

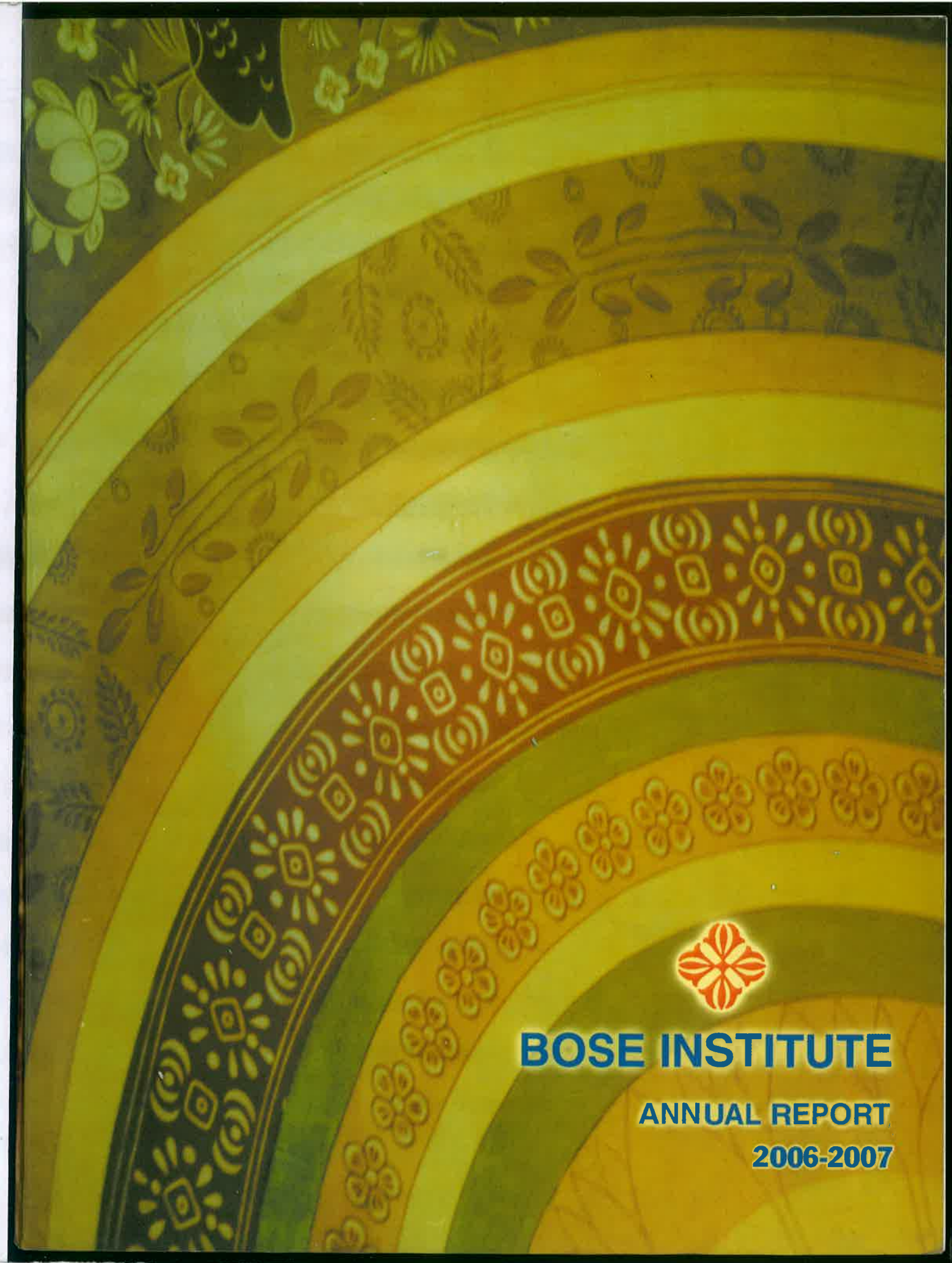
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“....I Offer My Salutation”

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

ANNUAL REPORT OF THE BOSE INSTITUTE FOR 2006-2007



Bose Institute

93/1, Acharya Profulla Chandra Road
Kolkata -700 009

Compiled and edited by the Annual Report
Committee 2006-2007 consisting of the following members :

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The Bose Institute

The Bose Institute was founded by Sir Jagadis Chandra Bose in 1917 for the advancement of science and dissemination of knowledge. The Institute has served the nation for the past 90 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 working in Biological, Biomedical and Physical Sciences, in the departments of Physics, Chemistry, Botany, Microbiology, Biochemistry and Biophysics, and the research sections on Plant Molecular & Cellular Genetics, Animal Physiology, Immunotechnology, Environmental Science and Astroparticle Physics & Space Sciences. Besides, there are service centres like Sophisticated Analytical Instrument Facility, Bioinformatics Centre, Library, Workshop, etc. In addition, the Acharya J.C.Bose High Altitude Research Centre at Darjeeling and experimental field stations at Falta, Madhyamgram and Shyamnagar are parts of the Institute. The scientific facilities available in the institute are also used by scientists from several universities and research centres in the country.

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90th Foundation Day Celebrated



The 90th Foundation Day of Bose Institute was celebrated on 30th November 2006. Prof. V.S. Ramamurthy, DAE Homi Bhabha Chair Professor, Inter-University Accelerator Centre, New Delhi graced the occasion as Guest of Honour and delivered 68th Acharya Jagadis Chandra Memorial Lecture on **Management of intellectual property assets in large, multi-disciplinary research and development institutions**. On this occasion **Sir Nilratan Sirkar Prize 2006**, was awarded jointly to Mr. Rudra Prasad Saha, a Senior Research Fellow, Department of Biochemistry and Mr. Sankar Bhattacharyya, a Senior Research Fellow, Animal Physiology Section. **Prof. B.B. Biswas Outstanding Student Award 2006**, was presented to Ms. Lily Goswami, a Senior Research Fellow, PMCG Section. The days celebration was started with floral offerings and garlanding of SAMADHI and BUST of Acharya J.C. Bose at both the campuses of the Institute. Prof. Sibaji Raha, Director, Bose Institute, delivered welcome address and presented Institute Report.

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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 with Prof. P. Chakrabarti as its secretary and eleven other 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. R.N. Chakravarti
2. Prof. Debi Chakravarti
3. Prof. S.N. Chatterjee
4. Shri Somnath Sanyal
5. Prof. D. Banerjee
6. Dr. Anutosh Chatterjee
7. Dr. Manish Chakraborty
8. Mr. D. Mandal
9. Shri Dilip Bhattacharyya
10. Prof. Parul Chakrabarti - Secretary
11. Director, Bose Institute
12. Shri Debabrata Bose

Members of the Council

1. Dr. Manish Sekhar Chakraborty
2. Shri D.Mandal
3. Prof. R. N. Chakravarti
4. Prof. (Mrs.) Debi Chakravarti
5. Shri Somnath Sanyal
6. Prof. S.N. Chatterjee
7. Mr. Dilip Bhattacharyya

Nominees of the
Governing Body

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

(iii)

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 Two Scientists from outside
18. Prof. Alope Bhattacharyya West Bengal, nominated by
DST. Govt. of India.

Members of the Finance Committee

1. Principal Secretary, Higher Education Department, Govt. of W.B. – Chairman
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
Registrar, Bose Institute – Secretary.

(iv)

Biochemistry

The department was created in 1974. Since its inception, the research activities of the department have been directed primarily towards an understanding of the process of gene expression in plants and bacteria. In the late eighties, these studies were continued using the recombinant DNA technology, and several new research programmes were initiated, including plant and animal biotechnology, cell cycle regulation in budding yeast and *Entamoeba histolytica*, structure-activity relationships of gene regulatory proteins. In recent years the elucidation of protein structures using X-ray crystallography and NMR spectroscopic methods, studies aimed at understanding protein conformation, folding, protein-protein association, binding of drugs to target proteins and theoretical modeling of protein structures and docking have been undertaken.

The thermodynamics of podophyllotoxin-tubulin interaction (Prof. B. Bhattacharyya)

The Thermodynamics of podophyllotoxin binding to tubulin and its multiple points of attachment with tubulin has been studied using isothermal titration calorimetry. The calorimetric enthalpy of association of podophyllotoxin with tubulin is negative and occurs with negative heat capacity change. The binding is unique with simultaneous participation of both hydrophobic and hydrogen bonding forces with unfavorable negative entropic contribution at higher temperature, favored with enthalpy-entropy compensation. The podophyllotoxin-tubulin association depending on the temperature of the reaction has favorable entropic and enthalpic component, which resembles both B and C-ring properties of colchicine. Based on crystal structure of podophyllotoxin-tubulin complex, distance calculations have indicated possible interaction between threonine 179 of α -tubulin and the hydroxy group on D-ring of podophyllotoxin. In order to confirm the involvement of the oxalone moiety as well as the lactone ring of podophyllotoxin in tubulin binding, analogues of podophyllotoxin are synthesized with methoxy substitution at the 4' position of ring D along with its isomer and another analogue epimerized at ring E. From these results, involvement of oxalone as well as lactone ring of the drug in a specific orientation inclusive of ring A is indicated for podophyllotoxin-tubulin binding. Therefore, podophyllotoxin, like colchicine, behaves as a bifunctional ligand having properties of both B and C ring of colchicine by making more than one point of attachment with the protein tubulin.

Chromosome replication and segregation in yeast (Prof. Pratima Sinha)

Work on the characterization of yeast (*S. cerevisiae*) *mcm* mutants, which cause loss in the fidelity of chromosome transmission, was continued. Several kinetochore proteins (Mcm16, Chl4/Mcm17, Iml3/Mcm19) were found to stabilize interactions between kinetochore proteins belonging to other subcomplexes or interactions between different subcomplexes. In another

work, deletion of the histone deacetylase coding gene, *SIR2*, was found to suppress the *tub1-1* mutation in alpha tubulin gene. The acetylation status of the alpha tubulin gene, however, remained unaltered. The absence of Sir2p could be elevating the acetylation status of some other protein that could be instrumental in the suppression of microtubule defect. Attempts are on to identify this protein. In another work, the loss of interactions between the spindle pole body protein Bbp1p and a centromere protein Ctf19p leads to partial disruption of centromere clustering, a phenomenon displayed by inetrpase eukaryotic cells. The Chl1/Mcm12 protein has been further characterized as required for the repair of MMS-induced DNA damage.

Patterns in protein structure and conformation (Prof. P. Chakrabarti)

We are involved in characterizing the native folds and protein-protein interactions based on various structural parameters calculated using known structures in Protein Data Bank. It has been shown that the residue-based amino acid composition of proteins is inversely correlated with the residue-size, which is not the case if the composition is based on the number of atoms each residue contributes to the total count of protein atoms.

Cloning, expression, purification and structural studies on proteins from *Vibrio cholerae*. (Prof. P. Chakrabarti)

Vibrio cholerae is the causative agent of the diarrheal disease cholera, which is usually acquired by oral ingestion of the bacterium with contaminated water or food. The bacterium expresses virulence factors that allow it to colonize the human intestine and cause the disease. Regulation of virulence genes can involve the ToxR, Fur, or HlyU regulatory system. We have cloned, expressed, purified HlyU and carried out biophysical studies.

The cell cycle of *Entamoeba histolytica* (Anuradha Lohia)

We have demonstrated that *E.histolytica* cells may contain multiple nuclei with heterogenous genome contents. This suggests that regulatory mechanisms that ensure alternation of DNA synthesis and mitosis are absent in this organism. Our data shows that irregular endo-reduplication and genome partitioning lead to heterogeneity in the genome content of *E.histolytica* trophozoites. Using a functional genomics approach we have characterized the role of Eh CDKs –cyclins, kinesins Eh Klp2,3,4 and Eh formin homology proteins in regulating genome content and cell division in *E.histolytica*.

RecA-mediated cleavage of λ cI repressor (Dr. R. 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 against previous studies inferring repressor monomer as a preferred substrate. Whether prolyl *cis-trans* isomerization might be involved in the RecA-mediated cleavage of cI, was experimentally tested in two different ways: it is found that two known prolyl isomerases cannot cleave cI by themselves, but their inhibitors cyclosporin A and rapamycin do inhibit the RecA-mediated cleavage. Free histidine, and lysine to a smaller extent, are shown for the first time to cleave cI repressor in a

non-enzymatic fashion whereas other amino acids like arginine and glutamate do not. When histidine in activated RecA filament is covalently modified by using diethyl pyrocarbonate, RecA-mediated cleavage of cI is inhibited. When lysines in activated RecA filament are covalently modified using maleic anhydride, RecA mediated cleavage is inhibited to a smaller extent. It is argued that His163 in loop L1 of RecA is the crucial residue involved in cI repressor cleavage by combining with the catalytic Ser149 in cI. Model building was employed to study the location of His 163 in the RecA filament based on the crystal structures of RecA. It is suggested for the first time that subunits *n* and *n* + 5 in the filament contribute one loop each for holding the C-terminal domain of the repressor during the cleavage in agreement with previous scanning transmission electron microscopy results. The involvement of His 163 explains the experimental observation that the ADP-form of the filament is inactive and the ATP-form of the filament is active regarding repressor cleavage.

