecular Medicine (Coordinator)], Dr. Tanya Das (Molecular Medicine), Dr. S. Majumder (Microbiology), Dr. N. N. Mandal (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. J. Basu (Chemistry), Dr. Tanya Das (Molecular Medicine), Dr. Sujoy Das Gupta (Microbiology), Dr. Tapan Dutta (Microbiology), Dr. M. Kundu (Chemistry), Dr. A. Lohia (Biochemistry), Dr. P. Parrack (Biochemistry), Dr. Subrata Majumder (Microbiology), Dr. S. Sau (Biochemistry).

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VI. Development of Systems Biology :

Dr. J. Basu [Chemistry (Coordinator)], Dr. S. Banik (Chemistry), Dr. Indrani Bose (Physics), Dr. B. K. Chatterjee (Physics), Dr. Tanya Das (Molecular Medicine), Dr. T. K. Ghose (Botany), Dr. M. Kundu (Chemistry), Dr. A. Lohia (Biochemistry), Dr. J. Mukhopadhyay (Chemistry), Dr. A. K. Ray (Molecular Medicine), Dr. Gaurisankar Sa (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. S. S. Bandopadhyay (Physics & CAPSS), Dr. B. K. Chatterjee (Physics), Dr. Pradip Das (Chemistry), Dr. Sanjay K. Ghosh (Physics & CAPSS), Dr. Dhruba Gupta (Physics & CAPSS), Dr. Amitabha Mitra (Physics & CAPSS), Dr. S. Raha (Physics & CAPSS), Dr. Rajarshi Ray (Physics & CAPSS), Dr. S. K. Saha (Physics & CAPSS), Dr. T. P. Sinha (Physics),



The 92nd Foundation Day of Bose Institute was celebrated on 30th November 2008. **Francesco Paresce Marconi**, Institute of Space Astrophysics and Cosmic Physics, Italian National Institute of Astrophysics, Bologna, Italy graced the occasion as Guest of Honour and delivered the 70th Acharya Jagadis Chandra Bose Memorial Lecture on **Marconi, Bose and the Telecom Revolution in Science**. On this occasion Prof. M.G.K. Menon was present as Chief Guest and Dr. T. Ramasami, Secretary to the Govt. of India, Dept. of Science & Technology presided over the programme. **Sir Nilratan Sirkar Prize 2008** was awarded to Ms. Kamakshi Sureka, a Senior Research Fellow, Department of Chemistry. A Special Cover on Sir A.J.C. Bose was also released by the Post & Telegraph Department, Govt. of India. A Bengali Book on Sir J.C.Bose's Life & Works was published by the Bose Institute. Two special volumes were also published by Indian Science Association and Anushtup, respectively



124th Birth Day of Prof. D.M. Bose was celebrated on November 26, 2008. Dr. Virginia Shepherd, a Senior Research Scientist, Department of Physics, School of Physics, The University of New South Wales; Sydney, Australia, graced the occasion as Guest of Honor and delivered the **D.M. Bose Memorial Lecture** on **Reflections on the Many-in-one : J. C. Bose and the Roots of Plant Neurobiology**



Prof. S. R. Sikdar, Coordinator, Rural Biotechnology Programme was teaching mushroom cultivation procedure to the trainees during the training programme on mushroom cultivation preservation and spawn production held during 25th August – 16 September 2008

Scientific Reports

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

Inositol metabolism in relation to abiotic stress: Search for novel genes from wild rice:
(Dr. A. N. Lahiri Majumder)

The gene for the chloroplastic inositol synthase in *Oryza* has been identified by a combined proteomic, molecular and bioinformatics analysis and has been found to be located in Chromosome 3. A number of upstream stress- regulatory sequences have been identified in the *Porteresia Inol* gene (*PcINO1*). Co-expression of the *PcINO1* and *McIMT1* (inositol methyl transferase from *Mesembryanthemum crystallinum*) gene in tobacco rendered the transgenic plants more salt-tolerant and photosynthetically more competent than the ones with either of the gene(s) introgressed in them. Several other partial or full-length gene sequences such as, chloroplastic fructose-1,6-bisphosphatase , ADH1, PEPC, TPI have been isolated and deposited in NCBI GenBank.

Characterization of a wild genotype of Basella (Dr. K. K. Mukherjee)

A naturally occurring circumnutating stem form of *Basella alba* L. has been characterized in the background of two procumbent stem forms of *B. alba* L., cultivated commonly as leafy vegetable. The difference between the procumbent and circumnutating stem form was quite distinct particularly in terms of biomass. Though there was no cytological difference between the three materials under study, there was loss of certain unique DNA fragments in the circumnutating stem form. This loss probably contributed to change in function of twinning in the circumnutating form; and this phenotype plausibly is a stable variant of the more common procumbent form of *Basella*.

Effect of UV on growth and quality of commercially important crops: (Dr. Swati Sen-Mandi)

Seed longevity during post harvest storage: Our earlier studies suggest that over-expression of the gene for ACCase, that a) catalyzes the first committed step in lipid biosynthesis and b) under stress condition drives the secondary metabolic pathway for production of flavonoids, is associated with high vigour / longevity traits in orthodox seed. Our recent studies on expression of ACCase gene using Normalized Expression Method (ddCT) in a Bio-Rad iQ5 Real Time PCR have shown higher gene expression in varieties that exhibit better germination performance in fresh as well as aged seeds. This gene expression was found to be much lower in varieties that succumb to stressful condition in

a) the farmers' field and b) in farmers' seed storage. This confirms our hypothesis that overexpression of ACCase gene confers vigour and longevity trait in orthodox seed.

Plant DNA Fingerprinting and Diagnostics of Medicinal Potential in plants: (Dr. Swati Sen-Mandi)

Molecular Documentation and associated antioxidant status of high altitude plants:

Tea: Higher antioxidant potential have been demonstrated in Darjeeling grown tea plants compared to the same clones growing in Assam. Preliminary studies indicate that this is an epigenetic effect. We finally report AFLP characterization with 2 selective primers (allotted for Bose Institute) of 1644 tea genotypes under a National Network Programme sponsored by DBT for documentation and identity establishment of Indian tea germplasm.

Curcuma and Zingiber: Medicinal plants viz. *Curcuma* and *Zingiber* collected from the wild in Manipur, Shillong and parts of North Bengal are being maintained in the glass house at the Main Campus of Bose Institute for use in DNA characterization studies following RAPD, AFLP, SNP techniques starting with standardization of DNA from various plant parts. a) *Zingiber officinale* land races: Genomic differences have been revealed among 20 genotypes using AFLP and RAPD techniques. The land races showed variations in total antioxidant potential; the value was markedly high in 4 of the land races. SNP studies on Chalcone synthase gene of 2 land races (one with high and one with low antioxidant value) showed SNP in the DNA sequence. b) *Curcuma longa* and *C. angustifolia* land races: Collections from North Bengal consisting of 34 land races of *Curcuma* are being grown in Madhyamgram Experimental Farm for use in genome characterization and antioxidant evaluation. Genome analysis of these genotypes using AFLP studies with several primer pairs and also RAPD analysis using 10-mer primers have led to the establishment of variety-related DNA fingerprinting patterns. Genetic relatedness between the varieties has also been studied by development of a dendrogram using NCSS Statistical and power analysis software. Biochemical analysis have shown different levels of Antioxidant, Curcuminoid and total Phenolic Compounds in the different land races. Some important genes in the phenylpropanoid pathway in *Curcuma*, viz. curcumin synthase and diketide CoA synthase have been cloned and sequenced.

Search for MYMIV- resistance genes/proteins in *Vigna mungo* : (Dr. Amita Pal in collaboration with Dr. K.P. Das, Chemistry)

Proteins from MYMIV-resistant lines and MYMIV-susceptible cultivar of *Vigna mungo* were separated on 2-D PAGE following a proteomic approach. Several upregulated or new protein(s) present in MYMIV-resistant-lines were identified through MALDI-TOF analysis of the peptide fragments generated by trypsin digestion. Similarly salicylic acid

induced upregulated proteins were identified through proteomic and bioinformatics analyses. Several of these predicted proteins are related to either photosynthesis or to stress, or have a role in metabolism. Photosystem II oxygen-evolving, rubisco activase, phosphoribulokinase, superoxide dismutase, ascorbate dehydrogenase, chaperonin etc. are some such examples. Two MYMIV-linked functional markers developed in previous years are partial *R* genes; through genome walking upto 2.1 and 3.0 kb fragments of these two putative genes and the respective c-DNA fragments were deciphered.

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

(a) Sixty-three Indian varieties / accessions of *Sesamum indicum* along with three accessions of *Sesamum mulayanum*, a wild relative of cultivated sesame, were procured from the germplasm collection of NIPGR (National Institute of Plant Genetic Resources), India, and seeds of six local cultivars reared in MEF. The seed characters as well as the agro-morphological characters were studied. The seed characters showed similar origin. Five clusters were observed in relation to their seed characters by statistical analysis.

(b) *Enhancement of safed musli productivity*— Foliar application of sodium dikegulac (NaDK) at different concentrations on 16-day old safed musli (*Chlorophytum borivilianum* Sant et Fernand.) enhanced potential status of the plants. NaDK deferred senescence of the contributory leaves as evidenced from the chemical-induced alleviation of the loss of chlorophyll, protein, DNA and RNA content as well as catalase activity in leaves.

Regulation of Gene Expression Induced by light and salinity stress or ABA treatment in leaves during salinity stress in Rice and by Light and Ethylene in Fruit Ripening : (Dibyendu Narayan Sengupta)

Cloning and sequencing of the upstream of the OSBZ8, SAMdC, and Rab16A genes from rice have been done and the presence of important cis-acting elements e.g. light responsive elements, ABA responsive elements, and many other elements for binding of other transcription factors have been identified. GMSA has been started to find out the binding of factors and their difference in salt sensitive and salt tolerant rice cultivars.

Similarly the upstream of the genes for ethylene inducible ACC synthase 2, ACC synthase 4, sucrose phosphate synthase (SPS) and the RIN factor that regulates the developmental programme involved in fruit ripening in Tomato and Banana, have been cloned and many cis-acting elements have been identified. By GMSA binding of ripening-specific factors have been identified.

The upstream region of the gene for single polypeptide DNA polymerase lambda (ddNTP sensitive DNA Pol β equivalent) has also been cloned and sequenced. Light responsive elements (LRE) have been identified from the sequencing results. Since the enzyme is

involved in DNA repair in plants and endoduplication in developing seeds we are now trying to identify the status on the expression of the gene. We are also trying to find out the trans-acting factors which binds to the cis-acting elements by GMSA. So far the LRE detected from the upstream of RIN and SPS genes when used as probe in GMSA binding of ripening specific factors from tomato and banana fruits have been detected. Our goal is to clone the cDNAs for those factors.

Identification and Expression of insect/pathogen resistance genes in plants : (Dr. Sampa Das)

Insect resistant transgenic tobacco plants that were antibiotic-resistant-marker-gene free, were successfully developed using Cre-lox mediated recombination strategy through the expression of insect resistance gene which is now being applied to raise marker-free environment friendly rice and mustard plants. A unique alkaline phosphatase receptor protein of Cry1Ac type Bt toxin was identified in *Helicoverpa armigera* (commonly known as pod borer). Few differentially expressed gene/ gene fragments related to *Fusarium* wilt resistance were isolated from wild chickpea varieties, the expression profile of them were validated through Real Time PCR techniques.

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

Areca catechu pollen has been found to be an important aeroallergen from West Bengal. The pollen contains two important cross reactive components, of which one is cross reactive to other palm pollen grains. Hence it has the potential to be used in allergen immunotherapy of susceptible subjects. The patients with different allergic symptoms visiting the allergy clinic of the Institute of Child Health, Kolkata, were clinically studied and the relationship between the number of patients admitted and aerospora of a particular area was established. Two allergenic proteins (35.5 KDa & 15.5 KDa) were confirmed from *Rhizopus stolonifer*. An investigation on food sensitization in respiratory allergic patients of Kolkata proves that apart from age, food hypersensitivity also reflects different genetic factors and variations in cultural and dietary habits of each individual. 50 honey samples were studied palynologically, collected from different parts of West Bengal. Interestingly, different levels of heavy metals were found in some of the studied honey samples.

Regeneration of transformed *Plumbago indica* : (Dr. Sabita Bhattacharya)

Agrobacterium rhizogenes ATCC 15834 - mediated genetically transformed *Plumbago indica* plants were regenerated using hairy roots as the source material. Hormone-free MS medium, orbital shaking at 70 rpm and continuous irradiance are the conditions required for spontaneous regeneration. Integration of *rolB* gene in transformed plants was tested and

confirmed by sequencing and RT-PCR. All healthy transformed (T1) *P. indica* plants yielded significantly higher root bio-mass and plumbagin content (estimated by HPLC) in comparison to that obtained from the *in vitro* maintained non-transformed *P. indica*.

Maintenance of stability of "Rorippobrassica" lines : (Dr. Samir R. Sikdar)

Five original BC1S1 lines of "Rorippobrassica" (somatic hybrid between *Rorippa indica* and *Brassica juncea*) having five different chromosome numbers (2n=24, 40, 48, 54 and 60) were stabilized to 2n=20 in BC1S3 generation. All these five lines were maintained the same status in the BC1S4 generation, these also maintained highly branched, dwarf, early maturity and moderate aphid tolerance characters compared to *B. juncea* parent.

Genetic Diversity Analysis of Rice Landraces of West Bengal : (Dr. Tapas Kumar Ghose)

DNA profiling using 21 rice SSR markers of 120 rice genotypes has been completed along with determination of grain and kernel dimensions. Quality and biochemical characteristics of these genotypes were also determined. Genetic diversity analysis using RGA primers and sequencing thereof is in progress.

Genetic Diversity Analysis of *Carica papaya* (In Collaboration with Calcutta University, Dr. Pinaki Acharya, Faculty of Agriculture) : (Dr. Tapas Kumar Ghose)

Twenty four different genotypes of papaya were collected and their SSR study using 20 microsatellite primers is underway. Field study of agromorphology is underway.

DNA Fingerprinting of *Curcuma longa* (In Collaboration with Dr. S. Sen-Mandi, Department of Botany) : (Dr. Tapas Kumar Ghose)

Forty one different accessions of turmeric have been collected and their genetic diversity analysis is being done using 10 microsatellite markers. Collection of germplasm is underway.

Characterization and isolation of upstream elements of *Sinapis alba* genes induced by *Alternaria brassicola* : (Debabrata Basu)

Differential screening of *Alternaria brassicola* challenged cDNA library of *Sinapis alba* has allowed us to identify a number of full length cDNA clones which were induced during incompatible interaction with the fungal pathogen. Some of the promising genes are in the process of ascertaining the in-vivo function through transgenic approach. Furthermore, upstream elements of a few genes have been cloned by PCR based walking. Sequence analysis revealed the presence of WARKY as well as phytohormone dependent motifs in the promoters.

Differential expression profiling of *Fusarium oxysporum* f.sp.ciceris induced genes in resistant chickpea plant : (Debabrata Basu)

Through a functional genomic approach about 400 cDNA AFLP fragments induced by challenging with pathogen have been characterized. Sequence analysis indicates that a number of genes is involved with early signal perception.

Towards the development of a "shatter proof" genotype of Sesame : (Dr. Gaurab Gangopadhyay)

Sesame (*Sesamum indicum* L.) is an age-old yet under-exploited oilseed crop. Fully mature pods of Sesame plants are extremely sensitive to opening or dehiscence, resulting in seed loss (pod shatter) before harvest, which is a major economic problem for mechanized production. To overcome this problem the only viable solution is to develop "Shatter proof" genotypes of Sesame, which are presently not available in the Indian context. To fulfill the aforesaid ultimate objective, work has been initiated aiming at descriptor-based genotyping of the available sesame genotypes after procurement of Sesame accessions from germplasm repositories.

Role of transcription factors and regulation of miRNA biogenesis in Plant Stress Biology : (Pallob Kundu)

We are working on deciphering the molecular signature of transcription factors during specific stress response and establish the role of the transcription factors in signaling crosstalk during biotic and abiotic stress. Accumulating evidences revealed that microRNA (miRNA)-mediated posttranscriptional regulation plays a crucial role in the plant defense against pathogens. We will study how the pathogen induced stress signal is transmitted for the regulation of miRNA expression and activity in plant.

II. Protein Structure, Function and Engineering :

Indanocine binds to the colchicine site of tubulin : (Dr. B. Bhattacharyya)

Indanocine, a synthetic indanone, has shown potential antiproliferative activity against several tumor types. It is different from many other microtubule-disrupting drugs, because it displays toxicity toward multidrug resistance cells. Indanocine binds to the colchicine site of tubulin, although it bears no structural similarity with colchicine. Nevertheless, like the colchicine analogue (AC), indanocine is a flexible molecule in which two halves of the molecule are connected through a single bond. Also, like AC, indanocine binds to the colchicine binding site of tubulin in a reversible manner and the association reaction occurs at a faster rate for colchicine. The binding kinetics was studied using stopped-flow fluorescence. The association process follows biphasic kinetics similar to that of the colchicine-tubulin interaction. The activation energy of the reaction was 10.5 ± 0.81 kcal/mol. Further investigation using ITC revealed that the enthalpy of association of indanocine with tubulin is negative and occurs with a negative heat capacity change ($\Delta C_p = -175.1$ cal.mol⁻¹.K⁻¹). The binding is unique with a simultaneous participation of both hydrophobic and hydrogen bonding forces. Finally, we conclude that even though indanocine possesses no structural similarity with colchicine, it recognizes the colchicine binding site of tubulin and its binding properties resemble those of the colchicine analogue AC.

Identification of Zn⁺² binding sites in α -crystallin : (Dr. K. P. Das)

Mutational analysis has revealed that His18 and His119 of human α B-crystallin are part of the Zn⁺² binding sites. Replacement of His18 by Ala nullifies the effect of Zn⁺² on wt α B-crystallin, such as enhanced chaperone activity, enhanced hydrophobic exposure and enhanced thermodynamic stability. It was revealed that the 6-His-tag of some recombinant preparations interfered with the Zn⁺² binding.

Structural insight of α -crystallin through thiol reactivity : (Dr. K. P. Das)

We distinctly see two kinds of thiols in α A-crystallin, one active (cys142) and the other inactive (cys131) in native condition. We analyzed the kinetic profile of the thiol-DTNB reactivity according to a simple double exponential equation. Under partial unfolding at 1.5 M urea, cys131 was not much affected, although cys142 got more exposed. Exposure of cys131 was observed at higher urea concentration (>3.5M) only after cys-142 was fully exposed. Additives such as SDS, TFE, Tween-20, Na-deoxycholate bring the two cysteine residues close together by formation of an inward loop. Binding of ATP significantly enhanced the cys-131 accessibility without affecting cys-142. Thiol reactivity remained unaffected on Zn⁺² binding. The results indicate that the sequence region between residues 131 to 142 is affected only marginally when α A-crystallin interacts with α B-crystallin. It

also indicates that the unfolding in this sequence region occurs in stages. Further work is in progress.

Role of alternative sigma factors in *M. tuberculosis* gene regulation : (Dr. Jayanta Mukhopadhyay) (Institutional Programme II, VI)

Transcription is the first step in gene expression and is the step at which most regulation of gene expression occurs. RNA polymerase (RNAP) is the enzyme responsible for transcription and is the target, directly or indirectly, of most regulation of transcription. RNAP is an attractive target for broad-spectrum antibacterial therapy. Rifampin, used as an anti-tuberculosis agent, functions by binding to and inhibiting *M. tuberculosis* RNAP. The clinical utility of rifampin is limited by the existence of *M. tuberculosis* strains resistant to rifampin. Resistance to rifampin typically involves substitution of residues in or immediately adjacent to the rifampin binding site on *M. tuberculosis* RNAP. Therefore, there is an urgent need for new anti-tuberculosis agents that target sites within *M. tuberculosis* RNAP distinct from the rifampin binding site and thus exhibit additive or synergistic effects with rifampin. Our lab seeks to understand the structure and mechanism of transcription complexes of *M. tuberculosis* in order to provide a platform that would be useful for identifying and designing novel anti-tuberculosis agents. We are using integrated biophysical, biochemical and genetic approaches, along with a recombinant *in vitro* transcription system to address two specific issues: 1. Determination of the role of alternative sigma factors in gene regulation of *M. tuberculosis*. 2. Identification and characterization of inhibitors of *M. tuberculosis* gene expression.

Wag31, a chaperone-like protein that protects mycobacteria under oxidative stress : (Dr. Joyoti Basu, Dr. K. P. Das and Dr. Manikuntala Kundu) (Institutional programme II, V, VI)

This is an overlapping project (Institutional Programme II, V and VI). A detailed description can be found under Institutional Programme VI).

Characterization of regulatory and stress proteins of bacteria and bacteriophages (Dr. Subrata Sau)

The temperate *Staphylococcus aureus* phage $\phi 11$ harbors two putative repressor genes, namely, *cI* and *cro*. These genes were suggested to be involved in the lysogenic-lytic development of $\phi 11$. We have purified $\phi 11$ Cro (the product of $\phi 11$ *cro* gene) to homogeneity and characterized it by various *in vitro* techniques. $\phi 11$ Cro possesses a single domain, shows moderate thermostability, forms dimers in solution and carries substantial extent of α -helix even at 45°C. Of the three homologous 15-bp operators (*O1*, *O2*, and *O3*) in the $\phi 11$ *cI* - *cro* intergenic region, $\phi 11$ Cro has shown efficient binding only to *O3*, located upstream of the *cI* gene. Our comparative analyses indicate that the

structure and function of $\phi 11$ Cro are distinct from those of P22 Cro and λ Cro, the best characterized representatives of two structurally different Cro families.

We have also investigated the DNA binding capacity of the repressor of temperate mycobacteriophage L1 at length. L1 repressor was found to bind to its cognate operator DNA as a monomer. Several bases of the operator DNA were shown to contribute to the binding of L1 repressor *in vitro*. L1 repressor most possibly interacts with the major groove of operator DNA helix.

Staphylococcus aureus harbors three cold shock protein encoding genes, namely, *cspA*, *cspB*, and *cspC*. While the former two genes are cold inducible, the latter gene was found to be expressed extensively at 37°C. We have purified CspC (the product of *cspC*) to homogeneity and investigated its structure, function and stability elaborately. CspC exists primarily as a monomer in solution and binds preferably to the thymine base-rich single-stranded DNA. It is not a very stable protein but its stability was found to increase significantly upon its binding to the single stranded DNA.

S. aureus encodes four sigma subunits to express its housekeeping, virulence and competence genes. Structure, function and stability of staphylococcal sigma factors have not been studied at length though they are putative drug targets and multiple antibiotic-resistant strains of *S. aureus* have emerged and disseminated in almost all countries including India. Under this context, we have recently purified the primary sigma factor of *S. aureus* to homogeneity. Structural and functional characterization of this sigma factor is in progress.

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

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

Protein-nanoparticle interaction (Dr. P. Chakrabarti)

We have initiated a new project to understand the interaction of some model, as well as recombinant proteins with ZnO nanoparticles, synthesized and characterized in the lab of Dr. Vinay Gupta, Department of Physics and Astrophysics, University of Delhi.

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

Glutamyl tRNA synthetases come in three varieties, discriminatory (D-GluRS and GluRS1), non-discriminatory (ND-GluRS) and non-cognate (GluRS2). In order to elucidate the mechanism of tRNA discrimination by GluRS we are studying the structure/sequence/activity relationships between truncated versions of *E. coli* GluRS and several of its mutants. In addition, extensive bioinformatics studies are on to understand the evolution of bacterial GluRSs, with an emphasis on identification of residues that are responsible for tRNA discrimination. Results obtained so far strongly suggest that tRNA discrimination by GluRS is accomplished by both the catalytic as well as the anticodon-binding domains of GluRS. tRNA discrimination by the catalytic domain is a new result that has important implications.

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

The protein tubulin plays a central role in cell division and can bind a number of antimitotic drugs (like colchicine). Previously we had hypothesized that two residues (Ala248 and Pro268 in animal beta-tubulin) are crucial for colchicine binding to tubulin. In addition we had hypothesized that the colchicine-binding site of tubulin may play a biological role. We are now systematically mutating these residues in yeast tubulin to validate our hypothesis and to gain insight about the biological role of the colchicine-binding site. Preliminary data shows that these two residues indeed play a vital role in the viability of *Saccharomyces cerevisiae*. In addition we are also performing phage display experiments against goat tubulin to identify short peptide sequences that might bind the colchicine-binding site. We also recently completed the analysis of paclitaxel binding site of tubulin.

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

Recently we showed by NMR that Pro-Pro peptide bonds could substantially populate the cis conformer if Phe follows the Pro-Pro unit (as in Ac-Pro-Pro-Phe-NH₂). A number of peptides are currently being studied using NMR, where the Phe residue is being systematically varied to generalize our results. Preliminary data show that cis Pro-Pro peptide bonds are stabilized by the Pro-Pro-Aro motif where Aro is an aromatic amino acid. This is a new sequence motif discovered in our lab.

Ultrafast Trp dynamics in designed peptides from time resolved fluorescence : (Dr. Gautam Basu, Dr. Samir K. Pal, SNBNCBS)

Despite being an important marker for protein structure and dynamics, the origin of fluorescence lifetimes of Trp in proteins is not clear. We have synthesized a series of short

peptides with Trp and have conducted fluorescence experiments (along with NMR) to understand subtleties of Trp fluorescence. Our focus is on ultrafast (sub-nanosecond) dynamics of Trp.

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

The protein translocon channel resides in the membrane and allows newly synthesized proteins to be translocated into the endoplasmic reticulum from the ribosome. With the structure of the channel known, the focus is on elucidating mechanisms of protein translocation through the channel. In this regard we are synthesizing the isolated plug SecY plug domain in SecYEG protein translocation channel, hypothesized to block the channel in the closed state. The aim is to study the conformation of the isolated plug domain and its analogs by (CD and NMR) for further elucidation of the role of the plug domain in protein translocation.

Mechanism of the antiproteolytic activity of λ CIII : (Dr. Pradeep Parrack)

The CIII protein of bacteriophage lambda inhibits the protease activity of *E. coli* HflB, promoting λ lysogeny. We demonstrated that this antiproteolytic activity of λ CIII is due to a direct CIII-HflB interaction, for both λ CII and *E. coli* σ 32 proteins, the substrates of HflB, and does not involve any inhibitor (λ CIII)- substrate (λ CII or σ 32) interaction.

RecA-mediated cleavage of λ cI repressor : (Dr. Rajagopal Chattopadhyaya)

The λ cI repressor is found to be cleaved in the presence of activated RecA in its DNA-bound dimeric form at a rate similar to that in the absence of operator DNA in contrast to previous studies inferring repressor monomer as a preferred substrate. Though activated RecA does not possess any measurable isomerase activity against a standard peptide substrate, prolyl isomerase inhibitors cyclosporin A and rapamycin do inhibit RecA-mediated cleavage. Histidine and lysine to a smaller extent, are shown to cleave cI repressor in a non-enzymatic fashion whereas arginine and glutamate do not. When activated RecA filament is covalently modified by using an excess of diethyl pyrocarbonate or maleic anhydride, RecA-mediated cleavage of cI repressor is inhibited. Combining our chemical modification data with model building and earlier mutagenesis data, it is argued that H163, K177 and K232 in RecA are crucial residues involved in cI repressor cleavage by combining with the catalytic Ser149 and K192 in the repressor. It is suggested by model building that subunits n, n + 4 and n + 5 in the RecA filament contribute one loop each for holding the C-terminal domain of the repressor during cleavage within the RecA helical groove, explaining why its ADP-form is inactive and its ATP-form is active during repressor cleavage.

III. Bioinformatics and Computational Biology :

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

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

Analysis of surface pockets and cavities in protein structures : (Dr. P. Chakrabarti)

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

Evolutionary Bioinformatics : (Dr. T. C. Ghosh)

Major scientific interest of our group is to understand the processes and mechanisms of molecular evolution at the genomic level. We conduct systematic analyses on genomic data of both prokaryotic and eukaryotic genomes, by applying a multidisciplinary approach. Very briefly, the major results of the last one year (2008-09) are as follows:

Underlying evolutionary forces of synonymous codon usage in rice and in *Saccharomyces cerevisiae* have been identified.

By analyzing the proteins of *Saccharomyces cerevisiae* in protein-protein interaction network, we marked the structural aspects of proteins in their evolution.

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

Protein-protein interactions lie at the heart of the functioning of cellular processes. Two questions being currently addressed by us are: (1) How two protein subunits properly orient with respect to each other in order to form the final complex, and (2) Can such information be used to help reject wrongly oriented subunits in predicted protein-protein structural complexes, generated from molecular docking studies. We have now established that electrostatics plays a central role in the rejection of wrong subunit orientations in protein-protein interactions.

Molecular Dynamics simulations of short peptides : (Dr. Gautam Basu)

Although molecular dynamics (MD) is a powerful simulation technique, the main limitation of MD simulation is the lack of computational power for simulating long trajectories that are physically relevant. Despite these limitations, MD can provide useful

information about a molecule provided the system being simulated is small. We are currently performing MD simulations on a variety of peptides — short Pro-Pro peptides with CH- π interactions and constrained helical peptides with the amino acid Aib. We use traditional techniques as well as newer sampling techniques like replica exchange.

Analysis of protein dynamics using simplified harmonic models : (Dr. Gautam Basu, Dr. Pradeep Parrack)

Large-scale protein motions, like hinge bending, are biologically relevant. Although the system can become too large to be comfortably studied by full atomistic models, simplified models like the Gaussian Network Model (GNM) is becoming more and more useful to understand protein dynamics. We have started looking at the hinge bending motion of catabolite gene activator protein (CAP) from *E. coli*.

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

This is an overlapping project (Institutional Programme II, III). A detailed description can be found under Institutional Programme II.

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

This is an overlapping project (Institutional Programme II, III). A detailed description can be found under Institutional Programme II.

Evolutionary insight into bacterial aromatic ring-hydroxylating dioxygenases : (Dr. Tapan K. Dutta)

Bacterial aromatic ring-hydroxylating dioxygenases (ARHDs) constitute a large family of enzymes that have potential utility in bioremediation of recalcitrant aromatic compounds. To cope with the enormous diversity of toxic and/or carcinogenic aromatic compounds in the environment, this enzyme family has evolved remarkably. Several genes encoding ARHDs have been characterized in different species of bacteria, which give useful information about the evolution and diversity of catabolic pathway genes via horizontal transfer, gene duplication, transposition events and DNA rearrangements. But none of the studies have addressed the early evolutionary events and absolute information regarding the origin of these multi-component dioxygenase systems. The present study describes the evolutionary scenarios that might have occurred during the evolution of dioxygenases with such broad substrate specificity, by analyzing a complete set of published ARHD sequences as well as those obtained from complete genomes. We also suggest a possible origin of the oxygenase α -subunit from a hypothetical pre-oxygenase module.

IV. Molecular Medicine :

Localization and Expression of a 70 kDa Protein in Goat Spermatozoa having Na^+/K^+ - ATPase Inhibitory and Aryl Sulfatase - A Activities : (Dr. Parimal C. Sen)

We have previously isolated and purified a goat sperm protein of 70kDa molecular weight designated as P70 and characterized it as an inhibitor of Na^+/K^+ - ATPase. Our study reveals that the first ten amino acid residues from the N-terminal end of P70 has high degree of homology with arylsulfatase A from mice, pig and human. Indirect immunofluorescence study shows the presence of the protein on goat sperm surface. Furthermore, live goat sperm and the extract of peripheral sperm plasma membrane proteins exhibit arylsulfatase A's desulfation activity. P70 remains on the head surface of *in vitro* capacitated cauda epididymal sperm as shown by positive immunofluorescence staining of cauda sperm. Immunoblot and flow cytometric studies corroborate the above findings. The presence of P70 on capacitated cauda sperm surface suggest a possible role of this protein in sperm zona-pellucida binding. In the present report we demonstrate aryl sulfatase A-like activity in P70 and described its localization and expression in goat sperm.

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

A protein having inhibitory effect on Na^+/K^+ -ATPase as well as showing arylsulphatase A activity (ASA) was isolated from the cytosolic fraction of goat spermatozoa. The protein was characterized biochemically. The molecular mass of the protein was found to be 70 kDa on 10% SDS-PAGE after 35% ammonium sulphate precipitation, followed by hydroxyapatite column chromatographic separation. The ASA activity of the protein was studied with respect to its pH (5.5), temperature optimum (37°C) and incubation time (30 min). The isoelectric point (pI) of the protein was found to be 4.9. The protein and arylsulphatase from a commercial source were studied with respect to the sensitivity to different metal ions, vanadate, carbonyl compounds and ascorbate. Inhibition of AS activity in P70 by silver nitrate suggested that it was related to ASA. Comparable effects of different polyunsaturated fatty acids and purified anti P70-antibody on P70 and arylsulphatase from commercial source were observed. The findings suggested that the protein was novel in having both regulatory and catalytic functions, and showed similarities with the ASA reported from different sources.

Therapeutic efficacy of CXC chemokine against visceral leishmaniasis : (Dr. Subrata Majumdar)

IP-10, a proinflammatory CXC chemokine, has been shown to render protection against both *in vitro* and *in vivo* models of Visceral Leishmaniasis (VL). The protective response

was found to be mediated via the enhanced proinflammatory response in the form of Th1 cytokines and nitric oxide, which was almost similar to the established CC chemokine mediated immune therapy against VL.

Saprophytic mycobacteria as an immunomodulator in the control of visceral leishmaniasis: (Dr. Subrata Majumdar)

Mycobacterium welchii (Mw) is a saprophytic, non-pathogenic, cultivable mycobacterium species. Mw acts as a potent immuno-modulator as it could increase the immunotherapeutic effect of sCD40L and Amphotericin B at their non effective dose through the induction of pro-inflammatory response. Immunoprophylactic effect of Mw is significantly prominent in L. donovani infected BALB/c mice but not so significant in $\text{CD40}^{-/-}$ mice indicating that Mw may use CD40 to generate its protective immune response.

Ara-LAM triggers Th1 response in Leishmania infected Balb/c mice. : (Dr. Subrata Majumdar)

Arabinosylated lipoarabinomannan (Ara-LAM) is a cell wall glycolipid isolated from the nonpathogenic mycobacterium. Ara-LAM treatment can induce immunoprophylactic responses in murine model of VL. This protective response is mediated through activation and proliferation of Th1 cytokine secreting CD4^+ T cells.

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

Our research mainly focuses on the mechanism of the beneficial role of naturally occurring bio-active molecules in organ pathophysiology. Ongoing studies led us to the isolation and functional characterization of various bioactive molecules from a number of medicinal plants. On investigating cell signaling pathways, we found that some common pathways are shared by these molecules for their mode of action although chemical structures do not classify them under the same category. Studies are going on for further characterization of these protective biomolecules.

Rejuvenation of apoptotic program in resistant cancer cells : (Dr. Tanya Das)

The most common alterations found in human breast cancer are inactivation or mutation of the tumor suppressor gene p53. Theaflavins induced apoptosis in p53-mutated human breast cancer cells via two distinct signaling pathways: (i) activation of death receptor pathway, i.e, Fas/FADD/caspase-8/t-bid pathway, and (ii) inhibition of survival pathway, i.e, PI-3K/Akt/Bad, that converged to a common process of mitochondrial death cascade. Since breast cancer cells with mutant p53 are strongly resistant to conventional therapies,

these findings indicate a great potential for theaflavins in providing new avenues for treatment.

Inhibition of cancer metastasis : (Dr. Tanya Das)

Currently, there is no effective therapy for metastatic breast cancer. Theaflavins have been found to inhibit human breast cancer migration by inhibiting NF-kappaB via p53-dependent ROS generation. Inhibition of NF-kappaB resulted in down-regulation of the metastatic proteins MMP-2 and MMP-9. Targeted signal modulation therapy using theaflavins may, therefore, improve clinical management of invasive breast cancer cells.

Regulation of tumor angiogenesis : (Dr. Tanya Das)

Angiogenesis is a key step in tumor growth, targeting which seems to be a promising approach for anti-tumor treatment. Our objective was to verify the anti-angiogenic potential of plant polyphenols, curcumin, theaflavins, capcisin etc. Our results indicate that plant polyphenols down-regulated the expressions of the pro-angiogenic factors VEGF, HIF1 α and TGF- β , and upregulated anti-angiogenic p53 in human breast cancer cells thereby controlling the balance between pro/anti-angiogenic molecules in influencing angiogenesis.

p73 is accumulated and activated to induce Bax-mediated apoptosis in response to DNA damage when p53 function is impaired by genetic deletion or functional mutation : (Dr. Gaurisankar Sa)

The tumor suppressor p53 plays a central role in regulating apoptosis, cell cycle, genomic integrity and DNA repair in response to various forms of genotoxic stress. We report here that in functional p53-deficient cells, Chk-1 controls the expression and accumulation of p53 related transcription factor p73 in response to DNA damage. We also demonstrate that p73 mediates Bax expression in the absence of functional p53. Multiple experimental systems were used to demonstrate that interference of p73-signaling strongly impacts Bax expression in absence of functional p53. Thus, Chk-1, p73 and Bax function in a single pathway directing p53-independent apoptosis induced by the genotoxic drug curcumin. When p53 function is restored by ectopic-expression, Chk-2 controls the accumulation of p53 rather than p73 and dominant-negative (Δ N) variants of p73 suppresses p73 activity in response to DNA damage. When p53 is transiently silenced by RNA-interference, genotoxic stress fails to induce p73-mediated Bax as in these cells the status of Δ Np73 remains unchanged and acts in a dominant-negative manner against p73. Interestingly, during prolonged functional impairment of p53 by Δ Np53 overexpression, apoptotic role is conferred probably by disabling Δ Np73 activity, thus increasing the expression and accumulation of p73, which was sufficient to kill cells. Hence, activation of p53/p73

depends on the cellular micro-environment and the nature of genotoxic stress to induce apoptosis via control of p53-/p73-regulatory proteins. Since p53 is often obviated through functional mutation as a cellular port for anticancer intervention, this pathway controlling p53 autonomous pro-apoptotic signaling is of potential therapeutic significance.

Endocrine manipulation for better production of commercially important small animals : (Dr. Arun Kumar Ray)

In continuation of our previous findings that silkworms have their own specific radioactive estradiol(E2)-binding sites, further studies were undertaken to demonstrate the correlation of specific E2 binding in tissues with the appearance of different E2-specific metabolic enzyme activities in some vital organs of silkworm pupae, at different days of pupal development. The appearance of specific E2 binding sites, endogenous level of cytosolic estradiol, and expression of the estradiol-responsive enzymes such as glucose-6-phosphate dehydrogenase, NAD and NADP- linked malate dehydrogenase, and glutamate-pyruvate-transaminase correlated positively with each other during pupal life, in fat body and in gonads. Such a phenomenon indicates that endogenous estradiol is involved in some metabolic processes in silkworm.

Although the thyroid hormonal profile did not show marked alterations between diploid and the triploid *H. fossilis*, with unchanged plasma level of total and free T4 and T3 except in spawning period, the thyroid gland of triploid fish showed lower amount of cell/colloid area ratio at the spawning period of the reproductive cycle. However, massive failure of accumulation of vitellogenin, the egg yolk precursor protein in plasma, was noticed in triploid catfish even from the preparatory phase of the reproductive cycle. A parallel feature of lower accumulation of T3 molecules in oocytes in the triploid fish demonstrated an altered relationship of the three important parameters related to normal reproductive capability in triploid Singi fish.

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

In connection with our search for the specific signal(s) responsible for the onset of the Central Homeostatic Mechanism, the functional aspects of deiodinase type II (DII) have been studied. The enzyme is responsible for the cerebral conversion of T4 to T3. It showed a high degree of correlation with synaptosomal T3 content (correlation coefficient $r = 0.99$). DII activity increased on the day of onset (Day '2') of the 'central thyroid hormone homeostasis' concomitant with a rise in the synaptosomal T3 level. Such an increased DII activity persisted till Day '18', the day up to which the brain T3 level was maintained. Thus, higher DII activity indicated an adaptive increase in response to PTU-induced hypothyroidism to maintain the neuronal T3 level within a narrow limit. Again, the fall in DII activity after twenty days of continuous PTU injection (Day '20') is supportive of the

decreased synaptosomal T3 content and disruption of the central thyroid hormone homeostasis. The main signal for the central maintenance of T3 by increased DII activity is low serum total T4 content. In the absence or low concentration of T4, p29 (the substrate binding subunit of DII) is slowly endocytosed. Presence of T4 accelerates the rate of DII inactivation by polymerisation of actin fibres.

Capsaicin as a potential chemopreventive and chemotherapeutic agent in medullary thyroid cancer : (Dr. Arun K. Ray, in collaboration with Dr. Tanya Das)

Thyroid cancer is the most common among endocrine gland cancers. Recent discoveries have provided a greater understanding of the molecular basis of thyroid cancer; these advances are being exploited to provide targeted drugs and new therapeutic approaches. Recently naturally occurring plant products have provided opportunities to develop strategies for curing cancer by directly or indirectly altering specific cellular targets. In this regard, capsaicin, a homovanillic acid derivative (*trans*-8-methyl-*N*-vanillyl-6-nonenamide), the major pungent ingredient in red pepper, has already been shown to possess anti-carcinogenic effects against some of the tumor cell lines. Therefore, studies were undertaken to determine the role of capsaicin in inducing thyroid medullary cancer cell death.

Capsaicin treatment exhibited medullary thyroid cancer cell killing effect in a dose-dependent manner. The mode of cell death was found to be apoptotic. The ratio of pro-apoptotic and anti-apoptotic proteins was also found to be altered during this course of action. Capsaicin treatment probably drives the thyroid cancer cells towards apoptosis through a p53-independent pathway. Further work is in progress to delineate the complete mechanism.

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

Marine shrimp (*Penaeus monodon*) aquaculture is one of the most economically important industries all over the world, including India. White spot disease caused by white spot syndrome virus (WSSV) is the major threat in shrimp aquaculture that results in huge economic loss worldwide. Despite serious efforts, the failure in most cases in controlling the disease caused by viruses continues in huge economic loss. For the first time we have developed two DNA markers to identify disease resistant *Penaeus monodon*. We have collected wild *Penaeus monodon* from four geographically distant locations on the east coast of India (Digha, West Bengal, Chilka, Orissa, Visakhapatnam, Andhra Pradesh, and Chennai, Tamil Nadu). All shrimp samples were screened for WSSV and the highest WSSV prevalence was found among the natural population collected from Chennai followed by Digha, Visakhapatnam and Chilka respectively. Genomic DNA was prepared from pleopod tissue and will be tested for disease resistant population using two DNA markers developed in our laboratory. This information will be very useful in developing

disease resistant brood-stock for marker-assisted selection (MAS) of breeding program for shrimp hatcheries and the supply of disease resistant seeds to the rural shrimp farmers. As a result, this will prevent the huge socio-economic damages due to viral diseases in shrimp aquaculture industries, leading to rural development, socio-economic upliftment and improvement in both rural and urban populations.