Studies on proteins involved in the ϕ lysis-lysogeny switch (Dr. P. Parrack)

The antiproteolytic activity of the ICIII protein was investigated by various biochemical methods including the study of protein-protein interactions involving pulldown assays and coimmunoprecipitation. A model describing the molecular mechanism for this process was proposed. A key feature of this model is direct interaction between ICIII and *Escherichia coli* HflB.

Bacteriophage proteins, *S. aureus* reporter tool, and viral genomics (Dr. S. Sau and Dr. T. C. Ghosh [Bioinformatics center])

Repressor protein of mycobacteriophage L1 was shown to possess two domains, namely, an N-terminal domain and a C-terminal domain. They are separated by a small hinge region. C-terminal domain, which is more compact than N-terminal domain, contains substantial amount of α -helix at 32°C but unfolds at 42°C like that of intact repressor protein. Both intact repressor and C-terminal domain form dimers in solution at hundred nanomolar concentrations.

Repressor protein of *S. aureus* phage Phi 11 was purified to homogeneity. It binds to two sites located at the *cI* – *cro* intergenic region and forms dimers in solution.

A mycobacteriophage L1-specific protein HLG1 was shown to affect the growth of both *M. smegmatis* and *E. coli* when overexpressed from the resident plasmids. Analysis showed that HLG1 is a delayed early protein and severely impairs the RNA, DNA, and protein synthesis of both species.

A reporter *S. aureus* strain SAU006 was constructed by inserting a heat-inducible promoter (P_g)-*lacZ* transcriptional fusion into the chromosome of *S. aureus* strain RN4220. Solid phase assay, developed with SAU006, shows that P_g is induced distinctly by different classes of antibiotics. Sublethal concentrations of different antibiotics even induced P_g efficiently in microtiter plate grown SAU006. Interestingly, P_g is also induced by arsenate salt and hydrogen peroxide. The data suggest that simple and sensitive assay systems, developed with SAU006, could be

utilized for screening and detecting not only the novel antistaphylococcal compounds but also different toxic chemicals.

To understand about the architecture, evolution, and therapeutic potentials of viruses, codon and amino acid usage biases in some viruses were analyzed by standard procedures.

Biophysics

The research focus in the Department of Biophysics is on Structural Biology. Projects in the area of Protein-nucleic acid interaction, bioinformatics, spectroscopy and protein engineering are in progress.

Electrostatic aspects of tRNA and DNA protein interactions (Dr. G. Basu)

Analysis of electrostatic components of binding free energy on a series of protein-DNA and protein-RNA complexes has shown that the salt-dependent and salt-independent components compensate each other. This led us to propose that in the absence of significant non-specific electrostatic energy DNA and DNA-binding proteins, operator-like sequences scattered around the genome may provide semi-specific binding sites and aid target search.

Analysis of electrostatic interactions in protein-protein complexes (G. Basu)

Electrostatic potentials and electric fields derived from it in the presence of solvent showed that protein protein hetero-dimeric complexes are optimized to orient their dipoles in an energetically favorable way. Calculations have been initiated for organization of domains and their overall electrostatic properties.

Deciphering interactions responsible for Pro-Pro cis peptide bonds in proteins (Dr. G. Basu)

Identification of sequence motifs that favor cis peptide bonds in proteins is important for understanding and designing proteins containing turns mediated by cis peptide conformations. From 1H-NMR solution studies on short peptides, we show that the Pro-Pro peptide bond in Pro-Pro-Phe almost equally populates the cis and trans isomers, with the cis isomer stabilized by a CH... δ interaction involving the terminal Pro and Phe. We also show that Phe is over-represented at sequence positions immediately following cis Pro-Pro motifs in known protein structures. Our results demonstrate that the Pro-Pro cis conformer in Pro-Pro-Phe sequence motifs is as important as the trans conformer, both in short peptides as well as in natively folded proteins.

Mechanism of substrate recognition by truncated glutamyl-tRNA synthetase (Dr. G. Basu)

The N-terminal domain of GluRS was cloned, overexpressed and purified. Using fluorescence as a tool the interaction of GluRS and its N-terminal domain with ATP, L-Glu, tRNA^{Glu} was studied. Aminoacylation studies were also initiated.

Botany

The scientists of this department are engaged in several different aspects of plant science. They are e.g., transcript profiling of male and female floral buds of pointed gourd (unisexual flower), plant DNA fingerprinting, diagnostics of medicinal potential and effect of UV on growth and quality of rice and tea, resource survey analysis of wild gene pool with reference to seeds, cloning of the trans-acting factor that binds to ABA responsive MotifII cis-acting element, fruit ripening and lycopene biosynthesis in Tomato, Banana and other different fruits, application of biotechnology in medicinal plant species, studies on airborne allergenic pollen grains and spores, improvement of aromatic rice suitable for West Bengal and profiling of Resistant gene analogue in rice, functional genomic approaches to understand the mechanism of resistant against *Alternaria brassicola* and a survey of genetic resource in wild and cultivated variety of tomato resistant against *Fusarium oxysporum*. Many papers have been published in many different national and international journals.

Transcript profiling of male and female floral buds of pointed gourd (*Trichosanthes dioica* Roxb.), a cucurbit (Prof. K K Mukherjee)

Transcript profiling of unopened male and female floral buds of Pointed gourd (*Trichosanthes dioica* Roxb.), a dioecious cucurbit, at uniform developmental stage was done through cDNA-AFLP to look for the differentially expressed unique and/or up regulated gene fragments associated with sex expression. Thirty one such fragments, twenty three of which from male and eight from female, were selected, cloned, sequenced and assigned putative protein functions after database searching and obtaining GenBank accessions. Of these thirty one, the annotation of one male-derived clone (TDM16) as polygalacturonase with remarkably high level of homology as revealed from database searching is a promising finding since this protein has direct involvement with pollen development, germination, and tube growth with particular function in de polymerization of pectin.

Plant DNA fingerprinting for establishing sovereignty rights, Diagnostics of Medicinal Potential in plants and Effect of UV on growth and quality of commercially important crops viz. tea and rice (Swati Sen-Mandi)

We have completed AFLP fingerprinting of 1600 Indian tea clones with 2 selective primers (allotted to BI) under a DBT sponsored National Network Programme with IHBT, TERI, TRA, UPASI. Undertaken genome analysis studies on some elite clones of Curcumin growing in Manipur for identifying a DNA fragment associated with high antioxidant potential in some of these plants. Demonstrated enhanced production of some flavour related compounds of the flavonoid group under influence of UV radiation in field grown tea plants at Gopali Tea Garden, IIT Kharagpur.

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

In order to conserve and enhance germinability and potential status, it was possible to improve storability, germinability of plants of economic importance by the application of plant extracts. Scanning electron microscope aided micromolecular as well as macromolecular phenotypic characterizations have been done for Sesame and safed musli. The jute accessions and their wild relatives from CRIZAF are characterised using isozymic and PCR-based fingerprinting techniques (in collaboration with Prof. K.K. Mukherjee and Dr. Debabrata Basu).

The ddNTP sensitive DNA Polymerase from plant system, Cloning of Motif II binding protein from Rice, Lycopene biosynthesis during ripening in different Fruits and Molecular analysis of Fruit Ripening in Banana and Tomato (Dibyendu Narayan Sengupta)

The ddNTP sensitive DNA polymerase enzyme (62KD) was purified from developing seeds of Mung bean (*Vigna radiata* L.) and the proliferating cell Nuclear Antigen (PCNA) was purified from the over-expressed *E. coli* extract. When both of the them mixed the processivity of the DNA polymerase was found to be enhanced.

The cis-acting element (promoter), Motif II a when used as probe to screen an expression cDNA library from salt treated Nonabokra seed lings, the CEBP10 cDNA was cloned. Sequencing showed homology with a rice protein and experiments are going on to characterize the protein. Since the cDNA is incomplete full length cDNA will be isolated from rice and PCR primers have been made.

Light induces the mRNA synthesis of sucrose phosphate synthase (SPS) and inhibits the mRNA synthesis of α -1,3 glucanase. The cis-acting elements responsive to light (GATA box), auxin (ARE), and ethylene (ERE) has been identified from the upstream of (SPS) by gel mobility shift assay and the mol. wt. of the protein that binds were identified by Southwestern blot analysis. The light inducible mRNA synthesis of SPS gene was also detected. The cis-acting element which could be the site of interaction of Le-MADS-Rin factor is not known and therefore was searched by monitoring the binding of the protein factor to the upstream DNA. It was observed that Le-MADS-Rin protein binds with a cis-acting element present on the upstream of Expansin gene but not to Polygalactouronase gene which are also expressed in tomato fruits during ripening. To study the expression of the genes involved in the lycopene and carotene biosynthesis in different fruits during their ripening northern blot analysis was done by isolating total RNA from the fruits like tomato, papaya, capsicum, watermelon, pinkgrape fruit. Results showed maximum expression in ripe watermelon and very low in pink grape fruit.

Application of biotechnology in medicinal plant studies (Dr. Sabita Bhattacharya)

Transformed nature of the hairy roots from *Plumbago indica* was confirmed by the presence of rol B gene (from the Ti DNA) in its nuclear DNA following PCR analysis. Plumbagin was produced maximum in hairy root clones, grown in light and capable of direct regeneration of

P. indica. As a first attempt in cryopreserving *Rauvolfia serpentina* germplasm, regrowth and regeneration was possible from cryogenically treated explants of the plant. The pathogenic fungus, causing wilt disease of *Coleus forskohli* was characterized macro and microscopically. An initial in vitro screening of plants was made for increased disease tolerance using elicitors in cultures that resulted in changes in the level of some defense-related compounds in the plants.

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

A pollen calendar of southern Calcutta for the season 2004-2006 has been prepared. Clinical and biochemical studies have revealed the allergic potential of the avenue trees *Delonix* sp., *Peltophorum* sp., *Cassia* sp. and *Acacia* sp. IgE specific immunoblotting (*Delonix* sp.) with individual patient sera revealed several reactivity profiles. The allergenic bands are of 43 and 32 kDa. Total airborne fungal spore types and culturable molds in the air of an agricultural field (Madhyamgram Experimental farm) have been monitored throughout the year. A fungal spore calendar has been prepared. A high concentration of *Cladosporium* sp., Ascospores, Basidiospores and Aspergilli/Penicilli group and *Alternaria alternata* were among the prevalent culturable molds recorded. Protein profile by SDS-PAGE and IgE specific Immunoblotting of some these molds showed allergenic band(s). Studies on the polymorphism in FcεR1b receptor (high affinity receptor for IgE) gene, a candidate gene for asthma susceptibility are going on by PCR-restricted endonuclease fragment length polymorphism using the DNA samples collected from asthmatic population.

Improvement of aromatic rice: Resistance gene analogue (RGA) profiling of rice landraces of West Bengal and Nutritional Quality Characterization and DNA-Fingerprinting based Genetic Diversity Analysis of Aromatic Rice Landraces of West Bengal. (Dr. Tapas Kumar Ghose)

A set of rice landraces of West Bengal have been selected and a set of degenerate RGA primer pairs from Nb-ARC domains of known plant disease resistance genes designed. Preliminary profiling has been started.

Dr. Mrityunjay Ghosh, Senior lecturer, BCKV, spent four months on an INSA Visiting Scientist's Fellowship in our laboratory. In this project, 30 rice landraces, including 21 aromatic rice lines from our state, were characterized for quality and nutritional traits. DNA-fingerprinting of these 30 rice genotypes was carried out using 17 SSR markers.

Functional genomic approach towards understanding of resistance mechanism against pathogen *Alternaria brassicicola* and A survey of genetic resource and biochemical parameters among the cultivated and wild tomato lines involved with resistance against *Fusarium oxysporum* f. sp. *lycopersici*. (Debabrata Basu)

To understand the resistance mechanism, functional genomics approach was used to identify the differentially expressed genes from non-host resistant plant *Sinapis alba* on infection with *A. brassicicola*. Comparative reverse northern blot analysis with ~194 cDNA fragments showed

that 123 fragments were over-expressed preferentially in *S. alba* compared to *Brassica juncea*. Expressions of few of these genes were further confirmed by semi-quantitative RT PCR as well as by Northern blot analysis and genes were characterized.

Resistant gene analogue Polymorphism: Resistant gene analogue (RGA) profiles of number of cultivated tomato varieties of India, wild types and *F. oxysporum* f. sp. *lycopersici* resistant tomato lines have been compared. Furthermore, investigation of the diversity of the I2 class of genes, responsible for resistance to *F. oxysporum* f. sp. *lycopersici*, has been carried out. These results are of importance for identification of tomato genotypes resistant to *F. oxysporum* f. sp. *lycopersici*, in subsequent breeding programs.

Monitoring of calcium influx on elicitation: Calcium uptake as well as generation of reactive oxygen intermediate (ROI) were monitored in the resistant tomato cell suspension culture upon elicitation by *F. oxysporum* f. sp. *lycopersici* elicitor in presence of different inhibitors. The result shows that these are one of the early signal transduction events that have been instrumental for defense response.