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

Coronary heart disease (CHD) leads to a large proportion of all deaths worldwide. The number of deaths in the Indian population due to CHD has also increased drastically. It has been predicted that the cause of deaths from CHD in the Indian population will be rank one by the year 2015. The high tendency of developing premature and accelerated CHD in the Asian Indian population is only partially explained by the presence of conventional risk factors such as insulin resistance and abdominal obesity. Therefore, from the preventive point of view, it is very important to develop alternative biomarkers to predict CHD.

We have studied case control of CHD with ratios of different lipoproteins and apolipoproteins, LDL particle size as well as different traditional risk factors among the Asian Indian population in the Eastern part of India. From multivariate analysis it has been observed that apoB, apoB/HDL-c, nonHDL-c, apoB/apoAI and LDL particle size are the potent indicators that can be used for diagnosis of predisposed CHD.

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

Routine conventional therapies cannot differentiate between malignant and normal cells. As a consequence, purified chemical drug therapy i.e., Chemotherapy, often leads to harmful side effects in the patient's body. In some cases drug resistance is also another major problem. Thus, it is still a challenge for the scientific community to develop novel drugs against cancer. However, various plant products or metabolites are used to treat cancer in the ancient systems of medicine such as *Ayurveda*.

Reactive oxygen species (ROS), generated in cells, are fundamental in transforming various physiological functions and represent an essential part of aerobic life and metabolism. "Oxidative stress" resulting from an imbalance between formation and neutralization of pro-oxidants is initiated by ROS, which seek stability through electron pairing with biological macromolecules such as proteins, lipids and DNA in healthy human cells and cause damage to protein and DNA along with lipid peroxidation. This situation brings about a variety of disorders including coronary heart disease, neurodegenerative disorders, diabetes, arthritis, inflammation, lung damage and cancer. Since antioxidants are capable of preventing oxidative damage, the wide use of natural antioxidants as a

replacement for conventional synthetic antioxidants in food and food supplements has been employed since natural products are considered to be promising and safe. At the preliminary stage, we have established that 70% methanolic crude extract of some Indian medicinal plants possess potent antioxidants and ROS scavenging activities. Some of these also have very good iron chelating properties. These could be useful as natural antioxidants to prevent and cure various diseases including cancer.

Synthesis of glycoconjugates for their use in the immunology : (Dr. Anup K. Misra)

We have synthesized a number of complex oligosaccharides (tetra-, penta, hexa- and heptasaccharides) and published in journals of international repute. A series of glycosyl hydrazone derivatives were synthesized and evaluated as anti-dyslipidemic and antioxidative agents in collaboration with the Central Drug Research Institute, Lucknow.

V. Microbial Genomics and Infection Biology :

Helicobacter pylori antigen, HP0175 activates vascular endothelial growth factor VEGF in a HIF-1 alpha and Sp1-dependent manner : (Dr. Manikuntala Kundu and Dr. Joyoti Basu)

Helicobacter pylori (*H. pylori*) infection is associated with continuous remodeling of the gastric epithelium in which there is an interplay between tissue-damaging effects induced by the pathogen and the response of the host towards offsetting these effects. Vascular endothelial growth factor (VEGF); an angiogenesis-promoting molecule, is a major player in these processes. We have uncovered the mechanism of regulation of VEGF production by HP0175 involving the hypoxia regulatable transcription factor HIF-1, and Sp1. The histone deacetylase HDAC1 plays a central role by positively regulating both HIF-1-alpha and Sp-1-dependent VEGF promoter activation.

Dissecting the role of TNF and FLIP_s in *M. tuberculosis*-induced macrophage apoptosis : (Dr. Joyoti Basu and Dr. Manikuntala Kundu)

Apoptosis plays a central role in the interplay between pathogenic mycobacteria and host macrophages. We have initiated efforts to understand the signaling network that regulates *Mycobacterium tuberculosis*-induced cell death in host macrophages. We have uncovered a novel pathway involving the tumor necrosis factor (TNF), the ASK1, p38 and c-Abl kinases. FLIP_s phosphorylation on serine-4 and tyrosine-211 is effected by ASK/p38 MAP kinase and c-Abl respectively, eventually facilitating interaction of FLIP_s with the ubiquitin E3 ligase, c-Cbl. This interaction triggers proteasomal degradation of FLIP_s, which promotes caspase 8 activation and apoptosis. These findings reveal a previously unappreciated signaling pathway needed for *Mycobacterium tuberculosis*-triggered macrophage cell death.

Regulation of the sigma factor, SigE in *Mycobacterium tuberculosis* : (Dr. Manikuntala Kundu and Dr. Joyoti Basu) (Institutional programme V, VI)

This is an overlapping project (Institutional Programme V and VI). A detailed description can be found under Institutional Programme VI.

Wag31, a chaperone-like protein that protects mycobacteria under oxidative stress : (Dr. Joyoti Basu, Dr. K.P. Das and Dr. Manikuntala Kundu)

This is an overlapping project (Institutional Programme II, V and VI). A detailed description can be found under Institutional Programme VI.

Metabolic cooperation in the bacterial assimilation of phthalate esters : (Dr. Tapan K. Dutta)

In the degradation of phthalate esters with butyl benzyl phthalate (BBP) as a model compound by a coculture of *Gordonia* sp. strain MTCC 4818 and *Arthrobacter* sp. strain WY, the innate BBP-metabolic limitations of the individual species were overcome leading to the development of an efficient system capable of complete mineralization of BBP. In the assimilation of BBP by the coculture, the presence of multiple esterases was ascertained in both the species, depicting their distinct and/or synergistic roles in the degradation process. The esterases were found to be inducible in nature with unique or broad substrate specificities towards BBP and its monoesters. Moreover, synergistic effect of a number of catabolic enzymes other than esterases identified in the metabolism of BBP-degraded intermediates supposedly facilitated the coculture-mediated assimilation process. The versatility of the coculture was further established from an efficient and complete degradation of a mixture of phthalate esters which are of environmental concern.

Degradation of a large spectrum aromatics by a versatile *Sphingomonas* sp. : (Dr. Tapan K. Dutta)

Based on morphological, nutritional, biochemical and 16S rRNA analysis, a soil isolate was identified as *Sphingomonas* sp, capable of degrading naphthalene, phenanthrene, anthracene and biphenyl individually as sole carbon sources. The metabolic potential toward these aromatics were partially elucidated from TLC, HPLC and GC-MS analyses apart from oxygen uptake experiments by whole cells on probable metabolic intermediates and by monitoring spectral changes of the cell-free extract-mediated enzymatic transformations. A number of novel metabolic functions regulated under specific growth conditions was observed. Detailed biochemical and molecular analyses are underway to understand the regulation of novel metabolic functions and the mechanistic details of the pathways of assimilation of these aromatic compounds.

Mechanism of the antiproteolytic activity of λ CIII : (Dr. Pradeep Parrack)

This is an overlapping project (Institutional Programme II, V). A detailed description can be found under Institutional Programme II.

Functional studies on *Escherichia coli* HflX protein : (Dr. Pradeep Parrack)

The *Escherichia coli* HflX protein, whose function is unknown, was purified and studied. It was found that HflX is a purine-specific NTPase, and binds to 50S ribosomes. However, HflX has no effect on lambda lysogeny or on transposition.

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

In contrast to the perception that the DNA content of an organism is stable and maintained during different conditions and life cycle stages, new evidence shows that many organisms display changes in their DNA content at different stages of their life cycle. We have earlier identified intra-cellular and inter-cellular differences in DNA content of the protist pathogen *Entamoeba histolytica* and established that this organism can tolerate large variations in DNA content during axenic culture. In two papers published during 2008-2009, (PloS NTD) we have made an important advancement in the understanding of amoeba biology where we have shown that changes in growth conditions and life cycle stages are accompanied by large differences in DNA content involving gain or loss of whole genome copies. Additionally, we have shown that unlike in typical eukaryotes, re-duplication of DNA is followed by segregation on atypical and diverse microtubular structures in *E. histolytica*. In this parasite, cell division is erratic, so that each daughter cell may contain one or more nuclei and sometimes no nucleus. This uncoupling of cell cycle events and the survival of daughter cells with unequal DNA contents leads to genetic heterogeneity in *E. histolytica*. Our study highlights the inherent plasticity of the *Entamoeba* genome and the ability of this protist to survive in the absence of strict regulatory mechanisms that are a hallmark of the eukaryotic cell cycle. This property may well regulate the outcome of infection and subsequently the disease. Elucidation of molecular mechanisms regulating cytokinesis and genome segregation are current themes of work-in-progress.

Exploring the Mycobacteriophage metagenome – Characterization of novel genes derived from Mycobacteriophage D29 : (Dr. Sujoy K. Das Gupta)

Mycobacteriophages are considered as 'cornerstones of Mycobacterial research'. In recent years many Mycobacteriophage genomes have been sequenced. *In silico* analysis has predicted that Mycobacteriophage genomes are repositories of many novel genes. In an effort to identify such genes my laboratory has initiated studies with Mycobacteriophage D29. One of the various D29 genes characterized thus far in this lab, is gene 65. This gene encodes a novel exonuclease belonging to the hexameric DnaB helicase superfamily, which specifically acts on DNA forks and removes the 3' arms. The protein is expressed

in the middle early stages of Mycobacteriophage infection, and is probably involved in processing stalled forks for further replication and repair.

High Fidelity Chromosome Transmission in Yeast : (Dr. Pratima Sinha)

The budding yeast protein Sum1 is a transcription factor that associates with the histone deacetylase Hst1p to repress transcription. In our laboratory, *SUM1* has been identified as an allele-specific dosage suppressor of mutations in the major α -tubulin coding gene *TUB1*. The suppression was Hst1p-independent, suggesting that it was not mediated by acetylation-deacetylation events of Hst1p. When overexpressed using the *GALI* promoter, *SUM1* caused complete disruption of mitotic spindles. Cells deleted of this gene showed moderate hypersensitivity to benomyl and cold-sensitive growth. These observations suggest a novel role for Sum1p as a regulator of microtubule function. The mechanism of suppression is under study.

VI. Development of Systems Biology :

Interdisciplinary Physics/Systems Biology : (Dr. Indrani Bose)

We have studied the functional characteristics of a two-gene motif consisting of a double positive feedback loop and an autoregulatory negative feedback loop. The motif appears in the gene regulatory network controlling the functional activity of pancreatic β -cells. The model exhibits bistability and hysteresis in appropriate parameter regions. The double positive feedback loop involves the transcription factors (TFs) HNF-1 α and HNF-4 α each of which activates the synthesis of the other. There is also some evidence that HNF-4 α autorepresses its own synthesis. Mutations in the TF genes give rise to a type of diabetes known as the maturity-onset diabetes of the young (MODY) which has an early onset with age less than 25 years. The two stable steady states in the bistable region correspond to low (OFF state) and high (ON state) TF levels, respectively. Normal functioning of the pancreatic β -cells requires the system to be in the ON state. The circuit operation is, however, vulnerable to the loss in gene copy number (in a diploid organism, each gene has two identical copies) brought about by mutations. The origin of MODY lies in a sizable fraction of the β -cells being in the OFF state. Using deterministic as well as stochastic formalisms, we have identified the special dynamical features of the two-gene motif which help in the maintenance of the normal β -cell function with or without mutations. We have continued our studies on the roles of noise and positive feedback in initiating the stringent response in mycobacteria.

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

This is an overlapping project (Institutional Programme II and VI). A detailed description can be found under Institutional Programme II).

A systems biology approach to quorum sensing in marine bacteria : (Dr. Suman Banik)

Quorum sensing is a process through which a bacterial cell in a population communicates with another by detecting and then transferring the extracellular signal through a phosphorelay network. The chemical species that function as the signalling molecule are the autoinducers, released and detected by bacteria. The detected signal then flows through the phosphorelay cascade, finally activating a downstream gene to express different bacterial processes, e.g., bioluminescence, biofilm formation and virulence, etc. One of the well studied model organisms for quorum sensing based bioluminescence regulation is the marine bacterium *Vibrio harveyi* which produces light in the visible wavelength range at high population density. To model the signal transduction pathway in *Vibrio harveyi* we have adopted a systems biology approach based on the underlying biochemical reaction

network. We hope that our way of modelling will help in understanding the experimental results and in making new testable predictions.

Helicobacter pylori antigen, HP0175 activates vascular endothelial growth factor VEGF in a HIF-1 α and Sp1-dependent manner : (Dr. Manikuntala Kundu and Dr. Joyoti Basu)

A large scale genomic microarray analysis has been completed in order to understand overall activation or inhibition of different sets of genes in gastric epithelial cells after incubation with the above secretory antigen of *H. pylori*.

Dissecting the role of TNF and FLIPs in *M. tuberculosis*-induced macrophage apoptosis : (Dr. Joyoti Basu and Dr. Manikuntala Kundu)

This is an overlapping project (Institutional Programme V and VI). A detailed description can be found under Institutional Programme V.

Activation of the two-component system MprAB and the alternate sigma factor SigE in mycobacteria : (Dr. Manikuntala Kundu and Dr. Joyoti Basu in collaboration with Dr. Indrani Bose)

Long-term survival of *Mycobacterium tuberculosis* under nutritionally starved conditions poses a problem in the treatment of tuberculosis and underscores the need for understanding the biology of the organism with reference to its ability to adapt to nutritional limitation.

We show that both *mprA* and *sigE* expression shows bimodal distribution in a growing population of mycobacteria with two distinct peaks corresponding to low (L) and high (H) expression states. We observe that transition from the L to the H expression state occurs within a "window" where noise in gene expression is the highest. These results provide evidence that the effect of positive feedback and noise is propagated down a signaling pathway culminating in the expression of the stringent response regulator *rel*.

Regulation of the sigma factor, SigE in *Mycobacterium tuberculosis* : (Dr. Manikuntala Kundu and Dr. Joyoti Basu)

The regulation of alternate sigma factors in mycobacteria is poorly understood. Our studies demonstrate that the anti-sigma factor anti-SigE is degraded by proteolysis in cells exposed to surface stress (mild detergent or the drug vancomycin). Proteolysis of anti-SigE is effected by the ClpXP protease and requires phosphorylation by the serine/threonine kinase PknB. This study provides one of the few links of serine/threonine kinases to alternate sigma factor regulation.

Wag31, a chaperone-like protein that protects mycobacteria under oxidative stress : (Dr. Joyoti Basu, Dr. K.P. Das and Dr. Manikuntala Kundu) (Institutional programme II, V, VI)

We have undertaken proteome-level analysis of the interacting partners of Wag31.

Wag31 of *Mycobacterium tuberculosis* belongs to the DivIVA family of proteins known to regulate cell morphology in Gram-positive bacteria. Our investigation shows that the penicillin-binding protein PBP3 is protected from cleavage by the intramembrane metalloprotease Rv2869c under oxidative stress by virtue of its direct interaction with Wag31 which has been confirmed by surface plasmon resonance. Overexpression of Wag31(Δ^{46} NSD⁴⁸) [which is defective in its PBP3-interacting ability] attenuates the survival of *M. tuberculosis* in macrophages with concomitant cleavage of PBP3, and renders the organism more susceptible towards hydrogen peroxide as well as drugs which generate reactive oxygen species, namely isoniazid and ofloxacin. We propose that targeting Wag31 could enhance the activity of mycobactericidal drugs which are known to generate ROS.

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

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

On the basis of a variant of the EPR-Bohm example of quantum entanglement, it has been shown that the no-signaling condition can be employed as a useful tool for deriving a constraint on a suitably defined measure of the 'nonidealness' of a most general Stern-Gerlach (SG) setup.

The classical limit problem of quantum mechanics has been revisited on the basis of a scheme that enables a quantitative study of the way the quantum-classical agreement emerges while going through the intermediate mass range between the microscopic and the macroscopic domains. As its application, the classical limit of quantum time distribution, a hitherto unexplored area of study, has been investigated.

Non-uniqueness inherent in the standard quantum mechanical calculation of transit time distribution has been analyzed in terms of a testable example for which the transit time distribution can be measured in terms of the spin distribution of spin-1/2 neutral particles emerging from a spin-rotator. This analysis enables one to provide a critical test of the Bohmian model of quantum phenomena.

Quantum Phase Transitions and Entanglement : (Dr. Indrani Bose)

We have continued our studies on quantum phase transitions (QPTs) in two-chain antiferromagnetic spin ladders. The spin ladder is known to undergo second order QPTs at two critical values H_{C1} and H_{C2} of an external magnetic field H . There are now known examples of organic ladder compounds in which QPTs have been experimentally observed. We have determined the variation of some well-known entanglement and fidelity measures close to the two quantum critical points (QCPs). A well-known theorem suggests that the first derivatives of the entanglement measures with respect to H should diverge as the QCPs are approached. Based on numerical diagonalization data and a mapping of the ladder Hamiltonian onto the XXZ chain Hamiltonian for which several analytical results are known, we have shown that the derivatives of the entanglement measures diverge as $H \rightarrow H_{C2}$ but remain finite as $H \rightarrow H_{C1}$. The reason for this discrepancy has been analysed providing a concrete example of the invalidity of the theorem in certain cases. We have further established that reduced fidelity and reduced fidelity susceptibility provide appropriate signatures of the QPTs occurring at the two critical points.

Synthesis of thiazoloheteroarenes with bioactive potential : (Dr. Manas Chakrabarty in collaboration with Dr. Y. Harigaya, Kitasato University, Tokyo, Japan)

In view of the well documented pharmacophoric property of the thiazole ring, a series of novel 2-alkyl/alkylamino/anilino/alkylthio derivatives of thiazolo[4,5-f]quinolines, thiazolo[4,5-f]isoquinolines and thiazolo[4,5-g]benzothiazoles have been synthesised efficiently in two/three steps starting from 5-aminoquinoline, 5-aminoisoquinoline and 6-aminobenzothiazole, respectively. The products have been fully identified spectroscopically (IR, ^1H and ^{13}C NMR, LR and HR EI/FAB-MS) and the individual NMR assignments of at least one member of each series have been established from their 2D NMR (HMQC and HMBC) spectra. The biological potential of some of the synthesised molecules is being explored in the collaborative study.

Structure and microstructure of cholesterol esters : (Dr. Pradip Das)

Cholesterol esters are distinguished for their presence in biological membranes and tissues, and typical thermotropic mesogenic behavior. Crystal structure of Cholesteryl Oleyl Carbonate (COC) has been solved from powder XRD, with profile matching and strain-size analysis to follow. COC has a central transverse dipole and does not show smectic pretransitional behavior due to a lack of contrast between the background and the fluctuations. Such contrast mechanism is, however, present in cholesteryl oleate (CO). Mixture (4:1) of CO and COC exhibits strong fluctuations due to a competition between dipolar and dispersion interactions.

Detector Array for Cosmic Ray Air Shower Studies : (Dr. Swapan K. Saha, Dr. Dhruba Gupta and Dr. Sibaji Raha)

We are setting up an array of active detectors (1 m² scintillator + photomultiplier tube) at Mayapuri, Darjeeling, for cosmic ray air shower studies. The initial seven detector array (six forming a hexagon and one at the centre) would be extended to 50 detectors. Most of the components have been procured. We will start setting up the detectors in a few months.

Coulomb Fission : (Dr. Dhruba Gupta, Dr. Swapan K. Saha and Dr. Sibaji Raha)

We observed very low energy (~ 1 MeV/A) Coulomb fission of nuclei. The polyethylene terephthalate (PET) detector was exposed to a ^{252}Cf fission source and after chemical etching, multi-pronged tracks of Coulomb fission fragments were observed under the optical microscope. Similar tracks were also observed when the PET detectors were coated with metals (Cu, Ag and Pb) and then exposed to ^{252}Cf source.

Simulations for a Charged Particle Detector Array : (Dr. Dhruba Gupta)

Simulations have been carried out to study the response of a charged particle detector array. Such an array (Si-CsI) is being built at VECC. To study the response of the array a phenomenological event generator HIPSE has been used. The simulations show that the probability of multiple hits in the reactions of interest are small, implying high granularity of the array. Thus the array would be useful to carry out high precision multi particle correlation studies over a large solid angle.

Study of Cosmic Rays with passive detectors : (Dr. Swapan K. Saha and Dr. Sibaji Raha)

We have been working to characterize and calibrate a particular brand of PET which we intend to use as a solid state nuclear track detector (SSNTD) for exotic particle search in Cosmic rays. For much of the past year, we were involved in analyzing the data collected at the Inter University Accelerator Centre, New Delhi, where we exposed our detectors to high energy ^{56}Fe & ^{32}S beams from the Pelletron accelerator. This is in accordance with our continuing efforts to measure the charge response of PET to various ions so as to obtain a proper calibration curve for PET. We have further plans for PET calibration utilizing beams from CERN-ISOLDE, Switzerland.

We are also involved in studying the response of our detectors exposed to natural radioactive sources and also those that were given open air cosmic ray exposures at places like Ooty, Darjeeling and Kolkata. We are currently acquiring data at Hanley, Ladakh.

A study of the gamma-ray flux during the total solar eclipse of August 1, 2008 at Novosibirsk, Russia : (Dr. Swapan K. Saha and Dr. Sibaji Raha)

We have measured, in collaboration with TIFR, Mumbai, the flux of secondary cosmic gamma-rays during the total solar eclipse at Novosibirsk in Russia, on August 1, 2008. Highly sensitive measurements were carried out using a detector system consisting of two independent, large volume NaI (TI) scintillator detectors. The data showed significant variability in the flux of secondary gamma-rays in the energy range 50-4600 keV. The nearly identical time variations observed in the two independent measurements indicated that the measured variation was real and not an artifact of the instrumentation. Systematic observations during future eclipses are required to study this fascinating phenomenon which is poorly understood.

AC conductivity and scaling behaviour in complex perovskite oxides : (Dr. T. P. Sinha)

Dielectric materials $\text{SrMg}_{1/3}\text{Nb}_{2/3}\text{O}_3$, $\text{Pb}(\text{Fe}_{1/2}\text{Nb}_{1/2})\text{O}_3$ etc. having perovskite structure have been widely investigated for their uses in microelectronics such as capacitors and memory devices. The frequency dependence of AC conductivity of the materials at various

temperatures is used for analysing the electrical data. The scaling behaviour of various dielectric parameters (dielectric constant, loss tangent, electric modulus, conductivity etc.) indicates that the conduction describes the same mechanism at different temperatures. AC conductivity and dielectric relaxation in ionically conducting glasses have also been studied by using alternating current impedance spectroscopy.

Ferroelectric relaxor behaviour of perovskite oxides (Dr. T. P. Sinha)

Perovskite oxides $\text{Ba}_{1-x}\text{Sr}_x\text{Ti}_{0.6}\text{Zr}_{0.4}\text{O}_3$, $(\text{Ba}_{0.5}\text{Sr}_{0.5})(\text{Ti}_{0.6}\text{Zr}_{0.4})\text{O}_3$ have been synthesized by solid state reaction technique. The dielectric study of these oxides reveals that the materials are of relaxor type and undergo a diffuse type ferroelectric phase transition.

Electronic structure and ground state property of perovskites : (Dr. T. P. Sinha)

The electrical properties of perovskite oxides containing transition metals are dominated by the interaction between transition metal cations and oxygen anions. The study of the electronic structures of $\text{Sr}(\text{Fe}_{1/2}\text{Sb}_{1/2})\text{O}_3$, $\text{Ba}(\text{Al}_{1/2}\text{Nb}_{1/2})\text{O}_3$ and $\text{Pb}(\text{Fe}_{1/2}\text{Nb}_{1/2})\text{O}_3$ in terms of spectral density function and density of states was performed by full potential linearized augmented plane wave (FLAPW) method based on density function theory under generalized gradient approximation. An attempt has been made to clarify the electronic structure of the system as it emerges from a combined spectroscopic study and first principles calculations. The ^{27}Al and ^{93}Nb nuclear magnetic resonance studies of $\text{Ba}(\text{Al}_{1/2}\text{Nb}_{1/2})\text{O}_3$ were performed to obtain detailed information about the transport properties of charge carriers in terms of their dynamics at a microscopic level. The electronic transport properties of Li-In binary alloy have been studied by Harrison's first principle pseudopotential technique and the electronic band structure and density of states were obtained by employing full potential linearized augmented plane wave method.

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

The nucleation efficiency of superheated drop detector using R12 and R114 as active liquids was studied using the two-state isolation approximation. From the variation of the nucleation efficiency of the normal metastable state as a function of temperature, the energy spectrum for the neutrons emitted by the Am-Be neutron source was modeled.

The gamma detection efficiency of R12 superheated drop detector was studied using ^{241}Am (59.54 keV) and ^{137}Cs (662 keV) gamma rays at different temperatures and was modeled using the two-state isolation approximation model.

The relationship between dose rate and flux in a nondissipative media was studied for neutrons from Am-Be neutron source using NMB2 dosimeter and the R12 superheated drop detector.

In an active bubble counting device, a laser-LDR combination was used to detect bubbles of air displaced by the nucleated superheated droplets. These pulses were used in parallel with counting acoustic pulses produced by the nucleating droplets to provide an *in situ* volume distribution measurement for droplets in superheated drop detectors using R12 and R114 as active liquids.

Investigations on theoretical aspects of Compton scattering : (Dr. Barun K. Chatterjee)

Comparison between the double differential Compton scattering cross section computed using the S-Matrix model and the relativistic impulse approximation were carried out in a systematic manner (as a function of atomic number, incoming photon energy and scattering angle) to identify the regions where the two do not agree. A survey based on such a study was conducted to identify regions where experiments could be conducted.

Astrophysics of strongly interacting matter : (Dr. Sanjay K. Ghosh, Dr. Rajarshi Roy and Dr. Sibaji Raha)

Neutron stars provide a natural laboratory to test some unique implications of Quantum Chromodynamics (QCD) – the underlying theory of strong interactions – at extreme conditions of very high temperature and baryon density. It has been suggested that the true ground state of QCD is strange quark matter. As a consequence, neutron stars should convert to strange quark stars under suitable conditions. Substantial efforts have been, and are being, spent in studying the details of such conversion. We have shown that the presence of high magnetic field, an essential feature of neutron stars, strongly inhibits the conversion of neutron stars to bare quark stars.

The estimate of the energy deposition rate (EDR) for neutrino pair annihilation has been carried out. The EDR for the neutrinos coming from the equatorial plane of a rotating neutron star was calculated along the rotation axis using the Cook-Shapiro-Teukolsky (CST) metric. The neutrino trajectories and hence the neutrino emitted from the disk is affected by the redshift due to disk rotation and gravitation. The EDR is very sensitive to the temperature and its variation along the disk. The rotation of the star has a negative effect on the EDR; it decreases with increase in rotational velocity.

The unique implications of QCD can also be tested by effective models. Two phase transitions may arise under the extreme situations of very high temperature and baryon density. One is a transition to a deconfined state of nuclear matter to quark and gluon plasma, the second a transition associated with the axial isospin symmetry. We are actively

working with the Polyakov loop extended Nambu Jona-Lasinio model (PNJL) at finite temperature and non-zero baryon and isospin chemical potentials. Recently we have studied the finite isospin chemical potential case in great detail. The pion condensate, chiral condensate and the Polyakov loop were investigated as functions of temperature by minimizing the thermodynamic potential of the system. The resulting $(T, \mu I)$ phase diagram was studied. It was shown that the 3-momentum cutoff, despite being just a parameter of the model, plays an important role in determining the order of phase transition.

Plasma Physics (Dr. Partha S. Joarder and Dr. Sanjay K. Ghosh)

Variation of phase speed of the magnetoacoustic surface waves on an MHD tangential discontinuity (TD) is examined against the variation of Alfvén speeds on opposite sides of the discontinuity with the acoustic speeds remaining constant. The discontinuous thermal profile of the plasma is employed to classify various surface wavemodes. The existence conditions for the surface waves manifest themselves through the appearance of critical values for various parameters restricting the propagation of such waves on the TD. The limiting situation of extremely low-beta plasmas is studied to improve upon earlier results based on simplified calculations. Theoretical understanding of the basic structure of surface waves is then applied to specific observations of discontinuities in the interplanetary magnetic field (IMF) to arrive at simple estimates of phase speed of the surface waves on such discontinuities that may be tested in further observations.

Cosmic Ray air shower simulation studies (Dr. Partha S. Joarder, Dr. Sanjay K. Ghosh and Dr. Sibaji Raha)

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

Accessing global quantum information locally : (Dr. Somshubhro Bandyopadhyay)

Quantum information is stored in quantum states of many body systems. How much of the global quantum information stored in strongly correlated (entangled) many body states can be accessed by performing local quantum operations on the subsystems is a question of considerable interest in quantum information theory and quantum communication. It can

be shown that the problem can be equivalently posed as local distinguishability of quantum states. We have shown that perfect discrimination of orthogonal quantum states by local operations depends crucially on the composition of the ensemble as opposed to their average entanglement. This was shown by proving that for a class of canonical states of N spin $\frac{1}{2}$ -particles, the maximum number of perfectly distinguishable quantum states is independent of the average entanglement.

Presently we are working on a long-standing conjecture on the distinguishability of maximally entangled states in arbitrary but finite-dimensional two body quantum systems.

Physics of spherical dielectric solute immersed in a dielectric solvent : (Dr. Rajarshi Ray)

Dynamics of a substantial number of chemical and bio-chemical processes depend on the solute-solvent interaction. In recent times study of these interactions have taken a central stage in modelling various reactions studied in the chemistry and biological laboratories. This requires a decent physical theory. At the moment most work is done on the basis of several approximation schemes. We have been working on extracting accurate description of such systems from first principles. The objective is to be precise, keeping in mind the practicality of numerical simulations. Our work involves finding the interaction of solute and solvent working out in details the complicated electrostatics to a controllable accuracy. We have implemented variational techniques to obtain the energetics that can be experimentally confirmed against the more approximate calculations. Once implemented into a numerical code, it is possible to study much finer details of the solute-solvent interactions.

Development of hardware and software for high resolution Radar Imaging in simulated far field condition at millimetewaves : (Dr Amitabha Mitra, Dr Samita Saha, Soumendra Singh and Dr. Sibaji Raha)

Every object on the earth/ universe possesses *reflectivity* property on a certain band of the electromagnetic wave spectrum. Exploiting this property of materials in the radio frequency band, especially at millimeter wave frequencies (30 to 100 GHz), work is under progress in order to map the material reflectivity in a high resolution format (12-15 cm) for regular shaped objects in *Two* as well as in *Three-dimensional* domains, through the development of suitable radar and its data acquisition and processing softwares using various techniques of digital signal processing.

Rain reflectivity measurement under clutter environment at microwaves through design & development of suitable instrumentation radar and related softwares : (Dr Amitabha Mitra, Dr. Ajay K Datta, Manabendra Maiti, Krishna Kishore Mazumder, Dr. Sanjay K Ghosh and Dr. Sibaji Raha)

Rain scattering at higher microwaves and at millimeter wave frequencies plays a dominant role in remote sensing and telecommunications. An experiment through radar at multi-frequency band (L to W band) is planned in order to determine changing radar cross-section (RCS) models for various temporally and spatially diversified rain events at the outdoor environment in Kolkata. The necessary circuitry for the development of radar with its related softwares is under way to acquire large volume of data in order to evolve suitable statistical patterns of RCS.

IRHPA Project:

Studies on atmospheric water(liquid and vapour phase) content through radio remote sensing : (Dr. Sibaji Raha, Dr. Amitabha Mitra, Dr. Sanjay K. Ghosh, Manabendra Maiti and Soumendra Singh)

It is well known that the water in the atmosphere in its different phases imposes natural restrictions to the reception of different radio signals from the satellites and distant extraterrestrial objects. To understand its physics, efforts are on to evolve suitable rain model through collection of round the clock data from different instruments, e.g., rain radar, Lidar, photometers and radiometers operating in UVA, UVB, visible and microwave bands together with other related instruments at a high altitude station, Darjeeling.

PUBLICATIONS

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Symposium Publications :

28. Gupta D, Bhattacharya S *et al* (2008) Simulations for The Charged Particle Detector Array at VECC, *DAE-BRNS Symposium on Nuclear Physics*, 53, 701.
29. Mondal P K and Chatterjee B K (2008) *In situ* measurement of droplet size distribution using an active bubbler, *Nat. Symp. on Soft Matter* (Kolkata), 45.
30. Sarkar R and Chatterjee B K (2008) The limiting temperature for superheated liquids, *Nat. Symp. on Soft Matter* (Kolkata), 44.

Plant Molecular & Cellular Genetics Section

1. Bhattacharjee S, Gupta G, Bhattacharya P, Mukherjee A, Bhattacharyya Majumdar S, Pal A and Majumdar S (2009) Quassin alters the immunological patterns of murine macrophages through generation of nitric oxide to exert antileishmanial activity. *Journal of Antimicrobial Chemotherapy*, 63:317-324.
2. Chaudhuri R K, Pal A and Jha T B (2008) Conservation of *Swertia chirata* Buch. Ham. ex Wall. through direct shoot multiplication from leaf explants. *Plant Biotechnology Reporter*, 2(3): 213-218.
3. Chaudhuri R K, Pal A and Jha T B (2009) Regeneration and characterization of *Swertia chirata*-Buch. Ham. ex Wall. plants from immature seed cultures. *Scientia Horticulturae*, 120: 107-114.
4. Das M, Bhattacharya S, Singh P, Filgueiras TS and Pal A (2008). Bamboo taxonomy and diversity in the era of molecular markers. *Advances in Botanical Research*, 47: 226-268.
5. Chakraborti D, Sarkar A, Mondal H A, Schuermann D, Hohn B, Sarmah B K and Das S (2008) Cre/lox system to develop selectable marker free transgenic tobacco plants conferring resistance against sap sucking homopteran insect. *Plant Cell Reports*, 27:1623-1633.
6. Chakraborty U and Sikdar S R (2008) Production and characterization of somatic hybrids raised through protoplast fusion between edible mushroom strains *Volvariella volvacea* and *Pleurotus florida*. *World Journal of Microbiology Biotechnology*, 24: 1481-1492.

7. Kundagrami S, Basak J, Maiti S, Kundu A, Das B, Ghose T K and Pal A (2009) Agronomic, genetic and molecular characterization of MYMIV tolerant mutant lines of *Vigna mungo*. *International Journal of Plant Breeding and Genetics*, 3: 1-10.
8. Roy A, Chakraborti D and Das S (2008) Effectiveness of garlic lectin on red spider mites of tea. *Journal of Plant Interaction*, 3: 157-162.
9. Sarkar A, Hess D, Mondal H A, Banerjee S, Sharma HC and Das S (2009) Homodimeric alkaline phosphatase located at *Helicoverpa armigera* midgut, a putative receptor of Cry1Ac contains α -GalNAc in terminal glycan structure as interactive epitope. *Journal of Proteome Research*, 8:1838-1848.
10. Sengupta S and Majumder AL (2009) Insight into the salt-tolerance factors of a wild halophytic rice, *Porteresia coarctata*: A physiological and proteomic approach. *Planta*, 229: 911-929.
11. Sengupta S, Patra B, Ray S and Majumder AL (2008) Inositol methyl transferase from a wild halophytic rice, *Porteresia coarctata* Roxb. (Tateoka): Regulation of pinitol synthesis under abiotic stress. *Plant, Cell and Environment*, 31:1442-1459.

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

1. Chakraborty D, Chatterjee J, Datta S K (2007) Oxidative stress and antioxidant activity as the basis of senescence in chrysanthemum florets, *Plant Growth Regulation* 53; 107-115.
2. Chakraborty D and Datta S K (2008) Micropropagation of Gerbera: Lipid peroxidation and antioxidant enzyme activities during acclimatization process. *Acta Physiologia Plantarum* 30: 325-331.
3. Chakraborty D, Gupta V N and Datta S K (2007) Varietal identification and assessment of genetic relationships in *Hippastrum* using RAPD markers. *Plant Biotechnol Rep* 1: 211-217.
4. Datta S K (2008) Employment generation utilizing unutilized hill flora for preparation of diversified value added products using dehydration technique. *Journal of Hill Research*, 21(2) : 53-58.
5. Datta S K and Singh Santosh (2008) Marigold and its Commercial Potential; *Applied Botany Abstract*, 28, 1 : 73-93, Economic Botany Information Service, National Botanical Research Institute, Lucknow.

Library

1. Chakraborty A K (2009) Building Sustainable Digital Libraries: A socio-technical perspective. (Edited Book) Chapter : *Web2.0 and Social Web Applications*. M/s IGI Global, USA.
2. Chakraborty A K (2008) Symbiosis Between Knowledge Society and E-Governance. (DESIDOC *Journal of Library and Information Technology*, 28, 5, 27-34.
3. Chakraborty A K, Majumdar K P and Roy Choudhury S K (2008) Role and responsibilities of the library associations in the knowledge society, with special reference to India. *23rd National Seminar of IASLIC, Special Publication*, 48, (ISSN 09723668), 709-725.

4. Chakraborty A K, Mitra R, Sarkar P K and Chaudhuri B S (2008) : Bose Institute Library : A brief profile (In Academic Pride of West Bengal (Edited Book), published during 23rd National Seminar of IASLIC, commemorate 150th Birth Anniversary of Sir J.C. Bose, Bose Institute, Kolkata, 38-45.
5. Chakraborty A K (2008) Information Support for Rural Development. (Seminar on Role of Libraries in Rural Development organized by Burdwan University, Burdwan in association with RRRLF, IASLIC, BLA, WBPLEA.
6. Chakraborty A K (2008) 21st Century Library Challenges. (Rabindra Bharati University : *Journal of Library and Information Science*, 11, 1-5).
7. Chakraborty A K and et.all (2008) Edited the Seminar Volume – "Library Profession in search of a New Paradigm" National Seminar of IASLIC, Special Publication 48.
8. Mitra R (2008) : Bose Institute Library : A historical Overview (In Souvenir) published during 23rd National Seminar of IASLIC commemorate 150th Birth Anniversary of Sir J.C. Bose, Bose Institute, Kolkata, 7-39.
9. Roy Choudhury S K, Chakraborty A K and Majumdar K P (2008) : Kolkata : A vibrant City with Academic Pride and Cultural Heritage (In Academic Pride of West Bengal (Edited Book), published during 23rd National Seminar of IASLIC, commemorate 150th Birth Anniversary of Sir J.C. Bose, Bose Institute, Kolkata, 9-37.
10. Roy Choudhury S K, Chakraborty A K and Mitra R (2008) : Academic Pride of West Bengal (Edited Book), published during 23rd National Seminar of IASLIC, commemorate 150th Birth Anniversary of Sir J.C. Bose, Bose Institute, Kolkata, 210.

STUDENTTS AWARDED WITH PH.D. DEGREE

Name of the Student (University/year)	Title of thesis	Supervisor
Biochemistry Department		
Bhaskar Dasgupta (Jadavpur University – 2008)	Studies on sequence and structural features of protein chains beyond secondary structures	Dr. P. Chakrabarti
Sumit Biswas (Jadavpur University – 2008)	An analysis of protein-nucleic acid interactions and crystallization studies on proteins	Dr. P. Chakrabarti
Shubhra Majumder (Jadavpur University- 2008)	Molecular analysis of genes regulating cell division in <i>Entamoeba histolytica</i>	Dr. Anuradha Lohia
Chandrama Mukherjee (Jadavpur University- 2008)	Functional genomics of cell cycle control genes in <i>Entamoeba histolytica</i> .	Dr. Anuradha Lohia
Promita Ghosh Dastidar (Jadavpur University- 2007)	Molecular mechanisms regulating chromosome segregation in <i>Entamoeba histolytica</i> .	Dr. Anuradha Lohia
Sabyasachi Halder (Jadavpur University – 2008)	Biophysical and Biochemical Studies on the CIII protein of Bacteriophage λ	Dr. Pradip Parrack
Malabika Das (Jadavpur University – 2008)	Studies on the repressor and Cro proteins of temperate <i>Staphylococcus aureus</i> phage $\phi 11$	Dr. Subrata Sau
Partho Chattoraj (Jadavpur University – 2009)	Studies on the cloning and characterization Of the host lethal gene of the temperate Mycobacteriophage L1	Dr. Subrata Sau
Sudeshna Lahiri (Jadavpur University – 2008)	Functional Analysis of non-essential Mcm proteins of the budding yeast kinetochore and their roles in kinetochore structure and function during mitosis and meiosis	Dr. Pratima Sinha

Bioinformatics Centre

Tania Banerjee (Jadavpur University – 2008)	Studies on synonymous codon usage and DNA base composition in relation to the dynamics of genome evolution	Dr. Tapash C. Ghosh
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Botany Department

Kaushik Ghose (CU, 2008)	Identification of differentially expressed genes from <i>Sinapis Alba</i> plant on infection with <i>Alternaria Brassicicola</i> through functional genomic approach	Dr. D. Basu
Avik Ray (Jadavpur University – 2008)	In vitro studies on selected medicinal plants – an approach to their conservation and documentation	Dr. Sabita Bhattacharya
Swarup Roy Chaudhuri (Kalyani University - 2008)	Molecular Analysis of Gene Expression in fruits during Fruit Ripening in Different cultivars of Banana	Dr. D.N. Sengupta
Progya Paromita Saha (Jadavpur University – 2009)	Biochemical and Molecular Aspects of Fruit Ripening	Dr. D.N. Sengupta
Bhaskar Gupta (Jadavpur University – 2009)	Molecular Analysis of ABRE_DNA binding Protein in Rice Cultivars	Dr. D.N. Sengupta

Chemistry Department

Shresh Pathak (Jadavpur University - 2008)	Pathogen-mediated host cell signalling	Dr. Joyoti Basu Dr. M. Kundu
Sushil Kr. Pathak (Jadavpur University - 2008)	Understanding the immune response to bacterial infections	Dr. Joyoti Basu Dr. M. Kundu
Tarakanth Kundu (Jadavpur University - 2008)	Studies on Heterocycles	Dr. Manas Chakrabarty

Madhuchhanda Kundu
(Jadavpur University - 2008)Understanding the role of the N-terminal region of α -crystallin in its structure, stability and chaperone function through site directed truncationDr. K.P. Das and
Dr. Parimal C. SenNilanjana Chakrabarti
(Jadavpur University - 2008)

Textures, Surface Organization and Electrostatics of F-actin Nematic Liquid Crystal

Dr. Pradip Das

Microbiology DepartmentNivedita Majumder
(Jadavpur University - 2008)