Chemistry

Department of Chemistry is engaged in research in multidisciplinary areas covering biophysical chemistry, chemical physics, natural products, synthetic organic chemistry, lipids, enzymes, diseases and drug targeting. In keeping with the pace of modern developments, department is venturing into newer areas of research. At present both basic and applied aspects of various systems are being studied. Currently, mechanism of drug resistance in *Vibrio cholerae* and mycobacteria, modulation of host cell signaling by bacterial pathogens, antioxidative and protective role of active ingredients from Indian medicinal plants, electro-optical and theoretical studies of ferroelectric smectic liquid crystals, mechanism of chaperone function of α -crystallin, synthesis and reactions of heterocycles, regulation of ion-transport enzyme and mechanism of immunosuppression in *Visceral leishmaniasis* are being studied.

Regulation of Mg^{2+} -independent Ca^{2+} -ATPase by a low molecular mass protein purified from bovine brain (Prof. Parimal C. Sen)

The goat sperm microsomal membranes have been found to contain an Mg^{2+} -independent Ca^{2+} -ATPase, a low affinity but highly active enzyme sharing similarities with the SERCA family of ATPases. The present study reports the identification and characterization of a 14 kilodalton cytosolic protein from bovine brain which can act as an endogenous stimulator of the enzyme with an S_{50} (concentration producing 50% stimulation) of 0.8 μ M. Kinetic analysis suggests that the stimulation is noncompetitive with respect to the substrate, and the binding site(s) of the stimulator and substrate are distinct. Binding of the stimulator to the enzyme is reversible. The stimulator

increases the affinity of the enzyme for calcium as evident from a decrease in $K_{0.5}$ of the enzyme for calcium in presence of the stimulator. Radioactive labeling of the enzyme with [α - ^{32}P]-ATP suggests that the stimulator enhances the rate of dephosphorylation of the phosphoenzyme intermediate without altering the phosphorylation reaction step. The stimulatory effect of the protein has been observed only for the Mg^{2+} -independent form of the enzyme, the Mg^{2+} -dependent form being unaffected.

Lymph node cells from BALB/c mice with chronic *Visceral leishmaniasis* exhibiting cellular anergy and apoptosis: Involvement of Ser/Thr phosphatase (Prof. Parimal C. Sen in collaboration with Prof. A.C.Ghose, NICED, Kolkata)

Visceral leishmaniasis (VL) produced in BALB/c mice through intracardial administration of *Leishmania donovani* amastigotes was accompanied by hepato-splenomegaly with high organ parasite load and lymphadenopathy when followed up to four months or so. To elucidate the mechanism of immunosuppression associated with VL, we have reported the progressive impairment of the proliferative response of lymph node cells (lymphocytes) from infected animals (I-LNC) to *in vitro* stimulation with the combination of phorbol 12-myristate 13-acetate (PMA) and ionomycin (Io) that could be related to down regulation of PKC and MAP kinase (ERK $\frac{1}{2}$) activation process.

Further, pretreatment of I-LNC with the protein phosphatase inhibitor okadaic acid (OA), but not with calyculin A or sodium orthovanadate; significantly restored their proliferative response as well as PMA-induced activation of PKC. A population of LNC (primarily T-lymphocytes) from chronically infected animals was shown to undergo apoptosis, the number of which increased considerably following PMA+ Io stimulation. The apoptotic pathway, which was followed through binding to cells to Annexin V, activation of caspase 3 and fragmentation of DNA, involved destabilization of mitochondria, probably as a result of down regulation of PKC and Bcl-2. Interestingly, prior incubation of I-LNC with OA overrode the state of cell cycle arrest (anergy) and apoptosis through progression of cells from G0/G1 to S and G2/M phases with transcriptional activation of IL-2 and IL-2R genes. Our results suggest that the cellular (immune) dysfunction in VL could be attributed to dephosphorylation of key molecules in the T-lymphocyte signaling pathway by Ser/Thr phosphatase leading to their inactivation.

Cloning and functional expression of an acyl-ACP thioesterase FatB type from *Diploknema (Mdhuca) butyracea* seeds in *Escherichia coli* (Prof. Parimal C. Sen in collaboration with Prof. S.K. Sen, IIT-BREF, IIT, Kharagpur)

A cDNA of fatty acyl-acyl carrier protein (ACP) thioesterase (Fat) from developing seed of *Madhuca butyracea* has been cloned. The deduced amino acid sequence of the cDNA corresponding to the mature polypeptide showed 30-40% and 60-75% identity to the reported FatA and FatB class of plant thioesterases, respectively. The gene, MbFatB, is present as a single copy in *M. butyracea* genomes and the MbFatB protein was detected clearly in seed tissues of this plant but not in that of Indian mustard (*Brassica juncea*).

Heterologous expression of the MbFatB gene driven by different promoters in *E. coli* wild type and fatty acid β -oxidation mutant (fadD88) strains resulted production of the recombinant protein with various fusion tags either as biologically inactive (insoluble) or functionally active forms. Expression of functionally active recombinant MbFatB in *E. coli* affected bacterial growth and cell morphology as well as changed the fatty acid profiles of the membrane lipid and the culture supernatant. Alteration of the fatty acid composition was directed predominantly towards palmitate and to lesser extent myristate and oleate due to acyl chain termination activity of plant thioesterase in bacteria. Thus, this new MbFatB gene isolated from non-traditional oil-seed tree can be used in future for transgenic development of oil-seed *Brassica*, a widely cultivated crop that expresses predominantly oleoyl-ACP thioesterase (FatA) in its tissue and has high amount of unwanted erucic acid in edible oil in order to alter the fatty acid profile in a desirable way.

Synthesis and reactions of condensed heterocycles (Prof. Manas Chakrabarty)

A new one-pot synthesis of substituted benzimidazoles with bioactive potential in veterinary medicine and human therapeutics has been developed from commercially available starting materials using *para*-toluenesulphonic acid-on-silica gel (TLC-grade) as a cheap and environmentally benign catalyst. Novel, regioselective synthetic routes have been developed to two different classes of tricyclic heterocycles, both of which contain a well documented pharmacophore. A new formation of highly functionalised 3,5-dicyano-2-piperidinones has been established, whose importance lies in their formation via an unconventional sequence of tandem reactions occurring in one pot. (Professor Y. Harigaya of Kitasato University, Tokyo, Japan is a collaborator.)

Mechanism of substrate recognition by α -crystallin (Prof. K.P. Das)

We have shown that α -crystallin has the ability to interact with the unstable conformer of a wide variety of substrates apart from its own. However it possesses exceptional ability to recognize its own substrates. We showed that its ability to differentiate between its natural and non-natural substrates was related to its ability to retain subunit exchange when bound to its substrates. Its natural substrates being mainly α -sheet protein produced less hindrance in subunit exchange compared to its non-natural substrate which greatly reduced subunit exchange rate.

Analysis of the role of N-terminal region of α -crystallin (Prof. K.P. Das)

Detailed analysis of the studies with N-terminal mutants revealed that oligomerization was more important for providing the structural stability and in-vivo survival of the α -crystallin than for its chaperone function.

Role of Zn^{+2} in α -crystallin structure and function (Prof. K. P. Das)

Zn^{+2} ions have been shown to regulate the exposure of hydrophobic sites on the α -crystallin surface thereby enhancing its chaperone function. It has been shown that Zn^{+2} cause conformational changes in α -crystallin enhancing its thermodynamic stability. Therefore, loss of Zn^{+2} may play a crucial role in the development of cataract.

Drug resistance mechanisms in *Vibrio cholerae* (Prof. Manikuntala Kundu)

Characterization of tetracycline-resistant strains of *V. cholerae* with reference to the role of efflux pumps in resistance

V. cholerae clinical isolates, with high-level resistance to tetracycline (Tet^r) were obtained from International Centre for Diarrheal Disease Research, Dhaka, Bangladesh. RT-PCR data showed significant increase in the transcription of the gene encoding Vc1131 encoding a putative tet pump. The increased expression correlated with the increased MICs values of these isolates. Attempts will be made to inactivate the gene encoded Vc1131 in order to understand its role in the development of tetracycline resistance.

Drug targets and drug resistance mechanisms in mycobacteria (Prof. Joyoti Basu and Prof. Manikuntala Kundu)

We have continued our exploration into understanding the functions of the ABC transporters of *Mycobacterium tuberculosis*, polyphosphate metabolism and regulation of cell wall biosynthesis and cell division in mycobacteria.

A. ABC Transporters in *Mycobacterium tuberculosis* (Prof. Joyoti Basu and Prof. Manikuntala Kundu, in collaboration with Prof. Parul Chakrabarti, and Prof. Brigitte Gicquel/Dr. Mary Jackson, Institut Pasteur, Paris)

The *drr* operon, is present on a 50 kb virulence fragment of the genome of *M. tuberculosis* which contains genes involved in phthiocerol dimycocerosate biosynthesis. We have, in collaboration with the Institut Pasteur, Paris, knocked out the gene of the *drrA* in *M. tuberculosis*. The knockout strain has been used as a tool for understanding DrrAB function by complementation with wild type and mutated copies of *drrAB* and analysis of DIM export. The *in vitro* reconstitution and doxorubicin efflux assays were also performed. These studies revealed the critical role of K⁴⁸M (Walker A), D¹⁶⁵ and E¹⁶⁶ (Walker B) in the function of DrrA. The S142A complemented strain did not appear to show any defect in DIM export, whereas the G144D and D172G complemented strains appeared to be partially attenuated in terms of DIM-exporting ability.

B. The serine/threonine kinase PknA of *Mycobacterium tuberculosis* phosphorylates the protein encoded by the open reading frame (ORF) Rv0019c, a penicillin-binding protein required for cell division (Prof. Joyoti Basu and Prof. Manikuntala Kundu)

A cluster of genes encoded by open reading frames Rv0014c to Rv0020c in *Mycobacterium tuberculosis* encodes candidate cell division proteins RodA and PBPA, a pair of serine/threonine kinases (STPKs), PknA and PknB, a phosphatase, PstP and two ORFs Rv0019c and Rv0020c. In our attempts to delineate the functions of the protein encoded by the ORF Rv0019c, we have identified it as a substrate of PknA. Deletion of its counterpart gene in *M. smegmatis* results in increased susceptibility of the bacterium to oxidative stress.

C. Polyphosphate kinase regulates *rel*-mediated stringency of mycobacteria through modulation of sigma factor E gene expression (Prof. Manikuntala Kundu and Prof. Joyoti Basu)

Long-term survival of *Mycobacterium tuberculosis* under nutritionally starved conditions poses a problem in the treatment of tuberculosis and underscores the need to understand the biology of the organism with reference to its ability to adapt to nutritional limitation. In continuation of our previous work, we have now identified the extracytoplasmic sigma factor E as a regulator of *rel*, which in turn regulates the stringent response regulator ppGpp. Polyphosphate kinase 1 (PPK1) exerts its effects on *rel* expression through regulation of *sigma E* expression under conditions of hypoxia or oxidative stress or surface stress induced by detergents.

Modulation of host cell signaling by bacterial pathogens

A. Early secreted antigen-6 (ESAT-6) of *M. tuberculosis* modulates interleukin-12 release from macrophages by suppression of NF-kappa B activation (Prof. Joyoti Basu and Prof. Manikuntala Kundu)

Early secreted antigen-6 (ESAT-6) has been identified as an effector which *Mycobacterium tuberculosis* uses to subvert the host innate immune response. Interleukin-12 (IL-12) production is critical for mounting an effective immune response by the host against *M. tuberculosis*. We demonstrate that ESAT-6 inhibits IL-12 p40 production mediated by agonists of Toll-like receptor signalling which signal through the adaptor protein MyD88.

B. *Helicobacter pylori* antigen, HP0175 regulates vascular endothelial growth factor (vegf) gene expression in gastric epithelial cells (Prof. Manikuntala Kundu and Prof. 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. Our study shows for the first time that a secreted peptidyl prolyl *cis*-, *trans*- isomerase (PPIase), HP0175 regulates (*veg*f) gene expression. This regulation involves signaling through both Toll-like receptor 4 and epidermal growth factor receptor (EGFR).

Studies on Hepatoprotective Active principles from Herbal Sources (Dr. Parames C. Sil)

Major research interest of our laboratory is to determine the cytoprotective, antioxidative, as well as hepato-nephro protective roles of the active principles of various medicinal plants using both *in vivo* and *in vitro* systems. Studies have been carried out against various potent environmental toxins and drugs at the cellular and molecular levels. Although all the protective active principles are not fully characterized yet, it appears that they behave similarly in most of their preventive and curative activities. Further studies are needed to determine the mechanism(s) of action of these active principles and currently are in progress.

Electro-optic, X-ray and Theoretical Studies of Cholesterol Ester Mesogens (Dr. Pradip Das)

Structurally similar esters such as cholesteryl oleate and oleyl carbonate have been investigated with mean-field statistical methods to assess the role of location and orientation of dipole with respect to molecular long axis in determining the thermal cholesteric range and thermodynamic stability. Electro-optic studies are being carried out to especially characterize ferroelectric smectic liquid crystal found in a eutectic mixture of the two esters to explore the suitability for technical applications. X-ray studies are essential to find smectic layer thickness and pre-transitional fluctuations.