Immunomodulatory role of lipoarabinomannan isolated from virulent and avirulent mycobacterium Species on the murine macrophages :Effect of cytokines on cell signaling

Dr. Subrata
Majumdar**Division of Molecular Medicine**Kuntal Mukherjee
(Jadavpur University - 2009)Microsatellite DNA markers and disease resistance of *Penaeus monodon* (Giant black tiger shrimp)Dr. Nipendranath
MandalGaurisankar Sen
(Jadavpur University - 2009)

Role of curcumin in combinational cancer therapy: A mechanistic study

Dr. G. Sa

Tanusree Sengupta
(Jadavpur University - 2008)Identification and Functional Characterization of a Low Molecular Mass Modulator Protein from Goat Testes Cytosol and its Regulatory Role on Ca^{2+} -ATPase

Dr. Parimal C. Sen

Ayantika Ghosh
(Jadavpur University - 2009)Studies on the hepatoprotective role of the herb *Cajanus indicus* L on toxicant-induced liver damage

Dr. Parames C. Sil

Physics DepartmentRajesh Karmakar
(Calcutta University - 2008)

Role of nonlinearity and stochasticity in some complex non-equilibrium processes

Dr. Indrani Bose

Plant Molecular & Cellular Genetics SectionHossain Ali Mondal
(Jadavpur University - 2009)

Study on the efficacy of mannose binding plant lectin against agriculturally important homopteran insect pests and its possible mode of action

Dr. Sampa Das

Sudipta Roy
(Jadavpur University - 2009)

Analysis and protection of chloroplast functions during abiotic stress : A biochemical and transgenic approach

Dr. A.N. Lahiri
MajumderBarunabha Patra
(Jadavpur University - 2009)

Inositol metabolizing gene(s) and protein(s) from diverse sources: Their potential for biotechnological manipulation

Dr. A.N. Lahiri
MajumderSonali Sengupta
(Jadavpur University - 2009)

A comparative proteome analysis of glycophytic and halophytic plants under salinity stress

Dr. A.N. Lahiri
MajumderSamik Bhattacharya
(Jadavpur University - 2008)

Molecular profiling of commercially important tropical bamboo species for the assessment of genetic diversity

Dr. Amita Pal

GRANT-IN-AID SCHEMES

Investigator/ Co-Investigator	Title of the Scheme	Name of the Dept./Section
Schemes funded by CSIR		
Dr. P. Chakrabarti, PI Dr. G. Basu, Co-PI	Theoretical and crystallographic studies on protein-protein interactions	Biochemistry Biophysics
Dr. Subrata Sau	Studies on the structure-function relationship of the Repressor of the temperate mycobacteriophage L1.	Biochemistry
Dr. Tapash C Ghosh	Effect of base composition and codon usage on protein secondary structures: An extensive study on the crystallographic structures on bacterial proteins.	Bioinformatics Centre
Dr. Tapash C Ghosh	Evolutionary studies of duplicated genes in protein-protein interaction network of different organisms.	Bioinformatics Centre
Dr. Gautam Basu	Mechanism of substrate recognition by truncated glutamyl tRNA synthetase	Biophysics
Dr. D. N. Sengupta	The Molecular Analysis of the Expression of the Gene for Sucrose Phosphate Synthase February, (SPS) in Banana Fruit Ripening in Different Banana cultivars (2008 to 2011).	Botany
Dr. J. Basu (PI)	Functional analysis of the interplay between the gene products encoded by an operon harboring serine/threonine kinase and phosphatase and its implications in mycobacterial physiology	Chemistry
Dr. K.P. Das	Role of N-terminal region of α -crystallin for its structure, stability and chaperone function - a biophysical and site directed truncated study	Chemistry
Dr. Subrata Majumdar	Anti-leishmanial effect of mycobacterial Glycolipids through immunomodulation: Strategies involving modulation of chemokine receptors.	Div. of Molecular Medicine

Dr. Arun K. Ray	Studies on the specificity of estradiol-17beta binding protein (putative receptor) in different organs of silkworm, <i>Bombyx mori</i> L. (race Nistari) up to March 2009	Div. of Molecular Medicine
Dr. Parimal C. Sen	Structural and Functional Characterization of a Bi-Functional Protein from Goat Spermatozoa	Div. of Molecular Medicine
Dr. Sampa Das	Novel approaches for production of hybrid seeds with characterization of improved insect resistance and higher yield.	PMCG
Dr. Samir R. Sikdar	Screening of aphid tolerant <i>Brassica juncea</i> limited disomic chromosome addition lines from selfed backcross progenies of the <i>Rorippobrassica</i> somatic hybrid (<i>Rorippa indica</i> + <i>Brassica juncea</i>)	PMCG

Schemes funded by CCRH

Dr. T. Das (PI) Dr. G. Sa(PI)	Role of homeopathic medicine in cancer regression and rejuvenation of depressed Immune system: A mechanistic study	Div. of Molecular Medicine
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Schemes funded by CCRAS, Department of AYUSH, Ministry of Health & Family Welfare, Govt. of India,

Dr. Nripendranath Mandal	<i>In vitro</i> study of the antioxidant, iron chelating and DNA protective properties of medicinal plants, their formulations and usefulness to combat cancer	Div. of Molecular Medicine
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Schemes funded by DBT

Dr. S. K. Datta	Employment generation utilizing unutilized rural flora for preparation of value added products using dehydration techniques	A.J.C.Bose Biotech Inno- vation Centre (MEF)
Dr. P. Chakrabarti	Analysis of protein structures and soft-computing in functional annotation, chemogenomics and docking	Biochemistry

Dr. Anuradha Lohia	Development of a product from <i>O. corniculata</i> against <i>E. histolytica</i> (2005-2008 completed)	Biochemistry
Dr. Subrata Sau	Molecular characterization of two putative host Lethal Genes of temperate mycobacteriophage L1.	Biochemistry
Dr. D. N. Sengupta, PI Dr. Parames C. Sil	Mapping the binding of Trans-acting factors on the upstream and promoter activity analysis of ACS2 and ACS4 genes in Fruits of wild type and mutants followed by the cloning of those trans-acting factors	Botany
Dr. J. Basu (PI) Dr. M. Kundu	Mechanisms of modulation of host cell signaling by RDI-encoded proteins of <i>Mycobacteria</i>	Chemistry
Dr. J. Basu (PI) Dr. I. Bose Dr. K.P. Das Dr. M. Kundu	Multi faceted approaches towards characterizing potential drug targets in the cell division and stress response pathways in <i>Mycobacterium tuberculosis</i>	Chemistry
Dr. M. Kundu (PI) Dr. J. Basu	Polyphosphate kinase and its role in mycobacterial physiology	Chemistry
Dr. Subrata Majumdar	CD40 and Toll like receptors (TLR) at the interface of <i>Mycobacterium w</i> (<i>M. w</i>) and macrophage interaction: Probing the mechanism of action of <i>M.w</i> using <i>Leishmaniasis</i> as a model	Div. of Molecular Medicine
Dr. Subrata Majumdar	Effect of gene silencing on the modulation of cell Signaling mechanisms during the early phase of <i>Leishmania donovani</i> infection	Div. of Molecular Medicine
Dr. Nripendranath Mandal	Disease resistance in giant black tiger shrimp, <i>Penaeus monodon</i> ,	Div. of Molecular Medicine
Dr. Tapan K. Dutta	Molecular characterization of novel catabolic genes and enzymes involved in a distinct metabolic pathway in the assimilation of phenanthrene	Microbiology
Dr. Sampa Das (Coordinator & PI) Dr. S. R. Sikdar (Co-P.I.)	Programme Support on 'Biotic stress in Plants: A concerted approach based on functional genomic, proteomic and transgenic techniques'.	PMCG

Dr. Sampa Das (PI) Dr. S. R. Sikdar (Co-I)	A transgenic approach to develop aphid resistant <i>Brassica juncea</i> plant types and their field evaluation.	PMCG
Dr. Sampa Das	Study of the interaction between the receptor protein(s) isolated from <i>Helicoverpa armigera</i> and the CryIAc toxin coded by <i>Bacillus thuringiensis</i> through biochemical and bioinformatic approach.	PMCG
Dr. A. N. Lahiri Majumder	Engineering inositol metabolic pathway for raising salt tolerant rice plants	PMCG
Dr. A. N. Lahiri Majumder (PI) Dr. D. N. Sengupta (Co-PI)	Novel genes and their regulatory elements for salt tolerance from the wild halophytic rice <i>Porteresia coarctata</i> : Introgression into cultivated rice	PMCG/ Botany
Dr. Amita Pal	Phylogeny of NBS-LRR protein motifs in the family Fabaceae, identification of new conserved motifs and their implications in Geminivirus resistance	PMCG
Dr. Amita Pal, P.I Dr. K. P. Das (Co-P.I.) Dr. Sampa Das (Programme Coordinator)	Identification of effector gene/proteins implicated in resistance for yellow mosaic disease through genomic and proteomic approaches.	PMCG/ Chemistry
Scheme funded by DAE		
Dr. Subrata Sau	Studies on the repressor and its cognate operators/ promoters of temperate <i>Staphylococcus aureus</i> phage $\Phi 11$ and development of a high expression vector for staphylococcal systems	Biochemistry
Dr. J. Basu (PI) Dr. M. Kundu	Molecular analysis of mycobacteria-induced MMP9 production in macrophage	Chemistry
Dr. Subrata Majumdar Dr. Nisith Pal	Signal Transduction mechanism during host-pathogen interaction: special emphasis on the changes in Th1-Th2 cytokine response in macrophages from different age groups infected with <i>M. tuberculosis</i> . Collaborative grant	Div. of Molecular Medicine

Dr. Nripendranath Mandal	Quantification of the cytokines mRNA based on competitive RT-PCR	Div. of Molecular Medicine
Dr. J. Basu (PI) Prof. M. Kundu	Molecular identification of potential drug targets of <i>Mycobacterium tuberculosis</i>	Chemistry
Dr. M. Kundu (PI) Dr. J. Basu	Mechanism of activation of the transcription factor Sp1 and modulation of Sp1 regulated genes by the gastric pathogen <i>Helicobacter pylori</i>	Chemistry
Dr. G. Sa(PI) Dr. T. Das (Co-PI)	Molecular Regulation of cell growth and cell death: An approach to control cancer/aging by cellular engineering	Div. of Molecular Medicine

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

Dr. P. Chakrabarti (Biochemistry) presented papers/talked at (i) INPEC (International Network of Protein Engineering Centres) Meeting, Naantali Spa, Finland, June 12-15, 2008; (ii) 2nd International Conference on Molecular Perspectives on Protein-protein Interactions, Dubrovnik, Croatia, June 27- July 1, 2008; (iii) XXI Congress and General Assembly of International Union of Crystallography, Osaka, Japan, August 23-31, 2008; (iv) Workshop on Basics of Bioinformatics – A tool for Promotion of Biology Teaching, Tripura University, September 25-27, 2008; (v) EMBO-sponsored World Lecture Course, Recent Development in Macromolecular Crystallography, NCL, Pune, November 10-14, 2008; (vi) 74th Anniversary General Meeting of INSA, New Delhi, January 22-24, 2009; (vii) National Symposium on Cellular and Molecular Biophysics, CCMB, Hyderabad, January 22-24, 2009; (viii) BITS Annual Coordinators Meeting, NEHU, Shillong, February 2-4, 2009; (ix) National Seminar in Crystallography (NSC-38), Mysore University, February 2-4, 2009; (x) Workshop on Flexibility and Biological Recognition, Sophia Antipolis, France, March 18-20, 2009; was the speaker (xi) at the National Science Day Programme at IIT, Kharagpur, 28.2.2009. Was a resource person for (xii) the Refresher Course on Chemistry: Fundamentals and Frontiers in Chemistry, Jadavpur University, January 2-22, 2009; (xiii) the Seminar Series under CARE at Saha Institute of Nuclear Physics, January 7, 2009. He delivered a talk on (i) Pattern in sequence and structure of proteins, at Cotton College, Guwahati, 11.12.2008; (ii) DBT-sponsored Lecture Series, University of Burdwan, March 30, 2009.

Participation of conferences by Dr. P. Chakrabarti's group member (Biochemistry). Dr. T. Chatterjee, A. Pal, M. Guharoy, D. Mukherjee, S. Chakraborti and S. Dey attended the National Symposium on Cellular and Molecular Biophysics, CCMB, Hyderabad, January 22-24, 2009.

Dr. Rajagopal Chattopadhyaya (Biochemistry) spoke in the Molecular Biology Department of The Scripps Research Institute, La Jolla, California on December 9, 2008 and in the Molecular Biology Institute of the University of California, Los Angeles on December 18, 2008, both on "RecA-mediated cleavage of λ cI repressor", as special seminars.

Dr. Anuradha Lohia (Biochemistry) attended HUGO meeting September 2008, Hyderabad, India; delivered an invited talk at the American Society of Microbiology, Philadelphia, USA. 17th-21st May, 2009

Dr. Pradeep Parrack (Biochemistry) delivered orientational/ expository lectures on Cell Biology at the "Summer School in Biological Physics 2008" held at Harish Chandra Research Institute, Allahabad, May 28-30, 2008; participated at the Guha Research Conference in Gangtok, Sikkim, Oct 18-23, 2008; attended the 77th Annual Meeting of SBC (India), at IIT Madras, Dec 18-20, 2008 and delivered a talk entitled "Lysis-lysogeny switch in bacteriophage λ : A complex regulatory network involving proteins from the phage and the host"; delivered a talk in Bengali on J.C. Bose as part of the Annual Function of Barisha Vivekananda High School, Kolkata, on Feb 5th 2009.

Dr. Subrata Sau (Biochemistry) attended an International Conference on "Perspectives of Cell Signaling and Molecular Medicine" organized by Department of Molecular Medicine, Bose Institute, Kolkata, on 27th–29st November, 2008.

Mr. Palas K. Chanda (Biochemistry) delivered a talk in the Symposium "RECENT ADVANCES IN BIOLOGICAL SCIENCES" organized by Society of Biological Chemists (India), Kolkata Chapter, August 22-24, 2008.

Mr. Amitava Bandhu (Biochemistry) delivered a talk in the Symposium "RECENT ADVANCES IN BIOLOGICAL SCIENCES" organized by Society of Biological Chemists (India), Kolkata Chapter, August 22-24, 2008; Mr. Amitava Bandhu and Mr. Biswanath (Biochemistry) Jana jointly presented a poster in the International Conference on "Perspectives of Cell Signaling and Molecular Medicine" organized by Department of Molecular Medicine, Bose Institute, Kolkata, on 27th–29st November, 2008; Mr. Palas K. Chanda (Biochemistry) presented a poster in the International Conference on "Perspectives of Cell Signaling and Molecular Medicine" organized by Department of Molecular Medicine, Bose Institute, Kolkata, on 27th–29st November, 2008. His poster was judged one of the best posters presented in the conference.

Dr. Tapash Chandra Ghosh (Bioinformatics) attended on February 2009 the workshop on 'Bioinformatics-Concept and Application' organized by Bioinformatics Centre, Central Agricultural University, Aizawl; February 2009 in workshop on "Current trends in Evolutionary Biology" organized by Bioinformatics Centre, Kalyani University, Kalyani; March 2009 in workshop on "Bioinformatics- application in biological sciences" organized by Bioinformatics Centre, Dibrugarh University; November 2008 in a symposium on "Functional genomics and Evolutionary Biology" organized by Institute of Life Sciences, Bhubaneswar; November 2008 in International Symposium on "Microbial Biotechnology: Diversity, Genomics and Metagenomics" organized by Association of Microbiologist of India at University of Delhi; November 2008 in 1st BTISnet interactive meet for Bioinformatics Centres of North Eastern States, organized by Department of Biotechnology, Government of India at Sikkim State Council of Science and Technology, Gangtok.

Dr. Gautam Basu (Biophysics), attended 6th Asian Biophysics Association Symposium Jan 11-15, 2009 at Hong Kong University of Science and Technology (Title of talk: Electrostatic discrimination of cognate and non-cognate partners in biology); 2nd Indian Peptide Symposium Feb 26-27, 2009 at National Institute of Immunology, New Delhi (Title of talk: Energy Landscape of short Aib/Ala-based peptides); Flexibility and Biological Recognition: from Biophysics to Data Models March 18-20, 2009 at Inria Sophia Antipolis, France.

Dr. Debabrata Basu (Botany) delivered a talk on "An assessment of fitness against *A. brassicicola* through comparative expression profiling between incompatible white mustard (*S. alba*) and compatible India mustard (*B. juncea*)" in the International Symposium to Commemorate the 150th Birth Anniversary of Sir J. C. Bose & Birth Centenary of Prof S. M. Sircar entitled: A Journey from Plant Physiology to Plant Biology, held on 24–28 November 2008.

Dr. Sabita Bhattacharyya (Botany) participated 'A Journey from Plant Physiology to Plant Biology' An International Symposium to commemorate the 150th Birth Anniversary of Sir J. C. Bose & Birth Centenary of Dr. S. M. Sircar" and presented a poster.

Dr. Swati Gupta Bhattacharya, Miss Jyotshna Mandal and Mr. Himadri Shekhar Chakrabarti (Botany) participated in the International Symposium on A journey from Plant Physiology to Plant Biology, (Organized by Bose Institute) held at Bose Institute, Kolkata, India on 24th–28th November, 2008.

Miss Jyotshna Mandal (Botany) present a poster on Clinico-immunochemical studies on airborne Areca catechu L. (Betel nut palm) pollen, a probable risk factor in emergency asthma hospitalization from Eastern India in the 7th EAACI-GA2LEN (Global Allergy and Asthma European Network) Immunology winter school at Davos, Switzerland on 5th–8th February, 2009.

Dr. Swati Sen Mandi (Botany) delivered invited lectures at a Workshop on Biodiversity under sponsorship of JBNSTS at R. K. Mission H. S. School, Cherrapunji, 3-6 June, 2008; delivered Invited lecture on "J.C. Bose and his studies in Plant Physiology" at 150th Birth Anniversary Celebration of J. C. Bose organized by Institute of Science Education and Culture held in BITM Hall, 5th December 2008; delivered invited lecture on "Life and works of Sir J.C. Bose: Experiments on Plants" at the 150th Birth Anniversary Celebration of J. C. Bose in Botany Department, Kalyani University, 29th January 2009; delivered invited lecture on "The Great Scientist: Sir Jagadish Chandra Bose: 1858-1937" at the Annual Workshop on History of Science: Science, Scientist and the Society at Asiatic Society auditorium, 24th February, 2009; delivered four Summer School lectures for

B. Sc (Hons) on (i) "Metabolomics to Functional Genomics: Identifying a common genetic control for vigour and longevity of rice seed" (ii) "Plant Molecular Markers", (iii) "UV Damage and Repair in Plants" (iv) "UV defense in plants" at Botany Department (Biotechnology Section) NEHU, Shilong, 20th – 22nd May, 2009; delivered lecture on "Activities of the Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants from Eastern and North Eastern India at Bose Institute" at Department of Biotechnology, NEHU, Shilong, 22nd May, 2009; delivered lecture on "Activities of the Centre for Advanced Research in DNA Fingerprinting and Diagnostics of Medicinal Potential in Plants from Eastern and North Eastern India at Bose Institute" delivered at Dept. of Biotechnology, Gauhati University, Assam, 25th May 2009; delivered invited lecture on "Metabolomics to Functional Genomics: Identifying a common genetic control for vigour and longevity of rice seed", 2nd Annual World Congress of Gene (WCG-2008), Foshan, China, December 5-7, 2008.

Dr. P.K. Saha (Botany) participated in the National Symposium on "Frontiers of Plant Biotechnology and its relevance to food security" Organized by All India Crop Biotechnology Association & Department of Botany, Calcutta University, Kolkata held on 20th December, 2008; acted as resource person in two Rural Biotechnology Program at Falta, 24-Pgs. (South) 2008 & 2009; participated and presented posters entitled – 'Studies on phenotypic diversity in some members of Indian Sesame' in the International Symposium entitled – "A Journey from Plant Physiology to Plant Biology" held at Bose Institute, Kolkata, November 24-28, 2008.; invited Lecture on "Acharya J.C. Bose" In the 16th West Bengal State Science & Technology Congress held at Burdwan university, Burdwan, during 28 February to 1 March, 2009; delivered a Special Lecture on "Analysis of Phytochemicals: An overview" in the Inaugural Session of the National Seminar cum Workshop for research Scholars and Teaching Staffs held at Centre for Advanced Studies, Department of Botany, University of Burdwan, Burdwan on 25th March, 2009.

Dr. Joyoti Basu (Chemistry) visited the Karolinska Institute, Stockholm in October, 2008 in connection with a collaborative Indo-Swedish project and delivered an invited talk in the Centre for Microbiology and Infection; presented a paper in the Gordon Research conference on "Microbial Stress Response" held in Mount Holyoake College in July, 2008; presented a paper in the annual meeting of the European Cell Death Society held in Bern in September, 2008; delivered an invited talk in the 35th Annual meeting of the Indian Immunology Society Meeting organized by the Institute of Life Sciences, Bhubaneswar; delivered an invited talk in the UGC-DSA-sponsored One day National Symposium on "Modern Biology in Health and Disease" organized by Calcutta University; delivered an

invited talk in the 10th Sir Dorabji Tata Symposium on "Mechanisms of Microbial Pathogenesis" in March, 2009.