Microbiology

The 'Department of Microbiology' which was the first department of its kind in India was established in 1942. Since its inception work was done on production of important metabolites of microbes including antibiotics, utilization of waste, control of pathogenic microorganisms and on biofertilizer production.

At present the research activities of this department address the problems in the areas of parasitic and bacterial infections of human, plant-microbe and mineral microbe interactions and degradation of environmental pollutants.

Chemokine mediated induction of Th2 to Th1 class switching in Leishmaniasis (Subrata Majumdar)

Our detailed studies in this work hypothesize a promising immuno-prophylactic effect of chemokines against leishmaniasis by induction of Th2 to Th1 class switching, imparting a long-term resistance.

Ara-LAM mediated restoration of cell-mediated immune responses against Mycobacterial pathogenesis (Subrata Majumdar)

Our findings strongly suggest that Ara-LAM had the potency to restore the impaired cell mediated immune responses in C57BL/6 mice infected with *Mycobacterium tuberculosis* H37Rv, and hence could be utilized as an effective immuno-prophylactic tool in the control of Tuberculosis.

DNA protein interactions at the mycobacterial plasmid pAL5000 origin (Sujoy Kr. Das Gupta)

Previous studies have shown that the Replication protein RepB of pAL5000 binds at the plasmid origin of replication and that the efficiency of binding is strongly influenced by the bacterial Histone like protein HU. In the present study the DNA trajectory of the pAL5000 origin (200 bp) in the RepB bound state has been investigated. RepB is known to bind to the origin at two sites, a Low affinity (L) and a high affinity (H), separated by about four turns of the DNA helix. Using Permutation, Ring closure and Phasing experiments, it has been shown that binding of RepB to the 200 bp origin results in DNA bending, loop formation and melting of the origin. The mechanism by which RepB induces such conformational changes in the DNA is being

investigated.

Molecular genetics of Sulfur utilizing bacteria (Sujoy Kr. Das Gupta) Pseudaminobacter salicylatoxidans KCT001 is a sulfur utilizing bacteria which grows in the presence of Thiosulphate and can use it as the sole energy source. The oxidation of Thiosulphate to Sulphate, which takes place in a stepwise manner, is mediated by a multi-enzyme complex encoded by the sox operon (soxSRT-soxVWXYZABCD). In this operon soxR putatively codes for a transcriptional regulator. The regulatory role of SoxR has been investigated. soxR mutants were found to be constitutively active confirming the repressor function of soxR. In vitro DNA binding studies were then performed. SoxR was found to bind to two operator sequences in a highly cooperative. The cooperative interactions involved protein-protein interactions between operator bound monomers.

In another study the oxidation of reduced Sulfur through the Tertrathionate intermediate pathway has been investigated using the β -proteobacterium *Tetrathibacter kashmirensis* which was isolated earlier in this laboratory from Apple garden soils of Kashmir. Unlike in the previous case where reduced sulfur is oxidized directly to sulfate by a multi enzyme complex, here conversion takes place in discrete steps possibly involving independently acting enzymes. This system is particularly suitable for understanding the biochemical and molecular events that take place during sulphur oxidation. Investigation into the Tertrathionate pathway revealed that Sulphite which is the penultimate product of oxidation has a feedback inhibitory effect on the oxidative process.

Interestingly this organism was found to harbor a 50 kb plasmid. About 30 Kb of this plasmid has been sequenced at the Institutional genomics facility. Although no proof regarding the involvement of this plasmid in Thiosulphate oxidation has yet been obtained, it is being studied in details, as its origin may be used to construct novel shuttle vectors for investigating the molecular biology of Sulfur Chemolithotrophy.

A novel phenanthrene biodegradation pathway (Dr. Tapan K. Dutta)

Staphylococcus sp. strain PN/Y, capable of utilizing phenanthrene as a sole source of carbon and energy, was isolated from petroleum-contaminated soil. In the degradation of phenanthrene by the strain PN/Y, various metabolites, isolated and identified by a combination of chromatographic and spectrometric analyses revealed a novel phenanthrene assimilation pathway involving 2-hydroxy-1-naphthoic acid. Metabolism of phenanthrene was initiated by the dioxygenation on the 1,2-position of phenanthrene followed by *meta*-cleavage of phenanthrene-1,2-diol leading to 2-hydroxy-1-naphthoic acid, which was then processed via a novel *meta*-cleavage pathway, leading to the formation of *trans*-2,3-dioxo-5-(2 ϕ -hydroxyphenyl)-pent-4-enoic acid and subsequently to salicylic acid. In the lower pathway, salicylic acid was transformed to catechol, which was then metabolized by catechol-2,3-dioxygenase to 2-hydroxymuconaldehyde acid, ultimately forming TCA cycle intermediates. The catabolic genes involved in phenanthrene degradation were found to be plasmid-encoded. This is a detailed study of PAH metabolism by a Gram-positive species involving a unique ring-cleavage dioxygenase in a novel phenanthrene degradation pathway suggesting a new insight into the microbial degradation of PAHs.

Physics

The Department of Physics is one of the oldest Departments in Bose Institute and has contributed 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; Interdisciplinary Physics; 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.

Interdisciplinary Physics (Prof. Indrani Bose)

The p53 protein is well-known for its tumor suppressor function. The p53-MDM2 negative feedback loop constitutes the core module of a network of regulatory interactions activated under cellular stress. In normal cells, the level of p53 proteins is kept low by MDM2, i.e., MDM2 negatively regulates the activity of p53. In the case of DNA damage, the p53-mediated pathways are activated leading to cell cycle arrest and repair of the DNA. If repair is not possible due to excessive damage, the p53-mediated apoptotic pathway is activated bringing about cell death. A class of small molecules, nutlins, is known to inhibit the p53-MDM2 interaction. Nutlin has been used as an anticancer drug since it facilitates the activation of the p53-mediated pathways in human cancer cell lines. Recent experiments on different cancer cell lines (the p53 genes are not mutated in these cell lines) show that treatment with nutlin molecules leads to apoptosis in only those cell lines in which MDM2 is overexpressed though the cell cycle is arrested in all the cell lines. We have developed a mathematical model to explore the considerable difference in the apoptotic response of cancer cell lines. We make a number of key predictions which could be tested in experiments.

A single gene regulating its own expression via a positive feedback loop, constitutes a common motif in gene regulatory networks and signaling cascades. Recent experiments on the development of competence in the bacterial population *B. subtilis* show that the autoregulatory genetic module by itself can give rise to two types of cellular states. The states correspond to the low and high (competence state) expression states of the master regulator ComK. The high expression state is attained when the ComK protein level exceeds a threshold value leading to a full activation of the autostimulatory loop. Stochasticity in gene expression drives the transitions between the two stable states. We have developed a mathematical model to explain the appearance of bimodal protein distributions in *B. subtilis* cell population in the framework of three possible scenarios. Again some of the predictions are experimentally testable.

Quantum Entanglement (Prof. Indrani Bose)

We have studied the entanglement properties of a spin-1 model, the exact ground state of which is given by the matrix product (MP) state. The model exhibits a critical point transition at a parameter value $a \rightarrow 0$. We use three different entanglement measures: the one-site von Neumann

entropy, the two-body entanglement and the generalized global entanglement to determine the entanglement content of the MP ground state as the parameter a is varied. The entanglement length, associated with the two-body entanglement, is found to diverge in the vicinity of the quantum critical point $a = 0$. The behaviour of the first derivatives of the different entanglement measures close to the quantum critical point has been determined. The derivatives either diverge or attain a maximum value at $a = 0$. At the critical point itself all three entanglement measures become zero. Our study identifies some novel features of quantum phase transitions in MP-type ground states.

Foundations of Quantum Mechanics and Quantum Entanglement (Prof. D. Home)

1. The time-of-flight distribution for a cloud of cold atoms falling freely under gravity is considered. The probability current density approach is used to calculate the quantum arrival time distribution for the mixed state describing the Maxwell-Boltzmann distribution of velocities for the falling atoms. An empirically testable difference is predicted between the time-of-flight distribution calculated using the quantum probability current and that obtained from a purely classical treatment which is usually employed in analyzing time-of-flight measurements. The classical time-of-flight distribution matches with the quantum distribution in the large mass and high temperature limits. Such an analysis has wide appeal in atomic physics.
2. The quantum analogue of Galileo's leaning tower experiment is revisited using wave packets evolving under the gravitational potential. The position detection probabilities are calculated for particles projected upwards against gravity around the classical turning point and also around the point of initial projection, both of which exhibit mass dependence. The computed mean arrival time of freely falling particles using the quantum probability current also turns out to be mass dependent exhibiting quantum violation of the weak equivalence principle. The mass dependence of both the position detection probabilities and the mean arrival time vanish in the limit of large mass. Thus compatibility between the weak equivalence principle and quantum mechanics is recovered in the macroscopic limit of the latter. This type of hitherto unexplored study has a variety of foundational implications.
3. The phenomenon of quantum superarrivals is manifested in the testable probabilities for Schrödinger wave packets scattered from perturbed potential barriers. It is argued that both classical wave-like and classical particle-like properties can be exhibited in the same experimental setup while demonstrating superarrivals through the Schrödinger dynamics. An interesting question regarding the tenet of mutual exclusiveness of wave and particle-like attributes, à la Bohr, is raised in the context of this phenomenon.
4. A curious non-uniqueness inherent in the standard quantum mechanical calculation of transit time distribution is investigated by considering the example of a Gaussian wave packet propagating through a spin-rotator (SR) containing constant magnetic field confined within a region for which the transit time distribution can be measured in terms of the spin distribution of spin-1/2 neutral particles emerging from the SR. The predictions obtained for this example using the

probability current density approach are compared with that calculated based on the Bohmian model of quantum mechanics, the latter providing a unique procedure for calculating the transit time distribution. Thus this example can provide a critical test of the Bohmian model description of quantum phenomena in terms of the axiomatically formulated particle trajectories which cannot be directly measured.

Using superheated drop detectors to study the physics of superheated liquids Studying the physics of superheated liquids using superheated drop detectors (Prof. Barun K. Chatterjee and Prof. Suprakash C. Roy)

A two-state model, developed by us, to understand the nucleation of superheated drop detectors, is being tested using R12 as the superheated liquid. R12 droplets nucleate when exposed to energetic neutrons and the acoustic emission associated with the sudden phase transition is detected and counted in an MCS and is modeled using the two-state model. Using this model the spontaneous nucleation frequency as well as the neutron-induced nucleation frequency of the normal metastable state and the second metastable state is obtained as a function of the ambient temperature. The transition rates between the two states are also studied as a function of temperature. The Arrhenius-type plot of the two rates has a negative slope. This indicates that the formation of the second metastable state is exoergic. This finding also reaffirms the existence of the second metastable state of R12.

Nucleation of superheated R12 droplets by energetic electrons has been studied at an electron linac. A volumetric system to study the nucleation and record them directly on the computer is being fabricated. The droplet size distribution of R134A in the superheated drop detector was measured and was checked for gamma detection sensitivity. The nucleation frequency of the R134A by neutrons was studied room temperature.

Investigations on theoretical aspects of Compton scattering (Prof. Barun K. Chatterjee and Prof. Suprakash C. Roy)

The Coulombic A^2 approximation to the double differential Compton cross section was studied in comparison to the Impulse Approximation (IA) for K-shell of isolated atoms. The two methods were compared to S-Matrix results.

Studies indicate that the asymmetry of the Compton Profile (CP) can be explained on the basis of the shift in the initial electron momentum (p_z) called the Profile Defect (PD). The PD is defined as the shift of the peak of the CP with respect to the peak for IA. The CP for A^2 approximation and S-Matrix can both be described in terms of the PD and a scaling at nonrelativistic energies. This description is observed to fail at relativistic energies where the CP is intrinsically asymmetric.

Study of Cosmic Rays with passive detectors (Dr. S K Saha and Prof. S Raha)

We had found an unusual event of a cluster of six identical nuclear tracks in an area of size 67.5x67.5 mm in the PET detector exposed at Darjeeling. There are indications that this could be due to multifragmentation of some kind of encounter involving a $^{56}\text{Fe}_{26}$ ion in the cosmic ray

and a $^{238}\text{U}_{92}$ ion floating in the air, which may be the first observation of multifragmentation involving cosmic rays.

Study of Cosmic Ray showers and g-rays with active detectors (Dr. S K Saha and Prof. S Raha)

We are setting up an array of six active detectors consisting of plastic scintillator and photomultiplier tubes at Darjeeling in collaboration with TIFR, Mumbai for Cosmic Ray air shower studies. The objective for this study is to find the nature of cosmic ray primaries i.e., the composition and energy spectrum of the particles coming from outer space in the PeV (10^{15} eV) energy range, to shed light on the origin of this very-high energy cosmic radiation and to search for point sources of UHE g-rays $> 10^{14}$ eV from periodic sources during g-ray bursts.

Dielectric relaxation in complex perovskite oxides (Dr. T. P. Sinha)

Frequency dependent dielectric constant and the loss tangent of synthesized complex perovskite oxides having chemical formula $\text{A}(\text{B}^{1+}\text{B}^{2+})\text{O}_3$ are obtained at various temperatures. An analysis of the real and imaginary parts of impedance is performed, assuming a distribution of relaxation times as confirmed by Cole-Cole plot as well as the scaling behaviour of the imaginary part of impedance spectra. The scaling behaviour of imaginary electric modulus suggests that the relaxation describes the same mechanism at various temperatures.

Physics & Astrophysics of strongly interacting matter (Dr. Sanjay K. Ghosh)

The effect of gravitation on the emitted neutrinos during the quark-hadron phase transition inside a rotating compact star has been studied. It has been shown that, the gravitation along with the rotation increases the energy deposition of the neutrinos to the electron-positron pairs. We have also investigated the phase transition inside a neutron star in terms of propagation of shock front and the stability conditions.

Signatures of phase transition - Susceptibilities and speed of sound (Dr. Sanjay K. Ghosh)

The relation of theoretical susceptibility and the fluctuation in different observables in the heavy ion collision experiment is being investigated.

Animal Physiology

Animal Physiology was established as a separate entity as early as 1930 by the eminent naturalist Sri Gopal Chandra Bhattacharya. Sri Gopal Chandra was actively engaged in the study of natural behavior of some insects and fish, the research findings of which were published in Royal Society Journal and Journal of Natural History. Thereafter, during 1970s research in Animal Physiology were conducted in various fundamental and applied fields in piscine Physiology, Amphibian Physiology, Gerontology, Insect Physiology, etc. From 1990 onwards the research programs

were further modified and focused in applied and medical oriented themes with fundamental touch. At present Animal Physiology Section is mainly engaged in applied research in the fields of (a) animal biotechnology (aquaculture and sericulture) and (b) medical biotechnology (cancer chemoprevention and thyroid hormone-brain relationship) as well as in basic research in the fields of cell cycle regulation and immunology using various phytochemicals.

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

In recent years, various vertebrate peptide and steroid hormones have been identified in invertebrates, Estradiol-17b (E_2) being a major one. We have specifically shown NADP-malate dehydrogenase (NADP-MDH) activity in female fifth instar larval fatbody of silkworm, *Bombyx mori* as an E_2 responsive parameter, where a change in activity was noted with different doses of exogenous estradiol treatment. Interestingly enough this estradiol-induced increase could be counteracted by simultaneous application of specific E_2 -inhibitor, ICI-182780. Further, a nice correlation was obtained between the E_2 titer, specific $^3\text{H}\text{E}_2$ binding and expression of NADP-MDH activity in fatbody during different days of normal fifth instar larval development. The nature of the binding sites was found to be quite similar to known steroid receptors present in vertebrate. Fat body is a very important metabolic organ in insects very similar to liver in vertebrates.

Concentrations of hepatic estradiol-17 β (E_2) receptors (ER) in cytosolic and nuclear fractions were evaluated in diploid and triploid female catfish *Heteropneustes fossilis* (Bloch) during four different reproductive periods (resting, preparatory, pre-spawning and spawning) of a complete reproductive cycle. Basal level of ER concentration was noted in the resting period of both diploid and triploid female fish. But, ER concentration was significantly lower in triploid than the diploid counterpart. An elevation of ER concentration was noted in the preparatory period with triploids showing lower level than that of the diploids. Highest level of ER concentration was observed in the pre-spawning period both in diploids and triploids.

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

During adult-onset peripheral hypothyroidism, the brain maintains normal level of thyroid hormone for some time through a mechanism of 'central homeostasis'. Although the onset, duration and termination of such homeostatic phenomenon have been recently evaluated in our laboratory in rat model, the mechanism behind such phenomenon remains unknown. During our investigation to understand the mechanism further, we injected the protein synthesis blockers, actinomycin-D and cycloheximide along with propylthiouracil (PTU) to adult male rats during the days of onset (Day '2') and termination (Day '20') of the homeostatic mechanism. We evaluated the synaptosomal T3 level, neuronal Na^+/K^+ -ATPase and AChE enzymes along with deiodinase II (DII) activities and cAMP levels in the cerebral cortex. The results indicated prevalence of unchanged or lower levels of synaptosomal T3 on the above-mentioned days. Such condition has been parallelly supported by reflections in cerebrocortical deiodinase II enzyme activity and cyclic

AMP levels. The activities of cerebrocortical synaptosomal Na⁺-K⁺-ATPase and AChE, which are the two important physiological parameters for neuronal function, have been found to be supportive of involvement of a neuronal protein-mediated factor in the "on" and "off" reactions in central homeostasis during peripheral hypothyroidism.

Our study indicated that the expression of 'central thyroid hormone homeostasis' could be a genomic nuclear mediated mechanism.

Induction of differentiation and apoptosis: a possible strategy in the treatment of adult acute myelogenous leukemia (Dr. Tanya Das)

It is known that in acute myeloid leukemia (AML), cell proliferation and differentiation is uncoupled, causing a maturation block with accumulation of immature myeloid cells. Induction of terminal differentiation in combination with the activation of apoptotic program in immature cells may thus be the potential therapeutic strategies for AML. Recently it has been acknowledged that various plant polyphenols play important role in cancer regression. However, there is no detail study on the effects of plant polyphenols on the differentiation and/or apoptosis of AML cells. In our recent study, theaflavins have been found to induce differentiation of undifferentiated myeloblasts, the cause of myeloid leukemia, at lower doses whereas apoptosis of the same cells at higher doses. Underlying mechanisms involved down-regulation of NFkB. A combinatorial application of these plant polyphenols with ATRA (all trans-retinoic acid) showed compounded effect on differentiation. These results raise the possibility of utilizing theaflavins in the management of such a deadly disease in future.

Targetted immunoregulation of host to ameliorate tumor-induced immunodepression (Dr. Tanya Das)

Amelioration of immunodepletion of cancer-bearer is another aspect of cancer management. We observed that tumor cells secrete PGE-2 in a COX-2-dependent manner that in turn induces T cell apoptosis by disrupting IL2-Rg-dependant Jak3/Stat5 signaling pathway and thereby down-regulating Bcl-2/Bax ratio and caspase activation. Theaflavins, on the other hand, protect these immune cells against tumor-induced apoptosis by preventing Cox-2-induced PGE-2 secretion from tumor cells and thus protecting T cell survival signaling.

Tumor-induced oxidative stress perturbs NFkB activity augmenting TNFa-mediated T cell death: Protection by curcumin (Dr. Gaurisankar Sa)

Cancer patients often exhibit loss of proper cell-mediated immunity and reduced effector T cell population in the circulation. Thymus is major site of T cell maturation and tumors induce thymic atrophy to evade cellular immune response. Here, we report severe thymic hypocellularity along with decreased thymic integrity in tumor-bearer. In an effort to delineate the mechanisms behind such thymic atrophy, we observed that tumor-induced oxidative stress played critical role, as it perturbed NFkB activity. Tumor-induced oxidative stress increased cytosolic IkBa retention and

inhibited NFkB nuclear translocation in thymic T cells. These NFkB-perturbed cells became vulnerable to tumor-secreted TNFa-mediated apoptosis through the activation of TRADD-associated FADD and caspase-8. Interestingly, TNFa-depleted tumor supernatants, either by antibody-neutralization or by TNFa-siRNA transfection of tumor cells, were unable to kill T cell effectively. When T cells were over-expressed with NFkB, the cells became resistant to tumor-induced apoptosis. In contrast, when degradation-defective IkBa (IkBa super-repressor) were introduced into T cells, the cells became more vulnerable indicating that inhibition of NFkB is the reason behind such tumor/TNFa-mediated apoptosis. Curcumin could prevent tumor-induced thymic atrophy by restoring the activity of NFkB. Further investigations suggest that neutralization of tumor-induced oxidative stress and restoration of NFkB activity along with the reeducation of the TNFa-signaling pathway can be the mechanism behind curcumin-mediated thymic protection. Thus, our results suggest that unlike many other anti-cancer agents, curcumin is not only devoid of immunosuppressive effects but also acts as immunorestorator in tumor-bearing host.

Astroparticle Physics & Space Science

The development of the Centre for Astroparticle Physics and Space Sciences: A national facility at Darjeeling is under progress. Some instruments have already been installed and some of the observations have already been presented at the conference and submitted for publication.

- The instruments such as surface Ozone analyzer, respirable dust, fine particles, PM2.5 and weather monitoring systems are creating valuable data.
- A report on the surface ozone behaviour at Darjeeling has been presented at an International conference at China.
- The observations of particulate mater concentration and the corresponding source strength calculation has ben submitted for publication.
- Bose Institute, as a nodal center for Eastern India has also participated in the ICARB (an integrated campaign for aerosols, gases, and radiation budget over India)
- The radiometric measurements are under progress. At present 20.6GHz & 31.65GHz frequencies have been chosen for the dual frequency radiometry as 20.6GHz is more sensitive to water vapour while 31.65GHz channel is sensitive to liquid water: determined from the water vapour weighting function behaviour using radiosonde data but due to presence of Ku band satellite channels revised frequencies are **23.8 & 31.4 GHz**
- Ku-band Satellite receiving system is operative. The data obtained are being analyzed along with the other weather data.
- Cosmic ray studies using passive detectors have been continuing at Darjeeling. Preparation for setting up the large area array at an altitude of 3.5 Km above msl is proceeding. A mini array of active detectors at Darjeeling is under construction.

- The outreach programme involving school childrens' of Darjeeling area is continuing. Several lectures by eminent scientists like late Dr. A.P.Mitra FRS and scientists from Bose Institutes have been arranged.
- The school children training programme for the schools of North eastern regions have been planned. In the first such programme, Arunachal and Nagaland have agreed to participate.

Immunotechnology Section

The section was created in 1992. Aim of this section is to develop modern technologies in the field of Immunology and Molecular Biology. How the basic research is useful for the betterment of mankind is the main goal of the research from this section. Research programs in the section have been initiated in the field of Medical Biotechnology and Marine Biotechnology.

Medical Biotechnology (Dr. Nripendranath Mandal)

The theme of research programs in this area was to develop a very sensitive method for quantification of very low levels of mRNA from various immunologically important genes during immune response for various diseases. We have constructed a plasmid which contains two fragments of synthetic DNA of 420bp each. We have confirmed by DNA sequencing and used for synthesis of standard RNA by in vitro transcription. This standard RNA also used for RT-PCR using both forward and reverse primers specific for all 18 different cytokines genes. So this will be very useful to quantify expressed mRNA of 18 different cytokines from human system based on competitive RT-PCR. This will also be very useful for diagnosis and prognosis of various diseases from few drops of blood samples and also be useful to develop a novel immunomodulator from both terrestrial and marine resources of herbal medicine.

Another goal of this research program is to develop economically favorable herbal medicine from natural resources without any side effect to treat nearly noncurable diseases such as viral, cancer and other autoimmune diseases. Currently we have developed some formulae of herbal medicines. These are all made from very useful herbal products either from terrestrial or marine resources. Earlier we reported some herbals selectively induced apoptosis in Ehrlich's Ascites Carcinoma (EAC) and are very good natural immunomodulators. Hence these would be very useful to treat cancer especially arsenic induced cancer, viral diseases, and various autoimmune diseases such as arthritis, psoriasis and diabetes. Recently, we found some of the medicinal plant products are highly antioxidants. We also observed that at least nine of these medicinal plant products are very good iron chelator. We are developing some herbal formulations for thalassemia patients and other related diseases where iron over load is the major concern.

Next theme of our research program is genetic and immuno-genetic studies of predispose coronary heart disease risk among Asian Indian population in eastern part of India. The

prevalence of coronary heart disease (CHD) is known to be high among people of Indian origin. In India also rates are rising and CHD has been predicted to rank first among the causes of death in Indian population by 2015. Genetic and immuno-genetic factors of CHD will be associated with the polymorphism of six genes namely *ApoA1*, *Apo B*, *Apo E*, interleukin 6 (IL-6), 10 (IL-10) and tumor necrosis factor alpha (TNF- α). Therefore, it seems reasonable to consider that genetic factors such as *ApoA1*, *Apo B* and *Apo E* gene polymorphism are important determinants of premature CHD in Indians. Beside that factors of CHD appear to be mediated by changes in plasma cytokines level namely Interleukin etc. We have found that of the conventional risk factors smoking, hypertension, higher concentration of TC, LDL-c, apoB and lower concentration of HDL-c, apoAI were associated with CHD. But in addition to these, ratios of apoB/apoAI, apoB/HDL-c, non HDL-c/HDL-c, TC/HDL-c, LDL-c/HDL-c, TG/HDL-c and LDL-c particle size are account for new risk markers of CHD. This finding suggests that these ratios and LDL-c particle size should be useful as biomarker for diagnosis of premature CHD in Asian Indian population in Eastern part of India.