Dr. Manas Chakrabarty (Chemistry) participated in (i) the National Symposium on Soft Matter (NSSM 2008) held during September 18-19, 2008 and (ii) the Symposium entitled "Integrating Physics, Chemistry, Mathematics and Biology (IPCMB 2008) held during December 4-6, 2008, both the Symposia being organised by the Department of Chemistry and held at Bose Institute; delivered, as a Resource Person, a Talk on "Mass Spectrometry: Techniques and Applications" on the 13th February, 2009 in the UGC-sponsored Refresher Course on "Analytical Instruments and Their Role in Research" organised by the Academic Staff College, Jadavpur University and held at the Department of Instrumentation Science, J.U. during February 2-21, 2009.

Dr. Manas Chakrabarty (Chemistry) attended as a member of the UGC nominated Advisory Committee for the SAP-DRS of the Department of Chemistry, North Bengal University, meeting held with the Vice-chancellor N.B.U. on the 27th March, 2009.

Dr. Taraknath Kundu, Sulakshana Karmakar, Ajanta Mukherji and Ratna Mukherjee (Chemistry) participated in the Symposia NSSM, 2008 and IPCMB 2008. Additionally, S.K., A.M. and R.M. also participated in the UGC-sponsored "National Seminar on Current Trends in Chemistry-III (NSCTC-III)" held at the Department of Chemistry, Kalyani University, Kalyani during March 20-21, 2009.

Dr. K.P. Das (Chemistry) attended the 45th Annual Convention of Chemists and International Conference on Recent Advances in Chemistry held at Karnataka University, Dharwad, Karnataka, November 23-27, 2008 and presented an invited lecture entitled: "Micelle-like structures in proteins: Implications for molecular chaperone function and protein folding". He also chaired a session.

Dr. Manikuntala Kundu (Chemistry) presented a paper in the 12th International Congress of Bacteriology and Applied Microbiology held in Istanbul in August, 2008; delivered an invited talk in the 77th Annual Meeting of the Society of Biological Chemists held in Chennai in December, 2008; delivered an invited talk in the 10th Sir Dorabji Tata Symposium on "Mechanisms of Microbial Pathogenesis" in March, 2009; delivered an invited talk in the 12th Annual Conference of Chest Physicians held in Kolkata in February, 2009.

Dr. Jayanta Mukhopadhyay delivered a talk in the International Transcription Assembly Meeting, held at IMTECH, Chandigarh in March, 2009.

Dr. Tanya Das (Molecular Medicine) was invited to chair scientific session and delivered special lecture as the "Main Speaker" in the 8th International Conference of Anticancer Research at KOS, Greece, during 17-22 October, 2008; delivered special Invited Lecture in the DAE-BRNS 4th Life Science Symposium on Recent advances in immunomodulation in stress and cancer at BARC, Mumbai during December 22-24, 2008; delivered invited lecture at the Medical Science and Physiology section of the 96th Indian Science Congress, at Shilong, in January 2009. Dr. Das delivered lecture in the Perspectives of Cell Signaling and Molecular Medicine during 27-29th November, 2008. Dr. Das delivered special Guest Lecture in the national symposium on Innovative alleviations and potential explorations in cancer at Haldia Institute of Technology on 24th February, 2009.

Dr. Nripendranath Mandal (Molecular Medicine) attended International Symposium on "Perspective of Cell Signaling and Molecular Medicine" November 27-29, 2008 organized by Division of Molecular Medicine, Bose Institute, Kolkata, India; attended a seminar on the occasion of the celebration birthday of former prime minister late Shri Rajiv Gandhi at New Delhi, India on August 18, 2008 organized by India International Friendship Society (IIFS), New Delhi; attended in the conference on "Economic Growth and National Integration" at New Delhi, India on May 31, 2008 organized by India International Friendship Society (IIFS), New Delhi and International Institute of Success Awareness (IISA), New Delhi.

Dr. Anup Kumar Misra (Molecular Medicine) delivered lecture in the INSA-KOSEF (Indo-Korean) joint meeting on organic chemistry held at National Chemical Laboratory, Pune during January 12-13, 2009; delivered lecture in the Annual Meeting of Directors and Scientists of autonomous institutes of DST held at ARCI, Hyderabad during January 16-18, 2009.

Dr. Arun Ray (Molecular Medicine) attended XX Annual Conference of The Physiological Society of India held during December 12-14, 2008, in Tripura University, Agartala, and delivered a talk on "Central homeostasis for thyroid hormone: Indication for indispensability of thyroid hormone in adult brain function".

Dr. Gaurisankar Sa (Molecular Medicine) was invited to chair scientific session and delivered special lecture in the 8th International Conference of Anticancer Research at KOS, Greece during 17-22 October 2008. Dr. Sa delivered lecture in International Conference on Perspective of Cell Signaling and Molecular Medicine during 27 to 29 November, 2008 at Kolkata. He delivered Special Invited Lecture in the DAE-BRNS 4th Life Science Symposium on Recent advances in immunomodulation in stress and cancer at

BARC, Mumbai during December 22-24, 2008. Sa was invited to deliver invited lecture at the scientific session in the Medical Science and Physiology section of the 96th Indian Science Congress, at Shilong, in January 2009. He delivered special Guest Lecture in the national symposium on Innovative alleviations and potential explorations in cancer at Haldia Institute of Technology on 24th February 2009.

Dr. Parimal C. Sen (Molecular Medicine) attended 12th International Conference on Na,K-ATPase and related transport ATPases of P-Type at Aarhus, Denmark during August 5-10, 2008; Eindhoven Netherlands, during August 10-12, 2008 on invitation from FEI, Europe to visit TEM facility plant and to perform some analyses; August 12-24, 2008, Boston University and Meharry Medical School to deliver lectures on invitation. Delivered an invited talk organised by Electron Microscope Society of India, Zonal Chapter, Kolkata at Bose Institute on May 30, 2008. Delivered a talk in the International Conference on Cell signaling and Molecular Medicine, held at Bose institute during November 27-29, 2008. Served as Chief-guest in the Inaugural Ceremony and delivered Key-note address in UGC-Refresher Course organized by Jadavpur University.

Dr. Parames C Sil (Molecular Medicine) delivered an invited talk entitled, "Beneficial Role of Herbal Plants in Pathophysiology" held on 21st-23rd August, 2008 in the Euro-India 1st International Conference on Holistic Medicine (ICHM-2008) in Kottayam, Kerala, India; participated in the International Symposium organized by the Division of Molecular Medicine, Bose Institute, Kolkata on 26th-28th November, 2008.

Dr. Subrata Majumdar (Microbiology) presented an invited talk at the Indian Immunology Society Meeting at Bhubaneswar, Orissa in Dec 12-14, 2008; presented an Invited talk at the International conference on Perspectives of cell signaling and molecular Medicine at Bose Institute in Nov 27-29, 2008.

Dr. Somshubhro Bandyopadhyay (Physics) presented an invited talk in the Workshop on "Entanglement in quantum condensed matter system", at The Institute of Mathematical Sciences, Chennai, November 17 - 20, 2008, presented an invited talk at the Annual K. S. Krishnan discussion meet on "Frontiers of Quantum Science", at The Institute of Mathematical Sciences, Chennai, December 1 - 2, 2008 on "Monogamy and Polygamy of Quantum Entanglement".

Dr. Indrani Bose (Physics) delivered an invited talk on Noise in the living cell: a physical perspective at Condensed Matter Days 2008 (August 29-31, 2008) held in the Physics Department, Visva-Bharati University, Santiniketan; delivered two invited lectures on Introduction to Dynamical Systems at the National workshop on Systems Biology and its Use (November 18-22, 2008) at the Department of Biochemistry and Biophysics, University of Kalyani; delivered an invited talk on Signatures of Quantum Phase Transitions via Quantum Information Theoretic Measures at International Workshop on

Quantum Phase Transition and Dynamics: Quenching, Annealing and Quantum computation (February 3-7, 2009) at SINP, Kolkata; delivered an invited talk on Phenotypic Heterogeneity in Microorganisms at the International conference on Integrating Physics, Chemistry, Mathematics and Biology to understand Living Systems (December 4-6, 2008) at Bose Institute; Delivered an invited talk on Heisenberg spin ladder: variation of entanglement and fidelity measures close to quantum critical points at Conference on Recent Trends in Strongly Correlated Systems (March 2-4, 2009) organized by IACS and SNBOSE Centre; delivered an invited talk on Entanglement and Fidelity Signatures of QPTs in Spin Ladders at Conference on Recent Developments on quantum Condensed Matter (March 5-7, 2009) organized by the School of Physical Sciences, JNU, New Delhi; delivered on invitation two lectures on Introductory Systems Biology at Department of Botany, Calcutta University on August 4, 2008; Delivered on invitation a lecture on Systems Biology at the Course for Pre-doctoral students of IICB, Calcutta on September 5, 2008; delivered on invitation one colloquium and two lectures on Introduction to Dynamical systems theory: Deterministic and Stochastic Aspects in the Department of Chemical Engineering, Indian Institute of Science, Bangalore during October 16-17, 2008.

Dr. Barun K. Chatterjee (Physics) attended and chaired a session in the National Symposium on Soft Matter, held at Bose Institute, on September 18-19, 2008. He also attended the symposium on Integrating Physics, Chemistry, Mathematics and Biology to Understand Living Systems, held at Bose Institute, on December 4-6, 2008.

Rupa Sarkar (Physics) attended and presented a poster on "The limiting temperature for superheated liquids" at the National Symposium on Soft Matter, held at Bose Institute, on September 18-19, 2008. She also attended the Advance School of Radiation Physics [ASRP-08] held at Saha Institute of Nuclear Physics during November 17-21, 2008. She also attended the international symposium on Integrating Physics, Chemistry, Mathematics and Biology to Understand Living Systems, held at Bose Institute, on December 4-6, 2008.

Prasanna K. Mondal (Physics) attended and presented a poster on "*In situ* measurement of droplet size distribution using an active bubbler" at the National Symposium on Soft Matter, held at Bose Institute, on September 18-19, 2008. He also attended the Advance School of Radiation Physics [ASRP-08] held at Saha Institute of Nuclear Physics during November 17-21, 2008. He also attended the international symposium on Integrating Physics, Chemistry, Mathematics and Biology to Understand Living Systems, held at Bose Institute, on December 4-6, 2008.

Dr. Sanjay Kr. Ghosh (Physics) invited talk in VULCANO WORKSHOP 2008 – Frontiers objects in Astrophysics and Particle Physics, held during May 26-31, 2008 at VULCANO, ITALY, "Quark Stars – Their implication on Astroparticle Physics"; invited talk in the Workshop on Astroparticle Physics, December 18-19, 2008, Ooty, "Hadronic interaction

models and Cosmic ray air shower simulation"; Invited talk in the 3rd Winter School on Astroparticle Physics, December 20-28, 2008, Ooty, "Basic High energy physics".

Dr. Dhruba Gupta (Physics) participated in the Workshop on Cyclotrons : Rising Expectations and Mounting Challenges held at VECC, Kolkata, June 25-26, 2008; participated in The Homi Bhabha Centenary Workshop and Winter School on Astroparticle Physics (WAPP) held at CRL-TIFR, Ooty, Dec 18-29, 2008.

Dr. Swapan K. Saha (Physics) served as a joint-coordinator for the North East Student's Training Programme (NESST-BASE) organized by Bose Institute and held at Darjeeling and Kolkata June 9-21, 2008. Attended and delivered a talk at the All-Russian Conference on Corona and Plasma Physics at Novosibirsk State University, Novosibirsk, Russia August 1-3, 2008. Delivered two invited talks at Dr. Homi Bhabha Centenary Workshop and Winter School on Astroparticle Physics at Cosmic Ray Laboratory, TIFR, Ooty December 18-29, 2008. Participated and served as a member of Organizing Committee of the International Symposium on Millimeter Waves (ISoMM-09) at Bose Institute, Kolkata January 14-16, 2009. Attended the India-CERN ISOLDE Meeting at Saha Inst. of Nucl. Physics, Kolkata January 21-22, 2009.

Dr. T. P. Sinha (Physics) presented three papers in the National Symposium on Soft Matter held at Department of Chemistry, Bose Institute, Kolkata during September 18-19, 2008; presented four papers in the 15th National Seminar on Ferroelectrics and Dielectrics (NSFD-15) held at Thapar University, Patiala during November 06-08, 2008; attended a conference of Integrated Physics, Chemistry, Mathematics and Biology (IPCMB 2008) held at Department of Chemistry, Bose Institute, Kolkata during December 4-6, 2008; gave an oral presentation in the International Conference on Transport and Optical Properties of Nanomaterials held at Department of Physics, University of Allahabad during January 5-8, 2009; presented three papers in the Conference on Mesogonic and Ferroic materials (CMFM 09) held at Department of Physics, Banaras Hindu University, Varanasi during January 9-11, 2008; delivered an invited talk on Dielectric Relaxation and electronic structure of $\text{CaFe}_{1/2}\text{M}_{1/2}\text{O}_3$ ("M = Nb, Sb) in the 15th National Seminar on Ferroelectrics and Dielectrics (NSFD-15) held at Thapar University, Patiala during November 06-08, 2008; delivered an invited talk on Dielectric relaxation and electronic structure of double perovskite $\text{A}_2\text{B}'\text{B}''\text{O}_6$ [A = Ba, Sr, Ca; B' = Fe and B'' = Nb, Sb] in the Conference on Mesogonic and Ferroic Materials (CMFM 09) held at Department of Physics, Banaras Hindu University, Varanasi during January 9-11, 2008.

Dr. Sampa Das (PMCG) participated and delivered talk in an International Conference "Brassica 2008" at Lillehammer, Norway during 8th to 12th September, 2008. She and her research group have participated and presented papers at the International Symposium on

"A journey from Plant Physiology to Plant Biology", held at the Bose Institute, Kolkata from 24th to 28th November, 2008; delivered an invited talk on "Trends in Plant Biotechnological Research in India : A scope for Industrial -Academic convergence" in a work shop of Biosphere organized by Gujrat Liqui Pharmacaps Pvt. Ltd. during 25th-26th March, 2008. She also delivered an invited talk in the Indo-Swiss Collaboration in Biotechnology sponsored 'Technology Showcasing Workshop' on 6th October, 2008 at ICRISAT, Hyderabad.

Dr. A. N. Lahiri Majumder (PMCG) delivered an invited talk on "Bioprospecting salt-tolerant genes from *Porteresia coarctata*, a halophytic wild rice : a genomic and proteomic approach" in the Gordon Research Conference on "Salt and water stress in plants" at Big Sky, Montana, USA during 7th to 12th September, 2008. He and his research group have participated and presented papers at the International Symposium on "A journey from Plant Physiology to Plant Biology", held at the Bose Institute, Kolkata from 24th to 28th November, 2008; delivered invited talks at the Scottish Church College, Kolkata (February, 2009); GKV, Bangalore (March, 2009); Bethune College, Kolkata (March, 2009).

Dr. Amita Pal (PMCG) delivered an invited talk on "HPLC and MALDI TOF MS analysis of novel antileishmanial compounds from *Quassia amara*" EHRlich II- 2nd World Conference on Magic Bullets, held at Nurnberg, Germany, 3rd to 5th October, 2008. She has also chaired a Session on "Bioanalytics- The cutting age of LC-MS/MS - Part III". She and her research group have participated and presented papers at the International Symposium on "A journey from Plant Physiology to Plant Biology", held at the Bose Institute, Kolkata from 24th to 28th November, 2008; delivered two invited talks on "Agri-bioinformatics" as a resource person in the MHRD-AICTE sponsored Summer school for faculty members Engineering / Management / College / Institute on Bioinformatics, 7th-18th July 2008, organized by the Department of Biotechnology, National Institute of Technology, Durgapur, West-Bengal. She delivered an invited lecture as a resource person in the Winter School on "Molecular techniques for plant virus characterization and diagnostics" for Scientists/ Lecturers on 5th January, 2009 at the Central Research Institute for Jute and allied Fibers, Barrackpore, Kolkata-700120. She also delivered an invited lecture on "Genomic approach to identify and characterize disease resistance gene/s against MYMIV in *Vigna mungo*" at the Institute of Life Sciences, Bhubaneswar, Orissa on 14th January, 2009. Amita Pal delivered an invited seminar lecture on "A journey towards identification and characterization of disease resistance genes/proteins against MYMIV in *Vigna mungo*" at the Department of Botany, Presidency College, Kolkata on 7th February, 2009.

Dr. Samik Bhattacharya (PMCG) participated and delivered an invited talk on "Validation of bamboo systematics employing molecular techniques: Reconstruction of phylogeny from genomic perspective" at the International Seminar on Multidisciplinary approaches in

Angiosperm Systematics and XVII Annual Conference of Indian Association for Angiosperm Taxonomy, held from 11th to 13th October, 2008 at Kalyani, India.

Dr. S K Datta (A. J. C. Bose Biotechnology Innovation Centre) participated in the International Symposium on "Induced Mutations in Plants" (ISIMP), 12-15 August, 2008, Vienna, Austria having being sponsored by IAEA, Vienna; attended National Conference on application of identified chemical and biological technologies in agriculture held at Department of Chemistry, Jadavpur University, Kolkata and Eastern India Horticulture and Biotechnology Centre, Bahra, West Bengal.

Dr. Arun Kumar Chakraborty (Library) attended as organizing Secretary 23rd National Seminar of IASLIC held at Bose Institute, Kolkata during 10-13 December, 2008 to commemorate 150th Birth Anniversary of Sir J.C. Bose, Bose Institute, Kolkata; participated CSIR Open Access seminar on 24th March 2009 organised by CSIR Headquarters, New Delhi; nominated by Department of Science and Technology as one of the coordinators of CSIR-DST E-journal Consortia; attended meeting in RRI, Bangalore, NISCAIR Delhi; invited to deliver lecture on "Building-up Digital Library" in the Utkal University, Orissa on 4th April, 2008 for the Seminar on Digital Library; invited to deliver lecture as Guest of Honour in the valedictory function of the Seminar on Digital Library organized by the DLIS, Utkal University, Orissa on 5th April, 2008; delivered lecture and demonstration on "Usage of E-Resources and ISI WEB and ENDNOTE Web in Scientific Library" one day seminar of Bose Institute, Kolkata on 20th May 2008; invited to deliver lecture in valedictory programme of Annual Lecture 2007 of IASLIC which was delivered by Prof. Arup Roy Chowdhury and chaired by Prof. A R Thakur on 29th May, 2008 on topic "Libraries beyond Book"; invited to deliver talk as one of the inaugural panel member in the one day seminar of "Role of Libraries in Rural Development organized by the Burdwan University jointly with IASLIC, BLA and WBPlea and RRRLF to celebrate Librarian's Day to the mark of Birth anniversary of S. R. Ranganathan, father of LIS on 10th August 2008; delivered lecture on 12.08.08 in KIIT University, Bhubaneswar on Digital Library in a workshop; chaired session in the Refresher course of Dept. of LIS, Jamia Milia Islamia University, New Delhi on 26th August 2008; chaired session in the panel discussion for "PLANNER 2008" of INFLIBNET, UGC on "Open Access, Open Source and Open Libraries" in the Nagaland University at Dimapur on 06-07 November, 2008; organizing committee member of the International Conference on Asia Special Libraries (ICoSL) 2008 organised by SLA - Asian Chapter, IASLIC and SLP during 26-28 November, 2008 at India Islamic Cultural, New Delhi; invited as a member in the Meeting of Ministry of Culture for setting-up Permanent National Commission for Libraries in New Delhi on 6th February 2009; Academic Counselor for Post Graduate Diploma in Library Automation and Networking (PGDLAN) in IGNOU; guest faculty in the Rabindra Bharati University, Kolkata for MLISc. And BLISc., guest faculty for Kalyani University and external examiner of different universities in Kolkata.

Honours Received

Prof. Joyoti Basu (Chemistry) has been elected Fellow of the Indian National Science Academy (FNA, 2009).

Prof. A. N. Lahiri Majumder (PMCG) has been awarded the S B Saksena Memorial Medal (2008) from the Indian National Science Academy, New Delhi.

Prof. Sampa Das (PMCG) has been elected Fellow of the Indian National Science Academy (FNA, 2009).

Patent

Scientists involved : **Dr. Sampa Das** (PMCG), Santanu Banerjee, Pralay Majumder, Hossain ali Mondal, Prasenjit Saha, Dipankar Chakraborti.

Title : "A mannose binding lectin from leaves of *Allium sativum* Effective against whitefly, and process for its preparation"

Date of Application : 28.09.05

Date of grant : 10.02.09 ; Patent No. 228783

Sponsored by Bose Institute and partly by Indo Swiss Collaboration in Biotechnology

Symposia and Seminar Organized

Dr. K.P. Das and Dr. Pradip Das acted as (i) co-convener of "National Symposium on Soft Matter (NSSM-2008)" organized on the occasion of the 150th Birth Anniversary Celebration of Sir J. C. Bose from September 18 to 19, 2008; (ii) member of the organizing committee of the symposium "Integrating Physics, Chemistry, Mathematics and Biology to Understand Living Systems (IPCMB 2008) organized on the occasion of the 150th Birth Anniversary Celebration of Sir J. C. Bose from December 4 to 6, 2008.

Dr. Sampa Das (PMCG) acted as Joint Convener of the International Symposium held On the occasion of 150th birth anniversary of Sir J.C.Bose and birth centenary of Prof. S. M. Sircar, entitled "A Journey from Plant Physiology to Plant Biology" during 24th to 28th November, 2008 in collaboration with University of Calcutta.