Marine Biotechnology (Dr. Nripendranath Mandal)

Shrimp aquaculture is one have the most promising and job generating industries all over the world including India. Viral diseases are the major problems in this industry and continuing the loss of multimillion dollars each year. The theme of research programs in this area was to develop disease free shrimp aquaculture industry from structural and functional genomic studies of marine invertebrate, Giant Black Tiger shrimp (*Penaeus monodon*) and its viruses. For the first time we have developed a microsatellite DNA marker to identify disease resistant population of *Penaeus monodon*. We also found a very important DNA sequence of 57bp homology with WSSV genome that is responsible for disease susceptible in *P. monodon*. Another disease resistant DNA marker also has been developed from our laboratory using RAPD method earlier. After sequencing of this DNA marker we have designed new sets of primers and developed new conditions for PCR to identify disease resistant populations of *P. monodon*. Both DNA markers will be very useful to develop disease free shrimp aquaculture industry in our country. These will also be helpful to understand the molecular pathogenesis in *P. monodon*.

Plant Molecular & Cellular Genetics

Plant Tissue Culture Section was established in the year 1976 by late Dr. V. N. Gadgil and renamed as PMCG Section in the year 1989 with specific focus on researches on the plant genetic engineering towards improvement of plant productivity. In the last few years the major emphasis has been given, in addition to some basic research, to identify the basic genomic components coding for desirable phenotypes through genetical and molecular approaches. Conventional and transgenic approaches are being employed to introgress some of these genes in crop plants.

Genes for Inositol metabolism : Relation to abiotic stress (Prof. A. N. Lahiri Majumder)

The ORF sl1383 has been identified as coding for L-myo-inositol 1-phosphate phosphatase in *Synechocystis*. Analysis of the upstream sequences of *INO1* genes from *Oryza* and *Porteresia* identified a number of stress-regulatory elements. Evolutionary origin of the "salt-tolerance domain" of *PcINO1* has been delineated as resultant of a single nucleotide polymorphism. Introgression of *PcINO1* gene confers salt-tolerance to evolutionary diverse organisms while locale-specific expression leads to desiccation and oxidative stress-tolerance in addition to salt-tolerance to transgenic plants.

Selection of elite bamboo genotypes: A molecular marker based approach (Prof. Amita Pal)

Prevalent bamboo diseases in and around West-Bengal was documented and molecular marker associated with leaf-rust tolerant *Bambusa balcooa* was identified based on allelic polymorphism (EF455492). In woody bamboo, lack of regular sexual events limits the application of breeding based segregation to test the genetic linkage between a marker and the particular trait of interest; therefore allelic polymorphisms based selection has been adapted. A superior fiber yielding genotype of *B balcooa* was identified that has attributes required for quality pulp and paper production. The genotype specific molecular marker, 'Balco₁₁₂₈', was cloned and sequenced from two populations of *B. balcooa* (DQ9005800).

Development of insect resistant plants: A crop management strategy (Prof. Sampa Das)

Allium sativum leaf lectin (ASAL) expressing chickpea, mustard and rice T₁ / T₂ plants had been characterized using Southern, northern and western blot analyses. The single copy transgene bearing lines of each plant type had been selected. The segregation patterns of the transgene in the subsequent generations of each plant types were investigated. *In-planta* bioassay also established their efficacy to control respective insects. A number of receptor proteins of ASAL were purified from various insects affected by ASAL. One such receptor isolated from economically important insect, whitefly was identified to be a Ca dependent ATPase.

Development of aphid tolerant Brassica lines and hybrid mushroom strains (Dr. Samir R. Sikdar)

Segregating BC1S2 lines were raised through selfing of five independent BC1S1 lines (developed through protoplast fusion between *Rorippa indica* and *Brassica juncea*). Promising aphid tolerant and high yielding lines have been identified. Selected hybrid lines showed nutritionally improved fatty acid profiles with high oleic- and linoleic acid contents and low erucic acid content.

Fourteen out of twenty edible mushroom hybrid lines (*Pleurotus florida* + *Calocybe indica* var. APK2) raised through protoplast fusion, produced basidiocarps. Three hybrid lines showed a remarkable increase in the total linoleic acid content.

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ANIMAL PHYSIOLOGY

1. Sumedha Roy, Jhuma De, Samita Kundu, Angshuman Biswas, Mitali Pramanik, Arun K. Ray (2007): Estradiol-17beta: Tracing its metabolic significance in female fatbody of fifth instar larvae of silkworm, *Bombyx mori* L. (race: Nistari), *Life Sciences* (Elsevier, U.S.A.) **80**, 446-453.
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2. Sa G, Pal S and Choudhuri T. Curcumin: A journey from spice to cancer chemoprevention in *Emerging Pollutants: Impact on Agriculture, Environment and Health* (Ed. De A and Gupta S), Allied Publishers, India. Chapter 16. 164-179, 2006
3. Das T, Sa G and Siddiqi M. Potential targets of tea polyphenols in cancer prevention: significance in angiogenesis, metastasis and apoptosis as well as in protection of host defense system. In: *Protective effects of tea on human health* (Eds. J Weisberger, N K Jain and M Siddiqi) Cabi London, 76-90, 2006

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1. Ghosh Dastidar K, Maitra S, Goswami L, Roy D, Das K P, and Lahiri Majumder A. (2006) An insight into the molecular basis of salt-tolerance of L-myo-inositol 1-phosphate synthase (PcINO1) from *Porteresia coarctata* (Roxb.) Tateoka, a halophytic wild rice. *Plant Physiol.* **140**: 1279-1296.
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STUDENTS AWARDED WITH PH.D. DEGREE

Name of the student (University/year)	Department/Title of the thesis	Supervisor
Biochemistry Department		
Ranjit P. Bahadur (JU, 2006)	Structural studies on macromolecular interactions and protein folding	Prof. P. Chakrabarti
Botany Department		
Sudip Kumar Das (VU, 2006)	Percepts of successful seed storage by herbal methods with special reference to water uptake patterns and ultra-structures of testa.	Prof. P.K. Saha Prof. A. Bhattacharya
Kamala Neogie (JU, 2006)	Biochemical and Molecular Analysis of Mechanism of Polyamine Action in Rice Cultivars in Response to Salinity Stress	Prof. D.N. Sengupta
Saswati Laha (JU, 2006)	Genetic Engineering & Increase the level of Samdecarboxylase Enzyme in Transgenic Tobacco : Analysis of its effect in plant	Prof. D.N. Sengupta
Chemistry Department		
Madhumouli Chatterjee (J. U., 2006)	Characterization of a 70 KDa protein purified from goat testes cytosol having Na,K-ATPase inhibitory and arylsulphatase A activities	Prof. P.C. Sen
Piyali Mukherjee (C.U., 2006)	Immunobiological studies on Visceral Leishmaniasis in BALB/c mice intracardially infected with <i>Leishmania donovani</i> amastigotes	Prof. A.C. Ghose & Prof. P.C. Sen
Ashis Biswas (J.U., 2006)	Interactions, stability and substrate refolding ability of molecular chaperone α -crystallin	Prof. K.P. Das

Name of the student (University/year)	Department/Title of the thesis	Supervisor
Chemistry Department (contd.)		
Debabrata Mandal (J.U., 2006)	Insight into the mechanisms governing maintenance of structure and function of the human erythrocyte membrane	Prof. Joyoti Basu
Microbiology Department		
Suchandra Bhattacharyya C.U. (2006)	Regulation of cell signal transduction pathways for Cell survival or apoptosis by Tri and Pentavalent Arsenic	Dr. Subrata Majumder
Wriddhiman Ghosh J.U. (2006)	Phenetic, genetic and phylogenetic diversity of mesophilic, neutrophilic and facultatively sulfur chemolithotrophic bacteria isolated from some distinct terrestrial habitats with special reference to the rhizosphere.	Prof. P.K. Chakraborty
Mahashweta Mitra J.U. (2006)	Investigation into the developmental expression of genes during the intracellular growth of a mycobacteriophage, using proteome analysis tools.	Dr.S.K.Das Gupta
Abhik Saha J.U. (2007)	The 16-kda dormancy promoting alpha-crystallin like protein of Mycobacterium tuberculosis – its structure, mode of action and development of specific inhibitors	Dr.S.K.Das Gupta
Animal Physiology Section		
Angshuman Biswas (JU)	Subcellular responses of different organs of triploid female catfish, <i>Heteropneustes fossilis</i> (Bloch) in annual reproductive cycle	Prof Arun K. Ray
PMCG Section		
Aparajita Das-Chatterjee (J.U , 2006)	Salt stress responses in Plants: Molecular and transgenic approach	Prof. A.N.Lahiri Majumder

GRANTS-IN-AID SCHEMES

Investigator / Co-investigator	Title of the Schemes	Name of the Department
Schemes funded by CSIR		
Prof. B. Bhattacharyya	Unusual binding properties of colchicines-tubulin interactions.	Biochemistry
Dr. R. Chattopadhyaya	Autodigestion & proteolysis studies of the lambda cI repressor & investigation of its RecA-mediated cleavage (terminated on 31.07.2007).	Biochemistry
Prof. P. Chakrabarti Co-PI: Dr. G. Basu Biophys. Dept.	Theoretical and Crystallographic studies on protein-protein Interactions.	Biochemistry
Dr. Subrata Sau	Studies on the structure-function relationship of the Repressor of the temperate mycobacteriophage L1.	Biochemistry
Dr. Gautam Basu	Mechanism of substrate recognition by truncated glutamyl tRNA synthetase	Biophysics
Dr.S.K.DasGupta (2004-2007)	Investigation into the stimulatory effect of host factors on the origin binding activity of a mycobacterial plasmid replication protein.	Microbiology
Dr. Tapan K. Dutta (2004-2007)	Microbial management of environmental carcinogens: High molecular weight polycyclic aromatic hydrocarbons	Microbiology

Investigator / Co-investigator	Title of the Schemes	Name of the Department
Prof. K.P. Das	Role of N-terminal region of a-crystallin for its structure, stability and chaperone function - a biophysical and site directed truncated study (Started in November 2005)	Chemistry
Prof. 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)	Animal Physiology
Prof. Amita Pal	DNA fingerprinting for identification of bamboo species and genotypes for IPR protection and conservation.	PMCG
Dr. S. R. Sikdar	Screening of aphid tolerant <i>Brassica juncea</i> limited disomic chromosome addition lines from selfed backcross progenies of the "Rorippobrassica" somatic hybrid (<i>Rorippa indica</i> + <i>Brassica juncea</i>).	PMCG
Schemes funded by DBT		
Prof. Anuradha Lohia	Using bacterial toxins to arrest Proliferation and Differentiation of the human pathogen <i>Entamoeba histolytica</i> . DBT, Indo-German Collaborative Project, 2004-07 (terminated on 31.03.2007).	Biochemistry
Prof. Anuradha Lohia	Development of a product from <i>Oxalis corniculata</i> for <i>E. histolytica</i> .	Biochemistry
Dr. Subrata Sau	Molecular cloning & Characterization of the antibiotic Inducible cisacting gene regulatory elements of <i>Staphylococcus aureus</i> and development of biological Assay systems (terminated on 14.07.2006).	Biochemistry

Investigator / Co-investigator	Title of the Schemes	Name of the Department
Prof. P. Chakrabarti	Analysis of protein structures and soft-computing in Functional annotation, chemogenomics and docking.	Biochemistry
Dr. Subrata Sau	Molecular characterization of two putative host Lethal Genes of temperate mycobacteriophage L1 (started on 21.09.2006).	Biochemistry
Prof. KK.Mukherjee Prof. P.K.Saha Dr. D. Basu	Genotyping of cultivated jute and their wild relatives available at CRIJAF to cataloguing	Botany
Prof. S. Sen Mandi	Characterization and Improvement of Tea through Biotechnological Tools" (a National Network Programme) (Terminated on April, 2007)	Botany
Prof. D.N.Sengupta	Analysis of ABRE-based promoter and cloning of cDNA for ABRE binding Transcription Factor from Rice (Started from March' 2002)	Botany
Dr. D. Basu	Identification of the genes from <i>Sinapis alba</i> , involved with resistance against <i>Alternaria brassicicola</i> through proteomic approach" under the umbrella project Biotic stress in plants: A concerted approach based on functional genomic, proteomic and transgenic techniques" (Started on September 2006)	Botany
Prof. Parimal C.Sen in-collaboration with Dr. R.Bhadra (IICB)	Development of highly unsaturated marine lipids and ester and specific bioactive analogues for the treatment of some prevailing chronic disorder (Terminated on 30.06.2006)	Chemistry

Investigator / Co-investigator	Title of the Schemes	Name of the Department
Prof.. J. Basu (PI) Prof. M. Kundu & Prof. P. Chakrabarti	Role of lipoarabinomannan of <i>Mycobacterium tuberculosis</i> as a modulator of macrophage cell signaling(Terminated on 7.7.2006)	Chemistry
Prof. J. Basu (PI) Prof. M. Kundu	Mechanisms of modulation of host cell signaling by RD1-encoded proteins of <i>Mycobacteria</i> (16.11.2005-15.11.2008)	Chemistry
Prof. M. Kundu (PI)	Polyphosphate kinase polyphosphate metabolism and its implication in mycobacteria (15.3.2004-14.3.2008)	Chemistry
Prof.. J. Basu (PI) Prof.. K.P. Das Prof. I. Bose Prof. M.Kundu	Multi faceted approaches towards characterizing potential drug targets in the cell division and stress response pathways in <i>Mycobacterium tuberculosis</i> (27.10.2006-26.10.2009)	Chemistry
Dr.S.K.DasGupta (2005-2008)	Discovering mycobacterial drug targets through mycobacteriophage genomics	Microbiology
Dr. Subrata Majumdar (2006-2009)	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 Leishmaniasis as a model	Microbiology
Dr. Subrata Majumdar (2006-2009)	Effect of gene silencing on the modulation of cell Signaling mechanisms during the early phase of <i>Leishmania donovani</i> infection	Microbiology
Prof.A. N. Lahiri Majumder	Engineering inositol metabolic pathway for raising salt tolerant rice plants	PMCG
Prof. A. N. Lahiri Majumder	Identification and characterization of genes/proteins regulated in abiotic stress in <i>Porteresia</i> .	PMCG