Dr. P.C. Sen (Molecular Medicine) organized an International Conference on Perspectives of Molecular Medicine and Cell Signaling during November 27-29, 2008.

Dr. Joyoti Basu and Dr. Manikuntala Kundu acted as (i) co-conveners of the symposium "Integrating Physics, Chemistry, Mathematics and Biology to Understand Living Systems (IPCMB 2008) organized on the occasion of the 150th Birth Anniversary Celebration of Sir J. C. Bose from December 4 to 6, 2008 and acted as members of the Organizing Committee of the "National Symposium on Soft Matter (NSSM-2008)" organized on the occasion of the 150th Birth Anniversary Celebration of Sir J. C. Bose from September 18 to 19, 2008.

To commemorate the 150th Birth Anniversary of Acharya Jagadis Chandra Bose the following Symposium was organized during 14-16 Jan. 2009 at our main campus, *International Symposium on Microwaves and Millimeterwaves: Basics and Technology (ISoMM-09)*, **Dr. Amitabha Mitra** acted as Convener.

23rd National Seminar of IASLIC on the theme "Library Profession in Search of a New Paradigm" held at Bose Institute, Kolkata during 10-13 December, 2008 to commemorate 150th Birth Anniversary of Sir J.C. Bose. The seminar was inaugurated by Ex-Chief Justice Chittotosh Mukhopadhyaya and exhibition was inaugurated by Sh. Debesh Das, Minister of IT, Govt. of W.B. Eminent speakers were Prof. S. Dutta Gupta, Director, IISER, Dr. S. Mulick, USEFI, Dr. Moulik Berkhana, USIS, Ms. Sujata Sen, British Council, Prof. Atis Dasgupta, Director, State Archives, W.B., Prof. Asok Nath Basu, Chairman, West Bengal Pollution Control Board. In addition to this Director, Vice-Chancellors of different Universities in India have participated in the different Panel Discussions. The Seminar was attended by more than 450 Library/Information professionals from all over India and abroad. More than twenty five invited speakers from India and abroad delivered lectures. Thirty five exhibitors from India and abroad exhibited the Library/ Information product and services.

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 future technologies emanating out of the work done at different laboratories .

In addition to providing facilities for field experimentation for non-transgenic plant propagation, facilities have also been developed for carrying out plant transgenic research work with biosafe green houses. Further, work for sensory reception in plant movement , originally promulgated by Acharya J C Bose, is a recently conceptualized research interest .

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

Two varieties of *Mimosa pudica* based on differential sensitivity towards "touch" have been identified from natural sources and are maintained in the field and green house. One of them shows immediate leaf folding within 1 sec following "touch", the other shows delayed response (10-40 sec). A close relative of *Mimosa* , insensitive to "touch" , has also been identified . In addition, several species of *Desmodium* have been collected and are being raised . . Such plants, recognizable through their phenotype , offer valuable bioresource for comparative analysis of their "touch sensitivity" or "movement phenomenon" . both at physiological and molecular level.

Use of plant growth promoting rhizobacteria to control bacterial wilt of tomato (Dr. P. K. Chakrabarty)

Bacterial wilt caused by *Ralstonia solanacearum* is one of the most important diseases of field grown tomatoes in India. The present project has been initiated with a view to control the disease introducing plant growth promoting rhizobacteria in the rhizosphere. For the purpose we have initially isolated a few putative strains of *R. solanacearum* from diseased tomato and potato plants grown in the local fields. In search of biocontrol strains several organisms antagonistic to *R. solanacearum* have been isolated from rhizospheric soils of field grown plants. The organisms are being characterized.

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

For standardization of dehydration of different seasonal flowers seeds of Marigold, Pansy, Chrysanthemum, *Acroclium*, Aster, Cosmos, Phlox, Dianthus, Helichrysum, Calendula, Cleome viscosa etc. were collected from local market, NBRI, Lucknow and in and around the state. All plants were cultivated in beds at the farm and the flowers were dehydrated either by press drying or embedding as per suitability of the materials and objectives. The dried flowers are put for different floral craft designs for ultimate commercialization.

Centre for Astroparticle Physics & Space Science

Various projects are under progress in this Centre.

IRHPA :

The national facility for multidisciplinary research in the areas of Astroparticle physics and Space science, established at Darjeeling campus of Bose Institute has become a nodal centre for various activities. In, this facility, funded by Department of Science & Technology, Govt. of India, New Delhi under the IRHPA (Intensification of Research in High Priority Areas) scheme, at present, work is in progress in the following areas

- I. Cosmic Ray studies at High Altitude
- II. Changing Airspace Environment in Eastern Himalayas
 - (a) Radiometric studies of atmosphere
 - (b) Atmospheric Chemistry

I Cosmic Ray Studies

To study cosmic ray air showers, an array of active detectors (1 m² scintillator + photomultiplier tube) are being set up at Mayapuri, Darjeeling. The initial seven detector array (six forming a hexagon and one at the centre) would be extended to 50 detectors. Most of the components have been procured. We start setting up the detectors in a few months.

The search for exotic particles in cosmic rays using passive detectors (PET as an SSNTD) is in progress. For calibration, the PET detectors were exposed to ⁵⁶Fe & ³²S beams at IUAC, New Delhi. The response of PET, exposed to natural radioactive sources and open air at Ooty, Darjeeling and Kolkata are being studied. Detectors have been set up at Hanley as well. Recently, very low energy (~ 1 MeV/A) Coulomb fission of nuclei in the atmosphere has been

observed. The PET detector was exposed to a ^{252}Cf fission source and after chemical etching, multi-pronged tracks of Coulomb fission fragments were observed under the optical microscope. Similar tracks were also observed when the PET detectors were coated with metals (Cu, Ag and Pb) and then exposed to ^{252}Cf source.

In collaboration with TIFR, Mumbai, the flux of secondary cosmic gamma-rays during the total solar eclipse at Novosibirsk in Russia, on August 1, 2008 has been measured. Highly sensitive measurements were carried out by using a detector system consisted of two independent, large volume NaI(Tl) scintillator detectors. The data showed significant variability in the flux of secondary gamma-rays in the energy range 50-4600 keV. The nearly identical time variation observed in the two independent measurements indicated that the measured variation was real and not an artifact of the instrumentation. Systematic observations during the future eclipses are required to study this fascinating phenomenon which is not yet understood.

II Changing Airspace Environment in Eastern Himalayas

(a) Radiometric studies of atmosphere

Studies of atmospheric water vapour and cloud liquid water content have been a subject of continued interest during last two decades. For application in radio communication, the information on water vapour, liquid water content and rain has great importance in designing satellite communication links at Ku/Ka and millimeterwave bands. At this centre parallel monitoring of a number of signal parameters from three Ku-band satellite channels (10-13GHz) from NSS-6, INSAT-4B & Eurostar satellites are on for round the clock basis supported by fast response optical rain gauge for measurement of rain intensity and rain DSD. A recent study of rain rate and rain attenuation of Ku-band signal with operating frequency 11.57 GHz shows considerable variation from the standard rain attenuation model.

Also, the microwave radiometry being one of the most widely used techniques both space-borne and ground-based, these, with appropriately selected frequency, could provide continuous monitoring of not only atmospheric gases but also could estimate vertically integrated magnitudes of usual meteorological parameters, e.g., pressure, temperature and humidity. It is by far one of the most accurate methods to measure the vertically integrated liquid water content of the atmosphere. The dual-frequency radiometer at 23.8 GHz and 31.4 GHz provides a rather unique technique to monitor simultaneously the integrated water vapour(IWV) and the liquid water path delay(LWP) through inversion algorithm. Such dual frequency radiometer has been installed at our high altitude centre at Darjeeling (22°35'N, 88°26'E). we have also installed one millimeter wave *micro-rain radar* (24.1 GHz) at this centre, which gives simultaneously the vertical profile of rain intensity (mm/hr) and rain DSD profile up to an altitude of 6 km (max) as a part of our study of changing weather pattern of Eastern Himalayas so far as atmospheric water vapour and

liquid water contents are concerned. In view of intense fog accumulation at such high altitudes a dual frequency (in IR and visible bands) Laser LOS links are planned to be installed in order to study local DSD of fog particles. Installation is in progress for a He-Ne laser (632.8 nm) LOS link (300m) at the site. A LIDAR (DPSS Nd YVO₄:532nm) has also been installed at the same site recently to study cloud base characteristics by monitoring vertical aerosol profile over an altitude over an altitude of 10km.

(b) Atmospheric Chemistry

Several instruments for atmospheric measurements and analysis, such as, monitors for respirable dust, PM_{2.5}, PM₁₀, Automatic Weather system, Ozone analyzer, anemometer, gas chromatograph etc. has already been installed and working at Darjeeling. In a recent study it was found that there is a significant contribution of fine particulate matter, PM_{2.5} to the total respirable particulate matter, PM₁₀ in the atmosphere of Darjeeling. During the peak tourist season (month of April), more than 80% of PM₁₀ was found to be constituted by PM_{2.5}. The secondary anthropogenic species SO₄²⁻ and NO₃⁻ were found to be enriched mostly in fine mode aerosol although a major fraction of SO₄²⁻ accumulated in coarse mode aerosol as sea sulphate during monsoon. The chloride depletion in aerosol during monsoon period was prominent indicating the interaction between transported sea salt aerosol and locally generated anthropogenic aerosol. The higher chloride depletion was found in fine mode aerosol compared to the coarse mode aerosol.

Three major source regions like local, continental (e.g. north and north-western part of India) and marine (mostly from Bay of Bengal and from Arabian Sea in some events) sources were identified based on HYSPLIT backward trajectory model. It was found that the local and other continental source regions contributed 80% with high loading of secondary anthropogenic species whereas the contribution from marine source regions was 20% enriched with primary sea salt particles. Several evidences helped us to establish the fact that during summer season the high loading of aerosol mainly in fine mode was not only from the local sources but also due to long range transport of aerosol reaching at Darjeeling from various continental regions.

PROBE:

Participation of school children in the collecting meteorological data in 20 schools around Darjeeling is one of the main goal of this project. Data from various schools during the period 2006-2009 has already been collected. Analysis of these data is in progress. The final data will be sent to DST and IMD as well. These data will be extremely helpful in understanding the variation of meteorological parameters in and around Darjeeling. Various interacting sessions with school children as well as teachers has been arranged.

NESST-BASE programme:

North-East students' summer training programme on Basic sciences was organized during June-July 2009. This year this programme was organized specifically for give students' of classes IX - XI from seven North-East states along Sikkim and Darjeeling. This programme has now become a regular yearly programme of the Institute.

M.Sc Course in Physics with special emphasis on Astrophysics & Space Science:

The postgraduate course in physics, started in 2007, has entered its 3rd year. First batch of students will finish their course by May 2009 and the classes for new batch will commence sometime during August 2009.

Falta Experimental Farm

Rural Biotechnology Programme of Bose Institute was inaugurated at Falta Experimental Farm on 7th August 2008. Under this programme two training programmes on "Mushroom cultivation, preservation and spawn production" were carried out in 2008-2009. Seventy-six local people were trained. Mushroom spawn and fresh mushroom are being produced throughout the year to popularize mushroom in the rural areas of Falta. All old buildings were renovated for setting up laboratories and dormitories for gents and ladies. New Transformer was installed to cater the electricity demand of the whole programme.

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

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

All participants of Institutional Programme I, Dr. P.C.Sen, Dr. S. Dasgupta, Dr. G.Basu, Dr. P. Parack, Dr. P.C. Sil, Dr. G.Sa, Dr. T. Das, Dr. T.C. Ghosh

In a golden moment of September, 2007 a Programme on Integrated M.Sc. Ph.D in Plant Molecular Biology and Biotechnology was started at Bose Institute in collaboration with Calcutta University. The programme comprises four semesters Post Graduate curriculum over a span of two years followed by four year Ph.D. study. Graduate candidates (B.Sc.) with honours in any science subject securing 60% or more marks in previous Board/University examinations are selected through steps of stringent evaluation procedures. The first batch of six students after completing their third semester curriculum has entered into project based fourth semester in the month of March, 2009. The second batch of nine students were admitted in September, 2008. All students are offered a student fellowship

for two years. If any student fails to secure 60 % marks in any semester, his/her fellowship is withdrawn till he/she qualifies in next semester. All academic activities are regularly monitored by a Board of Studies comprising four members from the University of Calcutta, four in-house members and two reputed academicians of other Universities, chaired by the Director, Bose Institute. The degree will be awarded jointly by the University of Calcutta and Bose Institute.

IRHPA Genomics and Proteomics Facility

The facility for genomics and proteomics created under the aegis of IRHPA covers projects in three broad areas as outlined below.

(i) **Microbial Genomics:** The cell division cycle of *Entamoeba histolytica*, a protozoan parasite that causes dysentery, is being investigated, with a view to identifying useful anti-amoebic drug targets. Formation of kinetochore protein complexes of protozoan parasites is being studied using confocal microscopy and yeast two-hybrid based methods, using yeast as the model system. Mycobacteriophages that infect *Mycobacterium tuberculosis* are also being studied. These phages possess many novel genes. Insights into sulfur oxidation, an ancient metabolic process, are being sought through the study of the Sox operon of the sulfur chemolithotroph, *Pseudaminobacter salicylotoxidans*. A novel plasmid from *Tetrathibacter kashmirensis* has also been sequenced and being utilised to create a novel shuttle vector.

(ii) **Structure of Proteins:** Structural studies on several important proteins from *Vibrio cholerae* such as HlyU and ToxR have been done. Protein-protein interaction and post-translational modification studies involving the lens protein α -crystallin have been carried out using MALDI-TOF. The mechanism of interaction of the CII protein from bacteriophage λ and the host protease *E. coli* HflB has been studied by various biochemical means.

(iii) **Plant Genomics and Proteomics:** Stress response pathways in plants, covering both biotic and abiotic stress, have been investigated using proteomics based methods. Differential proteomic profiles were obtained, in response to agents like the fungal pathogen *Alternaria brassicola*, the insect Chickpea pod borer, and the virus MYMIV. Abiotic stress was also studied in the context of salinity. At least 16 genes in rice were found to be upregulated following high salt stress. These include genes related to osmolyte synthesis, photosystem functioning and Rubisco activation.

Library

The Institute Library system is one of the best Science Reference Libraries in Eastern India, set up in the main campus in 1917 and a wing at the Centenary building opened in 1983. In the year 2007 a small library is being set-up in the Salt Lake Campus of the Institute. At present Library is located in above mentioned three campuses. Library collection (online journals can be accessed from all the seven campuses of Bose Institute. Library provides latest information to the BI faculty, researchers and staff in their day-to-day research and development work and also to extend its facilities to other Institutions / universities in and around Kolkata. Faculty / researchers from Eastern India use the library extensively for reference. The library has total collection of 38,841 reading materials out of which 26251 Bound journals, 12625 Books, 428 Theses as on 31.03.2009. During this year library subscribed to 300 numbers of foreign and Indian periodicals out of which print only 25 numbers. Library has subscribed to more than 4000 online journals in different packages. Library also subscribed to online-only full-text journals / databases of different academic societies such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier etc., Century of Science, Science Citation Index Expanded and ENDNOTE Web of ISI Web of Science, Thompson, USA., Blackwell / John Wiley Journal's Premier Online, Current Protocols (Online) of John Wiley / Blackwell, Annual Reviews Online (Back volume), Methods in Enzymology (Online back volume) and Current Year Trial Access, E-Books of E-brary (2400 e-books), E-Books – of Cambridge University Physics E-Books package, E-Books package of Elsevier: (a) Agricultural and Biological Sciences (202); (b). Biochemistry, Genetics and Molecular Biology (260); (3). Environmental Science (113), Current Protocols package of Springer (20225 e-books), Knovel E-Book Collections : Biochemistry, Biology & Biotechnology, H. W. WILSON.

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

During the year, 1581 readers used the Library (both campuses) for their reference work. 24 permission cards were issued to the outside readers. Under Inter Library Loan system book / journals were issued to other institutions and also books / journals were taken on loan. Library has provided scanning service to users for research work—more than 1,00,000 documents were scanned for faculty members as well as research scholars and more than 3596 hours computer / internet used for accessing in full-text subscribed / free journals by the scholar from the Library itself. Library also provided article services to its faculty members from different institutions in India and abroad. Library also provides

citation services to its faculty members. Library Computer are used by researchers for accessing full-text subscribed / free journals by the faculty / research scholars apart from their laboratory / department computers.

Photocopy services are provided to outside users. A total 1,66,000 pages of photocopying (Xerox) services were given to our faculty and outside users. Some 547 bound volumes of book / journals and 273 loose periodicals were issued by our research scholars and faculty members throughout the year for their reference work.

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

J C Bose Centre

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).

On the occasion of 150th Birth Anniversary a Bengali book containing the life and achievement of Sir J. C. Bose released.

The following publications are now available for sale : J. C. Bose and Microwaves – A collection : Rs.200.00; Science and Society – Reflections : Rs.1050.00; J.C. Bose A Scientist and A dreamer – Vol. I : 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.

SAIF

Apart from the old Instruments, XRD, GC, the newly commissioned Instruments like SEM, FPLC, HPLC & RT-PCR have started catering services to the Scientific Community both within the institute and out side satisfactorily. Liquid Scientillation (LS) Counter has been installed & commissioned satisfactorily. Another new Instrument, Atomic Absorption Spectrophotometer (AAS) will be added to the list shortly. Training of the research workers as well as students from different organizations are being carried out on regular basis. The total revenue earned for the financial year 2008-2009 is Rs. 1,46,683.00.

Workshop

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

UNITS	REQUISITION RECEIPTS	JOB DISCHARED	CONTINUING JOB
ELECTRICAL	855 (M.C. & N.C.)	100%	nil
MECHANICAL	40	100%	nil
CARPENTRY	40	95%	5%
REFRIGERATION	30	100%	nil
DRAFTING	30	100%	Nil
LECTURE, SEMINARS & course work class attended	Above 320 (M.C & N.C.)	100%	Nil

Sri Panchugopal Karak, Sr. Carpenter has fabricated 3 nos. big laboratory table and 1 no Milipore Instrument cabinet for Prof. S. Sen Mandi for ICMR Project. Electrical substation at Falta Experimental Farm of 63 KVA capacity Transformer has been installed & commissioned. Water pump has been renovated for supplying adequate water at the said campus. KONE make passenger Elevator has been installed & commissioned at C.B.

Electrical AMC has been awarded to four campuses i.e. Main campus, Centenary Campus, Salt lake campus & MEF. Conventional fire alarm system has been installed & commissioned at CAPSS, Salt lake campus.

Induction of New AC Machines of various categories of 66 nos. has been working smoothly in four campuses of Bose Institute with good energy efficiency ratio as per guide line of Energy Audit Report.

Socially Relevant

Rural Biotechnology Programme

Rural Biotechnology Programme of Bose Institute was inaugurated at Falta Experimental Farm on 7th August 2008. Under this programme two training programmes on "Mushroom cultivation, preservation and spawn production" were carried out in 2008-2009. Seventy-six local people were trained. Mushroom spawn and fresh mushroom are being produced throughout the year to popularize mushroom in the rural areas of Falta. All old buildings were renovated for setting up laboratories and dormitories for gents and ladies. New Transformer was installed to cater the electricity demand of the whole programme.

Manipur Students' Winter Training on Basic Science 2008

Bose Institute organized a programme "Manipur Students' Winter Training on Basic Science" at the Centenary Campus of Bose Institute in Kolkata from December 14-22, 2008. Twenty class IX students, twenty class XI students and three School Teachers from the state of Manipur attended the training school. The programme included a two-day session of lectures and hands-on exposure in Physical Sciences, two days in Microbial Sciences, two days in Plant Sciences and one day was spent on Energy/Molecules. Another full day was spent on an educational excursion on the Ganges, a visit to the Birla Industrial and Technology Museum and a special show at the Birla Planetarium.

North-East School Teachers' Training on Basic Science 2009

Bose Institute organized a programme "North-East School Teachers' Training on Basic Science" (NESTT-BASE) at Kolkata, during January 12 – 21, 2009. 23 school teachers from Assam, Darjeeling, Manipur, Meghalaya, Mizoram, Sikkim and Tripura participated. The programme exposed them to different aspects of basic science such as diverse topics on Physics and Chemistry with an emphasis on preparing low-cost experiments for classes in Basic Microbiology, Molecular Biology, Mushroom cultivation, Biodiversity, Catalysis, Enzyme activity and Cancer Biology. Interactive hands-on sessions and practical demonstrations accompanied each lecture, delivered by faculty members of Bose Institute or other resource persons. In addition, visits to the Bose Institute museum, the West Bengal Renewable Energy Development Agency and the Variable Energy Cyclotron Centre were organised. Some special lectures were also arranged: "Searching for the Mysteries of the Universe" (S. Raha), "Nobel Prize 2008" (B. Bhattacharyya), "CHAANDRAYAN" (O.P.N. Calla), "DNA: The Eternal Molecule" (A.N. Lahiri Majumder).