Investigator / Co-investigator	Title of the Schemes	Name of the Department
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Prof. Amita Pal	Phylogeny of NBS-LRR protein motifs in the family Fabaceae, identification of new conserved motifs and their implications in Geminivirus resistance.	PMCG
Prof. 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
Prof. Amita Pal, P.I. Prof. K. P. Das (Co-P.I.) Prof. Sampa Das	Identification of effector gene/proteins implicated in resistance for yellow mosaic disease through genomic and proteomic approaches. (Programme Coordinator)	PMCG

Schemes funded by DST

Prof. Pratima Sinha	Cloning of yeast minichromosome maintenance genes MCM11, MCM12 and MCM13 and a Characterization of their roles in high fidelity chromosome transmission. (terminated on 31.10.2006).	Biochemistry
Prof. Anuradha Lohia PI / Coordinator	'Facility for genomics and proteomics at Bose Institute' IRHPA Scheme from DST, 2005-1010.	Biochemistry
Prof. P. Chakrabarti Co-PI: Dr. P. Parrack	Structural studies on Protein-DNA interaction (started on 02.05.2006).	Biochemistry
Prof. Anuradha Lohia	A genomic and proteomic analysis of nuclear matrix components to identify their role in regulation of gene expression in the human Pathogen <i>Entamoeba histolytica</i> under India-Israel S & T Cooperation Programme (started on 03.05.2006)	Biochemistry

Investigator / Co-investigator	Title of the Schemes	Name of the Department
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Prof. Sampa Das Dr. D. Basu	Identification of Molecular Factors Associated with Resistance Against <i>Fusarium oxysporum</i> f.sp. <i>ciceris</i> from Resistant Chickpea Plant through Functional Genomics and Proteomics Approaches. (started on September 2006)	Botany/MCG
Prof. J. Basu (PI)	Understanding mycobacteria- induced death signaling Prof. M. Kundu in the host macrophage (25.5.2005-24.5.2008)	Chemistry
Prof. M. Kundu	Understanding mechanisms of drug resistance in <i>Vibrio cholerae</i> (19.11.2004-18.11.2007)	Chemistry
Dr. M. Roy (CNCI) Dr. T. Das/Prof. M. Siddiqi/ Prof. R.K. Bhattacharyya (CNCI)	Introduction of tumor cell apoptosis via modulation of protein kinase C and suppression of telomerase by natural polyphenols and isothiocyanates	Animal Physiology

Schemes funded by ICMR

Prof. M. Kundu	Mechanism of activation of the transcription factor Sp1 and modulation of Sp1 regulated genes by the gastric pathogen <i>Helicobacter pylori</i>	Chemistry
Dr. Nripendra-nath Mandal	Quantification of the cytokines mRNA based on competitive RT-PCR	Immunotechnology
Dr. Subrata Majumdar (2005-2008)	An approach to immunotherapy against Visceral leishmaniasis	Microbiology

Schemes funded by DAE

Prof. J. Basu (PI) Prof. M. Kundu	Molecular analysis of mycobacteria-induced matrix metalloproteinase 9 production in macrophages (24.7.2006-23.7.2009)	Chemistry
Prof. M. Kundu (PI)	Regulation of cytokine/chemokine release	Chemistry

Investigator / Co-investigator	Title of the Schemes	Name of the Department
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Prof. J. Basu	from host cells by secreted antigens of <i>Helicobacter pylori</i> (14.3.2005-13.3.2008)	
Dr. Parames C. Sil	Functional characterization of a hepatoprotective protein from the herb <i>Cajanus indicus</i> L: Signal transduction mechanism (Terminated in September, 2006)	Chemistry
Dr. Subrata Majumdar (Nov, 2003 – Mar, 2007)	Modulation and intracellular mechanism of action of chemokines during leishmaniasis	Microbiology
Dr. S. R. Sikdar	Development and characterization of somatic hybrid between <i>Brassica campestris</i> and <i>Rorippa indica</i> and raising of selfed backcross progeny lines.	PMCG

Schemes funded by FIRCA

Prof. Anuradha Lohia	Replication control in <i>E. histolytica</i> FIRCA Grant from Fogarty International Centre, NIH. (2005-2008.)	Biochemistry
Prof. Anuradha Lohia	Identifying cell cycle gene networks in <i>E. histolytica</i> FIRCA, NIH, USA 2006-2009.	Biochemistry

Scheme funded by Indo Swiss Collaboration in Biotechnology

Dr. Sampa Das (PI)	Expression of insecticidal protein in chickpea (<i>Cicer arietinum</i> L.) in order to develop resistance to important pests, <i>Aphis craccivora</i> and <i>Helicoverpa armigera</i> .	PMCG
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Indo-US Scheme funded by DST (India) and NSF (USA)

Prof. Barun K. Chatterjee/ Prof. Suprakash C. Roy	Investigations on theoretical aspects of Compton scattering	Physics
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Scheme funded by IFCPAR

Prof. J. Basu (PI) Prof. M. Kundu Prof. P. Chakrabarti	ABC Transporters of <i>Mycobacterium tuberculosis</i> (1.5.2004-30.4.2007)	Chemistry
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Participation in Conferences/Symposia/Workshop

Prof. P. Chakrabarti (Biochemistry) was a lecturer in the First Virtual Training Workshop in Bioinformatics during May-June (<http://www.abren.net/>) organized by Asian Bioinformatics Research and Education Network (ABREN). Presented papers at (i) Indo-French Bioinformatics Meeting, NCBS, Bangalore, June 12-14, 2006; (ii) 75th Society of Biological Chemists Meeting, JNU, New Delhi, December 8-11, 2006; (iii) International Conference on Bioinformatics, InCoB 2006, New Delhi, December 18-20, 2006; (iv) International Symposium on Chemical Biology, IICB, Kolkata, March 7-9, 2007; (v) National Seminar in Bioinformatics, Kalyani University, March 28-30, 2007. Attended (i) BITS Annual Coordinators' Meeting, Gangtok, February 3-4, 2007; (ii) Seminar on Emerging Trends in Biotechnology, NIT, Durgapur, March 24, 2007.

Participation by Prof. P. Chakrabarti's group members. M. Guharoy presented paper at the Indo-French Bioinformatics Meeting, NCBS, Bangalore, June 12-14, 2006. Dr. R. Bhattacharyya, R.P. Saha, B. Dasgupta, M. Guharoy, A. Pal and D. Mukherjee presented papers at the International Conference on Bioinformatics, InCoB 2006, New Delhi, December 18-20, 2006. Dr. T. Chatterjee, R.P. Saha and D. Mukherjee attended the Tenth Transcription Assembly Meeting, Kolkata, December 14-16, 2006.

Prof. A. Lohia (Biochemistry) Presented talk at GRC-2006 in Leh (Ladakh), Jammu & Kashmir, September 3-8, 2006. Delivered invited talk at 30th All India Cell Biology Conference, and Chairperson of session, D.U., New Delhi, February 2-5, 2007.

Participation by Prof. A. Lohia's group member:

Mr. Shubhra Majumder, SRF visited Institute of Experimental and Clinical Pharmacology, Freiburg, Germany to carryout the Indo-German collaborative project work during April 10 to May 20, 2006.

Dr. P. Parrack (Biochemistry) Attended GRC-2006 in Leh (Ladakh), Jammu & Kashmir, September 3-8, 2006. Attended The 75th SBC meeting at JNU, New Delhi and delivered an invited talk entitled "Studies on host and phage proteins implicated in the lysis-lysogeny decision of phage lambda" on December 8, 2006. Attended The 9th International Symposium on Protein structure function relationship and delivered an invited talk on "Recognition of tandem repeats in DNA by ϕ CII, a prokaryotic transcription factor with an unusual tetrametric organization" and also chaired a session, held in Karachi, Pakistan, January 11-14, 2007.

Participation by Prof. P. Parrack's group members. : Pabitra Parua attended the National Symposium on Biophysics: Trends in Biomedical Research, IBS-2007 and presented a Poster on "E.coli HflD interacts with ϕ CII and HflB through its flexible C-terminus" during February 13-15, 2007 at All India Institute of Medical Sciences, New Delhi.

Sabyasachi Halder (Biochemistry) attended the special symposium on "Current Trends in Solid State NMR Methodology and Practice" and "13th National Magnetic Resonance Society Meet-

ing held during February 5-8, 2007 at National Chemical Laboratory, Pune (India).

Dr. P. Parrack, Sabyasachi Halder and Kaustav Bondyopadhyay (Biochemistry) attended the Tenth Transcription Assembly Meeting, Kolkata, December 14-16, 2006.

Dr. Subrata Sau (Biochemistry) attended the 11th ADNAT convention consisted 3 days symposium followed by a training course on "Protein Structure Prediction & Structure Determination", at CCMB, Hyderabad, February 23 to March 08, 2007.

Prof. Swati Sen-Mandi (Botany) (i) Invited to discuss at a Meeting on Tea Biotechnology at West Bengal State Council Board (WBSCB), Kolkata on 12th April, 2006; (ii) Invited by Annals of Botany to write a paper for publication in the proposed Memorial Volumes 2007, dedicated to the illustrious Seed Scientist, Dr. Daphne J. Osborne, Oxford, UK.; (iii) In the laboratory of Swati Sen-Mandi Hands on Training was imparted to DNA fingerprinting and establishment of DNA markers in economically important plants

Prof. P.K. Saha (Botany) (i) Participated in the first training of "Advanced Techno-Management Programme for Scientists and Technologists" sponsored by the Department of Science and Technology, Govt. of India held during March 07 to April 16, 2005 and awarded certificate for successful participation by Administrative Staff College of India, Hyderabad.; (ii) Participated and presented a paper in the National Conference on current researches in plants and microbes held at Department of Botany, University of Burdwan, W.B. during November 26-27, 2005.; (iii) Participated in the training Programme on "General Management for Senior Scientists" sponsored by the Department of Science and Technology, Govt. of India held during February 20 to March 3, 2006 and awarded certificate for successful participation by Administrative Staff College of India, Hyderabad (iv) Participated in the International Symposium on "Frontiers in Genetics and Biotechnology – Retrospect and Prospect" organized by Department of Genetics & Biotechnology, Osmania University, Hyderabad during 8th to 10, January, 2007; (v) Participated in the International Conference on "Chromosomes to Neurons" held at Calcutta University during January 12-14, 2007 organized by Department of Biophysics, Molecular Biology and Genetics, University of Calcutta and Saha Institute of Nuclear Physics, Kolkata in association with IICB, IACS, EMSI (zck).

Prof. D.N. Sengupta (Botany) has attended the DST, Govt. of India Sponsored Training Program on General Management for Senior Scientists, Organized at Administrative staff college of India, Bellavista at Hyderabad on September 4-15, 2006.

Dr. Sabita Bhattacharya (Botany) (i) Invited for writing an article in the scientific souvenir on the occasion of a National Symposium on 'Diversity of Medicinal Plants and Their Sustainable Utilization in Health Care and Improving Nutritional Standard in Rural Areas' held on 24-25 December, 2006 at Ramkrishna Mission Ashrama, Narendrapur. (ii) Bhattacharya Sabita (2006): Necessity of need-based cultivation of medicinal plants – current scenario in India. In 'Diversity of medicinal plants and their sustainable utilization in health care and improving nutritional standard

in rural areas' (eds. Gupta, S.K and Mitra, B.R.) pp. 4 –10, Narendrapur Mission Ashrama, Kolkata.

Dr. Swati Gupta-Bhattacharya (Botany) (i) participated and presented paper at the 8th International Congress on Aerobiology, at University of Neuchatel, Neuchatel, Switzerland from 21st to 25th August 2006 (ii) she participated, presented paper and chaired a session at the 14th National Conference on Aerobiology at Pt. Ravi Shankar Shukla University, Raipur, Chattisgarh, India from 15-17th January 2007.

Dr. Dola Borai, Jyotshna Mandal and Himadri Shekhar Chakrabarti (Botany) participated and presented paper at the 8th International Congress on Aerobiology, at University of Neuchatel, Neuchatel, Switzerland from 21st to 25th August 2006

Jyotshna Mandal and Himadri Shekhar Chakrabarti (Botany) (i) participated and delivered oral presentations at the 14th National Conference on Aerobiology at Pt. Ravi Shankar Shukla University, Raipur, Chattisgarh, India from 15-17th January 2007. (ii) participated at the National Workshop on Proteomics and Bioinformatics held in Bose Institute, Kolkata from 1st -2nd March, 2007.