List of Personnel

Administration

Dr. Sibaji Raha, *Sr. Professor & Director*

Sri Tushar Kanti Ghorui, *Registrar*

Dr. Utpal Sadhu, *Deputy Registrar*

Centenary Campus: Kazal Chaudhuri, Ram Krishna Kundu, Debidas Saha, Satyananda Pal, Parimal Ch. Das, Arup Kr. Sengupta, Sankar Nath Sinha, Sukumar Moitra, Subir Sen, Ashis Chakraborty, Sisir Chakraborty, Bidyut Kr. Mandal, Manick Ch. Das, Tapan Chakraborty, Ankur Dutta, Nikhilesh Roy Ghatak, Madhusudan Mitra, Amit Kr. Ghosh, Baldeb Goswami, Rina Roy, Ram Raj Pandey, Elizabeth Pal, Swapan Kr. Sinha, Dhrubajyoti Sen, Rubi Sarkar, Sudam Jana, Bably Marick, Rina Das, Somnath Das, Prodip Kr. Mullick, Sanjoy Krishna Chaki, Debasis Kaley, Angshuman Bhowmik, Sanjib Kr. Das, Biplab Malakar, Satya Chatterjee, Ramesh Chandra Sarkar, Dipak Dutta, Chotelal Rangwa, Kamalendu Sur, Tapan Kr. Banerjee, Jubaraj Paul, Krishna Turi, Sudhir Turi, Khoirul Basar Malla, Nagnarayan Yadav, Kuddush Ansari (Retired on 31.01.2009), Kanai Hazra, Prafulla Bhunya, Kanak Baran Hazra, Duryodhan Nayak, Bablu Mandal, Sukanta Chakraborty, Subrata Banerjee, Amarnath Hela, Ranjit Das, Sarada Devi, Sukumar Mandal, Bulaki Das, Jagabandhu Nayak, Jagannath Das.

Main Campus: Alakananda Sarkar (Retired on 31.10.2008), Tarun Kumar Maji, Rabindra Nath Karmakar, Chandra Kanta Sasmal, Tarun Chakraborty, Sanat Kr. Dey, Mahendra Nath Shee, Madhusudhan Marick, Sanat Kr. Dhara, Harekrishna Thoyal, Fulchanda Sardar, Kalicharan Turi, Kissan Das, Munna Turi, Kodan Das, Sk. Mohammad Illias, Manju Turi (Retired on 30.11.2008), Nagaswar Das, Rajbrat Ram, Rajkumari Balmiki, Tapas Chakraborty, Prabir Halder (I).

Acharya J.C. Bose Biotechnology Innovation Centre

Madhyamgram Experimental Farm

Faculty : Dr. P. K.Chakraborty, *Emer. Scientist*, Dr. S.K.Datta, *Emer. Scientist*, Dr. A.N.Lahiri Majumder, *Sr. Professor & Chairman*, Dr. P.K.Saha, *Sr. Professor & Co-Chairman*.

Supporting Staff : Dr. Supriya Roy, Mr. Asis Dalal, Mr. Atanu Deb, Mr. Pulak Roy, Mr. Rakhal Ch. Jana, Mr. Subhas Senapati, Mr. Dilip Pramanik, Mr. Sukumar Das, Mr. Rabin Talukder, Mr. Laxmi Kanta Pradhan, Sk. Inal Ali, Mr. Bhanu Kisku, Mr. Mahesh Dasgupta

Biochemistry Department

Faculty : Dr. B. Bhattacharyya, *Sr. Professor*, Dr. Pinakpani Chakrabarti, *Sr. Professor*, Dr. Rajagopal Chattopadhyaya, *Professor*, Dr. Anuradha Lohia, *Sr. Professor*, Dr. Pradeep Kumar Parrack, *Assoc. Professor*, Dr. Subrata Sau, *Assoc. Professor*, Prof. Pratima Sinha, *Sr. Professor and Chairperson* (since 11.07.08).

Students : Mainak Guha Roy (upto 31.03.09), Palas Kumar Chanda, Suparna Laha (upto 31.10.08), Somasri Pal (upto 17.03.09), Sankar P. Das, Sumit Biswas (upto 31.01.08), Lalita Das, Malabika Das, Tridib Ganguly, Pabitra K. Parua (upto 31.01.09), Sourav Sarkar, Kaustav Bondyapadhyay, Debadrita Mukherjee, Chandrama Mukherjee (upto 14.11.08), Dipak Manna (upto 09.02.09), Amitava Bandhu, Arumoy Pal (upto 31.03.09), Subhra Majumdar (upto 14.11.08), Prabal Chakraborty, Tanusree Bhattacharyya, Biswanath Jana, Jaspreet Singh Grewal, Abinit Saha, Dr. Tanaya Chatterjee, Soumyananda Chakraborty (Joined w.e.f. 04.04.08 f.n.), Himadri Biswas (Joined w.e.f. 04.04.08 f.n.), Baisakhi Halder (01.05.08 to 31.12.08), Maitrayee Dasgupta (01.05.08 to 31.12.08), Sarbani Chattopadhyay (01.05.08 to 31.12.08), Sriupa Das (05.08.08 to 30.11.08), Avisek Mondal (Joined w.e.f. 02.09.08 f.n.), Rajkrishna Mondal (Joined w.e.f. 16.12.08 f.n.), Dr. Subhash Halder (Joined w.e.f. 22.12.08 f.n.), Madhuchanda Mukherjee (Joined w.e.f. 26.02.09 f.n.), Dr. Sumana Sarkhel (Joined w.e.f. 19.03.09 f.n.),

Supporting Staff : Subhash Ch. Debroy (upto 31.12.08), Durga Charan Das, Swapan Kumar Das, Ashim Kumar Banerjee, Narayan Chandra Dutta, Subhash Chakraborty, Asim Kumar Poddar, Debarati Kanjilal, Asraf Ali Molla, Sudhangsu S. Maity, Basudeb Ghorui, Dulal Chandra Mandal, Ranubala Das.

Bioinformatics Centre

Faculty: Dr. P. Chakrabarti, *Sr. Professor & Scientist-in-Charge*, Dr. T.C.Ghosh, *Asstt. Professor*

Students: Dr. Rajasri Bhattacharya, Dr. Surajit Basak, Mr. Shrihari Sonavane, Dr. Ms. Pamela Mukhopadhyay, Ms. Madhurima Das, Ms. Sangeeta Kundu, Ms. Bratati Kahali, Dr. Bhaskar D. Gupta, Dr. Rudra P. Saha, Ms. Sucharita Dey, Ms. Soumita Poddar, Ms. Baisali Manna, Mr. Sumit Biswas, Research Scientist: Dr. Debjani Roy.

Supporting Staff: T.K. Bhattacharya, S. Roy, S.K. Gupta, J. Mamdal

Biophysics Department

Faculty: Dr. Gautam Basu, *Professor*, Dr. B. Bhattacharyya, *Sr. Professor & Chairman*

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

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

Botany Department

Faculty: Dr. D. Basu, *Assoc. Professor*, Dr. Sabita Bhattacharya, *Professor*, Dr. G. Gangopadhyay, *Asstt. Professor*, Dr. T. K. Ghose, *Assoc. Professor*, Dr. Swati Gupta Bhattacharya, *Professor*, Dr. P. K. Saha, *Sr. Professor*, Dr. Dr. Swati Sen-Mandi, *Sr. Professor*, Dr. D. N. Sengupta, *Sr. Professor*

Students: Moumita Gangopadhyay, Basabhatta Das, Suranjana Roy, Himadri S. Chakraborty, Annanda Mohan Sau, Supratim Basu, Dr. Subhash Kanti Roy, Jyostna Mondal, Sanjoy Kr. Sinha, Dr. Sanjukta Dey, Madhuvanti Chatterjee, Upala Saha, Dr. Swarup Roychoudhury, Dr. Koushik Ghosh, Dr. Yasmin Begum, Mrinmoy Majumder, Anindya Bhattacharya, Subhabrata Ghosh, Maitreyee Chatterjee, Manisha Debnath, Sheelee Chakraborty, Debabrata Paul

Supporting Staff: Sukumar Majumdar, Dr. Ramit Poddar, Chanchal Chakraborty, Binoy Krishna Modak, Jadab Kr. Ghosh, Kaberi Ghosh, Chaitali Roy, Bipul Kr. Nag, Sasanka Sekhar Bera, Siddhartha Roy, Sarama Pradhana, Moumita Basu Roy, Sambhunath Debnath (expired on 15.03.09)

Chemistry Department

Faculty : Dr. Suman Banik (from 06.11.2008), *Asstt Professor*, Dr. Joyoti Basu *Sr. Professor & Chairperson*, Dr. Manas Chakraborty, *Sr. Professor*, Dr. K.P. Das, *Sr. Professor*, Dr. Pradip Das, *Assoc. Professor*, Dr. Manikuntala Kundu, *Sr. Professor*, Dr. Jayanta Mukhopadhyay (from 19.01.2009) *Asstt. Professor*.

Students : Dr. Taraknath Kundu, Partha Mukherjee, Sulakshana Karmakar, Ajanta Mukherji, Ratna Mukherjee, Sanchita Basu, Tofajjen Hossain, Srabani Karmakar, Kamakshi Sureka, Sushil K. Pathak, Kuldeep Kamawat, Gargi Chatterjee, Sourav Sanyal, Subhasis Barik, Dr. Sujit Roy, Debarun Roy, Priyanka Halder, Paramita Chatterjee, Joyes Dey, Victor Banerjee.

Supporting Staff : Aniruddha Aich, Pranab Kumar Dey, Bhabani Prasad Banerjee, Tapas Ghosh, Dipak Chandra Konar, Debdas Nandy, Rama Chatterjee, Amarnath Bhatta, Subhas Chandra Paul, Ashoke Kumar Maity, Sachchidanand Ram

Central Instrumentation Facility

Faculty : Dr. B. Bhattacharyya, *Sr. Professor & Chairman*

Supporting Staff : Jaganmoy Guyin, Ranjan Dutta, Smriti Ranjan Maji, Mrinal Das, Alpana Bhattacharyya.

Division of Molecular Medicine

Faculty: Dr. Tanya Das, *Assoc. Professor*, Dr. Nripendranath Mandal, *Assoc. Professor*, Dr. Anup Kumar Misra (from 03.10.2008), *Asstt. Professor*, Dr. Subrata Mazumdar (from 01.05.2008), *Professor*, Dr. Arun K. Ray, *Sr. Professor*, Dr. Gaurisankar Sa, *Professor*, Dr. Parimal Ch. Sen, *Sr. Professor & Head*, Dr. Parames Ch. Sil, *Professor*.

Students: Dr. Baisakhi Saha, Dr. Sreya Chattopadhyay (upto 30.09.2008), Dr. Kaushik Das, Dr. Minakshi Mazumdar, Ms. Juni Chakraborty, Mr. Pallab Ray, Mr. Shuvomoy Banerjee, Mr. Argha Adhikary, Ms. Suchismita Mohanty, Ms. Pinki Nandi, Mr. Dewan M.S. Hossain (upto 28.02.2009), Mr. Bibhabasu Hazra, Ms. Swatilekha Ghosh, Mr. Samik Chakraborty, Mr. Santanu Biswas, Mr. T.K. Dhara (31.12.2008), Mr. Krishnendu Ghosh (upto 08.09.2008), Mr. Prasenjit Manna, Ms. Mahua Sinha, Mr. Mrinal Kr. Sarkar, Mr. Joydeep Das, Mr. Jyotirmoy Ghosh, Mr. Rudrangshu Chatterjee (up 01.06.2008), Mr. Mandar Sengupta, Mr. Rhitajit Sarkar (from 16.04.2008), Mr. Sourav Mandal (from 16.04.2008), Mr. Surajit Bhattacharjee (from 02.05.2008), Ms. Parna Bhattacharya (from 02.05.2008), Mr. Anupam Adhikari (from 02.05.2008), Mr. Gourav Gupta (from 05.05.2008), Dr. S. Bhattacharya (Mazumdar) (from 02.05.2008), Ms. Silpi Saha (from 09.07.2008), Ms. Shrivanti Mukherjee (from 14.07.2008), Mr. Brajogopal Samanta (from 23.07.2008), Ms. Payel Bhattacharjee (from 17.09.2008), Mr. Saikat Mazumder (from 03.09.2008), Chinmoy Mukherjee (from 03.10.2008 to 31.12.2008), Mr. Rajib Panchadhaya (from 03.10.2008), Mr. Samir Ghosh (from 03.10.2008), Goutam Guchhait (from 03.10.2008) and Mr. Pintu Kumar Mandal (from 03.10.2008).

Supporting Staff: Mr. Prasanta Pal, Mr. Indrajit Ray, Mr. Sujit Kumar Ghosh (upto 31.12.2008), Mr. Sukumar Maitra (from 01.01.2009), Mr. Barindra Nath Mandal (from 01.05.2008), Mr. Prabal Gupta (from 01.05.2008), Mr. Arindam Basu, Mr. Uttam Kumar Ghosh, Mr. Amartya Sen, Mr. Ranjit Das, Mr. Kalyan Das, Mr. Sankar Prasad Bari (from 01.05.2008), Mr. Purnendu Manna (from 01.05.2008) and Ms. Kanan Singh.

Environmental Sciences Section

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

Research Fellow: Abhijit Chatterjee (SRF), CSIR, Govt of India

Supporting Staff: Anandamay Adak, Sujata Roy, Saral Chandra Das, Bhaskar Roy (IRHPA Project, DST, Govt of India)

Falta Experimental Farm

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

Supporting Staff: Sk. Ansar Ali (Mali)

Library

Dr. Arun Kumar Chakraborty, *Librarian*

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

Microbiology Department

Faculty: Dr. Sujoy K. Dasgupta, *Professor*, Dr. Tapan K. Dutta, *Assoc. Professor*, Dr. Subrata Majumdar, *Professor*, Dr. Parimal C. Sen, *Sr. Professor & Chairman*

Students: Twishasri Das Gupta, Nabanita Giri, Joydeep Chakraborty, Arnab Basu, Sm. Madhumita Roy, Sri Boudhyan Bandhopadhyay, Sm. Joyita Sarkar, Sri Debajyoti Ghosal, Sm. Priyanka Bhowmick, Pratiek Khara, Sri Prithwiraj Kirtania, Sm. Piyali Pal Chowdhury, Dr. Wriddhiman Ghosh, Sm. Soumita Dutta, Suchandra Majumdar (transfer to Molecular Medicine Division), Sm. Parna Bhattacharya (transfer to Molecular Medicine Division), Sri Anupam Adhikari (transfer to Molecular Medicine Division), Sri Surajit Bhattacharya (transfer to Molecular Medicine Division), Sri Gourav Gupta (transfer to Molecular Medicine Division).

Supporting Staff: Biswanath De Sarkar, Barindranath Mandal (transfer to Molecular Medicine Division), Provat K. Chattopadhyay, Prabal Gupta (transfer to Molecular Medicine Division), Saifullah Gazi, Debashis Sarkar, Prabir Halder, Debashis Mazumder, Jamuna Prasad (retired on 31.08.08), Dilip Bhattacharyya, Ramesh Prasad, Robin Paul, Sankar Bari (transfer to Molecular Medicine Division), Purnendu Manna (transfer to Molecular Medicine Division), Narayan Patali.

Physics Department

Faculty: Dr. Somshubhro Bandopadhyay (Physics & CAPSS), *Asstt. Professor*, Dr. Indrani Bose, *Sr. Professor*, Dr. Barun Kumar Chatterjee, *Sr. Professor*, Dr. Sanjay Kumar Ghosh (Physics & CAPSS), *Assoc. Professor*, Dr. Dhruba Gupta (Physics & CAPSS), *Asstt. Professor*, Dr. Dipankar Home (Physics & CAPSS), *Sr. Professor*, Dr. Amitabha Mitra (Physics & CAPSS), *Assoc. Professor*, Dr. Rajarshi Ray (Physics & CAPSS), *Asstt. Professor*, Dr. Sibaji Raha, *Sr. Professor, Chairman & Director*, Dr. Swapan Kr. Saha (Physics & CAPSS), *Professor*, Dr. Tripurari Prasad Sinha, *Professor*.

Students: Dr. Supriya Das, (Research Scientist since 2/12/08, IRHPA Project), Dr. Sandhya Dey (Mondal) (Research Associate, IRHPA Project), Mr. Atanu Maulik (SRF, IRHPA Project), Alok K. Pan, Alo Dutta, Rittam Mallick (Physics & CAPSS), Prasanna Kumar Mondal, Amit Paul, Sayantari Ghosh, Anirban Lahiri (Physics & CAPSS), Sarbani Majumdar (Physics & CAPSS)

Supporting Staff: Sankar Prasad Singha, Shyamsundar Mallick, Rita Chakraborty Subhasis Banerjee, Manas Dutta, Subrata Das (Physics & CAPSS), Ms. Sumana Das (Technical Assistant, IRHPA Project), Bharat Prasad Ram, Bansi Dutta, Dayakant Thakur, Sujit K. Basu (Physics & CAPSS), Rajkumar Mourya.

Plant Molecular & Cellular Genetics Section

Faculty: Dr. A.N. Lahiri Majumder, *Sr. Professor*, Dr. Amita Pal, *Sr. Professor*, Dr. Sampa Das, *Sr. Professor*, Dr. S.R. Sikdar, *Professor*, Dr. Pallob Kundu, *Asstt. Professor*

Students: Dr. Paramita Nandy, Dr. Dipjyoti Chakraborty, Dr. Sudipta Ray, Dr. Samik Bhattacharya, Dr. Barunava Patra, Dr. Hossain Ali Mondal, Dr. Sonali Sengupta, Dr. Jolly Chatterjee, Ms. Nilanjana Banerjee, Mr. Soumitra Maiti, Ms. Sumanti Gupta, Mr. Jayadri Sekhar Ghosh, Ms. Subhodipa Sengupta, Ms. Lekha Bandopadhyay, Ms. Nutal Pal, Mr. Subrata Kundu, Mr. Anirban Kundu, Ms. Rumdeep Kaur Rangi, Ms. Anindita Sengupta, Ms. Suparna Ghosh, Ms. Arpita Bala, Mr. Amit Roy, Mr. Ayan Das, Mr. Anirban Jyoti Debnath, Ms. Gargi Pal, Ms. Sritama Mukherjee, Mr. Pijush Mullick, Ms. Dipta Shani Datta, Dr. Saswati Sengupta.

Supporting Staff: Mrs. Puspita Mukherjee, Sri Asim Kumar Nath, Sri Subal Basak, Sri Motilal Singh, Sri Arup Kumar Dey, Sri Nadiram Kayal, Sri Thakur Gond, Sri Birendra Kumar Bari, Sri Chiranjib Chakraborty, Sri Uttam Das, Sri Swarnava Das, Mr. Abhishek Mukherjee.

J.C. Bose Centre (Publication and Museum)

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

Supporting Staff: Tarun Kumar Maji, Chandra Kanta Sasmal

Sophisticated Analytical Instrument Facility (SAIF)

Faculty : Dr. P. C. Sen, *Sr. Professor & Scientist in-charge*

Supporting Staff : Tapan Datta; Gobinda Das; Shyamsundar Kundu; Amit Kr. Mahinder; Joydeb Chatterjee; Jaganmoy Guin; Arup Kr. Sen; Subhas Ch. Maikap; Samir Kr. Mukherjee; Pradip Kr. Karmakar; Tanima Modak Dhar; Ranjit Kr. Ghosh; Debabrata Polley; Sankar Kr. Santra; Saraswati Sarkar Sen; Sujit Kr. Ghosh (redeployed from the Division of Mol. Med. w.e.f. 02.02.2009) ; Alokanda Sarkar (retired on 31.10.2008); Pathik Ranjan Roy (retired on 31.12.2008)

Workshop

Mr. A.K. Mukherjee, Workshop Supdt.

Supporting Staff : *MAIN CAMPUS :* Ashutosh Sarkar, Samar Dutta, Sisir Ghosal, Dipen Sen, Sk. Md. Eha Hossain, Basanta Kr. Shit, Bholanath Saren, Abdul Rahaman Molla, Panchanan Santra, Panchugopal Karak, Goplal Ch. Das, Sk. Md. Farruck, W.D. Rozario, Kalachand Sen, Rajkumar Das, Pranab Banerjee, Brahmedo Prasad, Subrata Basak, Sanjoy Santra. *NEW CAMPUS :* Alok Kundu, Tapan Mondal, Ashit Bsnrejee, Md. Raffick, Murari Mohan Shee, Baidya Nath Murmu.



Prof. Douglas Young delivering a lecture at **IPCMB2008** on the occasion of the 150th Birth Anniversary Celebration of Sir J.C. Bose during December 4 to 6, 2008



The Inaugural dais at **ISO-MM-09**, sitting from left: Prof Sibaji Raha, *Director, Bose Institute*, Dr Vikram Kumar, *Director, National Physical Laboratory, Delhi*, Prof. Suranjan Das, *Vice Chancellor, Calcutta University*, Dr B. M. Reddy, *Emeritus Scientist, NGRI, Hyderabad* and Prof. S. Ananthakrishnan, *Adjunct Professor & Raja Ramanna Fellow, Pune University*



The inaugural ceremony of the **National Symposium on Soft Matter** held during September 18-19, 2008 on the occasion of the 150th birth anniversary of Sir J. C. Bose and 90th Jubilee year of Bose Institute. From left to right : Dr. P. Das (Convener), Prof. D. K. Chattoraj (Guest of Honour), Prof. A. Roy Chowdhury, Director, SNBCBS and Prof. S. Raha, Director, BI



23rd National Seminar of IASLIC on **In Library Profession in search of a New Paradigm** on the occasion of the 150th Birth Anniversary Celebration of Sir J.C.Bose, during 10 – 13 December 2008



Acharya J. C. Bose - with his students, 1928.
Sitting from left to right: Meghnad Saha, Jagadis Chandra, J. C. Ghosh; Standing from left to right: S. Dutta, S. N. Bose, D. M. Bose, N. R. Sen, J. N. Mukherjee, N. C. Nag.