Mr. Swarup Roy Chaudhury (Botany) went to 94th Indian Science Congress held at Annamalai University and defended the poster on Banana Fruit Ripening. Mr. Sanjay K. Singh also went to the same meeting and defended the poster on ddNTP sensitive DNA polymerase enzyme from the developing seeds. (Sujit Roy, Sanjay K. Singh and Dr. D.N. Sengupta). This poster received 2nd best poster Award in the New Biology Section of the meeting.

Moumita Gangopadhyay (Botany) participated and presented a poster in (i) the National Symposium on 'Medicinal Plants: Role of Biotechnology and Bioinformatics' held at Birla Institute of Technology, Mesra, Ranchi on August 3-5, 2006. She was awarded for the 3rd best poster. (ii) attended the 'National Workshop on Proteomics and Bioinformatics' at Bose Institute, Kolkata held on March 1-2, 2007.

Prof. Parimal C. Sen (Chemistry) attended (i) Intellectual Property Rights (IPR) meeting organized by DST at Hyderabad during July 31-August 4, 2006; (ii) DBT Task Force Meeting on 4th September, 2006 at New Delhi and (iii) Meeting organized by DST regarding programmes of DST Institutions at Bangalore on September 23-24, 2006.

Prof. Manas Chakrabarty (Chemistry) participated in (i) the 4th Chemical Research Society of India Symposium (Kolkata Chapter) held at the Department of Chemistry, University of Kalyani, Kalyani, W. Bengal on August 4, 2006, (ii) the Seminar on "Acharya Prafulla Ch. Ray and Chemistry Today" held by the Indian Chemical Society, Kolkata at the SINP Auditorium at Calcutta University on September, 15, 2006 and (iii) the International Symposium on Current perspectives in Organic Chemistry held at the Indian Association for the Cultivation of Science, Jadavpur, Kolkata on November 2-3, 2006. Prof. Chakrabarty delivered (i) an Invited Lecture and Co-Chaired a Session at the "Symposium on Natural Products and Biodiversity: Chemistry

and Utilisation" held at the Department of Chemistry, Forest Research Institute, Dehradun on November 2-3, 2006, (ii) an Invited Lecture and Co-Chaired a Session at the 2nd International Conference on Heterocyclic Chemistry held at the Department of Chemistry, University of Rajasthan, Jaipur on December 16-19, 2006 and (iii) an Invited Lecture and acted as a Member, Board of Adjudicators for the Yong Scientist Award Papers at the 43rd Annual Convention of Chemists held at the Department of Chemistry, Dr. B. Ambedkar Marathwada University, Aurangabad during December 23-27, 2006.

Prof. K.P. Das (Chemistry) delivered an invited talk (i) on "Specific ion interactions with micellar protein α -crystallin: structural and functional implications" at Department of Chemistry, Kalyani University on the occasion of the Fourth CRSI symposium held on 4th August 2006; (ii) on "Mechanism of protein-protein recognition" at the NATCOSEBXII conference on Disperse Systems, held at the Assam University, Silchar, Assam, during November 9-11, 2006; (iii) on "Molecular chaperone function of α -crystallin: a possible mechanism of differentiation between natural and non-natural substrates" at the 43rd Annual Convention of Chemists held at Dr. Babasaheb Ambedkar Marathwada University, Aurangabad during December 23-27, 2006; He participated in the DST sponsored administrative training program for the senior scientists at ASCI, Hyderabad during February 5-16, 2007.

Prof. Joyoti Basu (Chemistry) delivered an invited lecture in (i) the Indo-UK symposium on Tuberculosis organized by the Royal Society in London in September, 2006; (ii) the 94th session of the Indian Science Congress held at Annamalai University, Tamilnadu from January 3-7, 2007; (iii) the International Symposium on New Frontiers in Tuberculosis Research held at ICGB, New Delhi from December 4 to 6, 2006; (iv) the 33rd Indian Immunology Society Conference held in All India Institute of Medical Sciences, New Delhi from January 28 to 31, 2007. Prof. Basu delivered a lecture and chaired a session on invitation in the jointly organized 25th International Congress of Chemotherapy and 17th European Congress of Clinical Microbiology and Infectious Diseases held in Munich from March 31, 2007. She also chaired a session in the XX All India Cell Biology Conference "Molecules to components, crosstalks and networks" held in New Delhi from February 2 to 4, 2007; She presented a paper in (i) the 2nd FEMS Conference held in Madrid from July 3 to 8, 2006; (ii) the "International Conference on Innate Immunity: Receptors, Response and Regulation" held in San Antonio, Texas from November 9 to 11, 2007; (iii) the Keystone Symposium: "Tuberculosis: from lab research to field trials" in Vancouver, British Columbia, Canada from March 20 to 25, 2007.

Prof. Manikuntala Kundu (Chemistry) delivered an invited lecture in (i) the International Symposium on "Translational Research in Cancer" organized by Institute of Life Sciences and Imgenex in Bhubaneswar from January 17 to 19, 2007; (ii) the XX All India Cell Biology Conference "Molecules to components, crosstalks and networks" held in New Delhi from February 2 to 4, 2007; (iii) the 4th International Congress on Tumor Environment held in Florence, Italy from March 6 to 8, 2007.

Prof. Manikuntala Kundu visited the Institut Pasteur, Paris in March, 2007 in connection with a collaborative Indo-French project.

Ms. Ajanta Mukherjee and Ms. Ratna Mukherjee (Chemistry) participated in (i) the 4th Chemical Research Society of India Symposium (Kolkata Chapter) held at the Department of Chemistry, University of Kalyani, Kalyani, W. Bengal on August 4, 2006, (ii) the Seminar on "Acharya Prafulla Ch. Ray and Chemistry Today" held by the Indian Chemical Society, Kolkata at the SINP Auditorium at Calcutta University on September, 15, 2006 and (iii) the International Symposium on Current perspectives in Organic Chemistry held at the Indian Association for the Cultivation of Science, Jadavpur, Kolkata on November 2-3, 2006.

Ms. Ratna Mukherjee (Chemistry) presented a Poster entitled "A green and expeditious synthesis of arylidene Meldrum's acids" in the Symposium at the F.R.I., Dehradun.

Ms. Sulakshana Karmakar (Chemistry) participated in (i) the 4th Chemical Research Society of India Symposium (Kolkata Chapter) held at the Department of Chemistry, University of Kalyani, Kalyani, W. Bengal on August 4, 2006, (ii) the Seminar on "Acharya Prafulla Ch. Ray and Chemistry Today" held by the Indian Chemical Society, Kolkata at the SINP Auditorium at Calcutta University on September, 15, 2006.

Sri Taraknath Kundu (Chemistry) participated in the Seminar on "Acharya Prafulla Ch. Ray and Chemistry Today" held by the Indian Chemical Society, Kolkata at the SINP Auditorium at Calcutta University on September, 15, 2006.

Sri. Sushil Kr. Pathak (Chemistry) participated in the RIKEN Research Centre for Allergy and Immunology (RCAI) Summer Program (September 4-15, 2006), held at RCI, Tsurumi, Yokohama, Japan; Presented a poster in The Miami Winter Symposium 2007 (January 27-31, 2007), held in Miami, Florida, U.S.A.

Prof. Indrani Bose (Physics) delivered an invited talk on Physics in Biology: Challenges and New Directions at the Workshop organized by the West Bengal State Council of Science and Technology and the SNBOSE National Centre for Basic Sciences on 30.8.06; delivered an invited talk on Role of Noise in transcription-Factor-Regulated Gene Expression at the Tenth Transcription Assembly Meeting at Vedic Village, Kolkata during December 14-16 (2006); delivered an invited talk on The p53-MDM2 network: from oscillations to apoptosis at the International Conference on Bioinformatics (Systems Biology Section), New Delhi during December 18-20 (2006); delivered an invited talk on Positive feedback, Stochasticity and Genetic competence at the 30th All India Cell Biology Conference and Symposium on Molecules to Compartments: Cross-Talks and Networks during January 2-4 (2007); delivered an invited talk on Noise in Gene Expression: Origins and consequences at the International Conference on Assembly, Organization and Propulsion in Complex systems at IIT, Chennai during February 22-24 (2007).

Prof. Barun K. Chatterjee (Physics) attended and presented a poster on "Asymmetry of the Compton profile" at Division of Atomic Molecular and Optical Physics Conference (DAMOP-06) held at Knoxville, Tennessee, USA, May 16-20, 2006. Participated as a judge at the Young Physicists Colloquium (YPC-06), hosted by IPS, at Saha Institute of Nuclear Physics on September 25, 2006.

Dr. Swapan K. Saha (Physics) Delivered a talk at the DAE-DST Vision Meeting for Drawing Roadmap for High Energy & Nuclear Physics Research at Homi Bhabha Centre for Science Education, TIFR, Mumbai - April 7-8, 2006; Delivered two talks at the 23rd International Conference of Nuclear Track Society at Beijing, China - September 11-15, 2006; Delivered two invited talks at Golden Jubilee Workshop on Astroparticle Physics at Cosmic Ray Laboratory, TIFR, Ooty - December 18-28, 2006; Participated and served as a member of Organizing Committee of the 21st International Workshop on Weak Interactions and Neutrinos at Saha Institute of Nuclear Physics, Kolkata - January 15-20, 2007; Delivered a talk at the ISRO-Respond Review Meeting at the Physical Research Laboratory, Ahmedabad - March 23-24, 2007

Dr. T. P. Sinha (Physics) presented a paper in the symposium Condensed Matter Days-2006 held at Tezpur University, Tezpur during August 29-31, 2006; presented a paper in the International Workshop on the Physics of Mesoscopic and Disordered Materials held at Indian Institute of Technology, Kanpur from 4 to 8 December, 2006; gave an invited talk in 14th National seminar on Ferroelectric and Dielectrics held at Department of Physics and Meteorology, Indian Institute of Technology, Kharagpur from 18 to 21 December, 2006; gave an invited talk in National Workshop on Nanomaterials and Nanotechnology held at Department of Physics, University of Lucknow, Lucknow from 24 to 25 March 2007; gave an invited talk in National conference on Advances in Electronic Materials and Devices held at Department of Pure and Applied Physics, Guru Ghasidas University, Bilaspur from 25 to 26 March, 2007; gave an invited talk in National conference on Recent Trends in Condensed Matter Physics, held at University Department of Physics, T. M. Bhagalpur University, Bhagalpur from 28 to 29 March 2007.

Dr. S. K. Ghosh (Physics) served as resource person in the 3rd SERC school on nuclear physics (quark gluon plasma and hadron physics).

Sri. Tamal K. Mukherjee (Physics) attended and delivered a short oral presentation at the 17th DAE-BRNS Symposium on HEP, held at IIT Kharagpur, India, during December 11-15, 2006; attended the SERC School on QGP held at Institute of Physics, Bhubaneswar, during December 21, 2006 to January 9, 2007; attended the DAE-BRNS workshop on Physics and Astrophysics of Hadrons and Hadronic Matter, held at Viswa Bharati, Shantiniketan, during November 6-11, 2006.

Sri. Alok K. Pan (Physics) attended and presented a poster in the International Summer School

on Scalable Quantum Information Processing and Computing, held at Benasque Centre for Science, Benasque, Spain, during June 12 - 24, 2006.

Sri. Bhaswar Ghosh (Physics) attended the Minerva School on "Design Principles of Biological Circuits", held at Weizmann Institute of Science, Israel, during December 31, 2006 to January 5, 2007; attended and presented a poster in the summer school on "Physics of Cellular Objects", held at Cargese, France during August 14-26, 2006.

Ms. Rupa Sarkar (Physics) attended and presented a poster in the DAE Symposium on Nuclear Physics, held at Baroda, during December 2006.

Ms. Alo Dutta (Physics) attended and presented a poster in the symposium Condensed Matter Days-2006 held at Tezpur University, Tezpur during August 29-31, 2006; attended and presented a poster in the International Workshop on the Physics of Mesoscopic and Disordered Materials held at Indian Institute of Technology, Kanpur from 4 to 8 December, 2006; attended the 14th National seminar on Ferroelectric and Dielectrics held at Department of Physics and Meteorology, Indian Institute of Technology, Kharagpur from 18 to 21 December, 2006.

Sri Amit Tribedi (Physics) attended and presented a poster in the symposium Condensed Matter Days-2006 held at Tezpur University, Tezpur during August 29-31, 2006.

Sri Ritam Mallick (Physics) attended the SERC School on QGP held at Institute of Physics, Bhubaneswar, during December 21, 2006 to January 9, 2007.

Sri Prasanna K. Mondal (Physics) attended and presented a poster in the DAE Symposium on Nuclear Physics, held at Baroda, during December 2006.

Prof. Arun K. Ray (Animal Physiology) and Dr. Tanya Das (Animal Physiology) delivered invited talks to 18th Annual Conference of The Physiological Society of India at Presidency College Calcutta, during 8-10th December 2007. Prof. Arun K. Ray delivered plenary lecture, and Dr. Gaurisankar Sa (Animal Physiology) and Dr. Tanya Das delivered invited talks to 4th congress of Federation of Indian Physiological Societies, held from January 11-13, 2007, at DRDO, Delhi.

Dr. Nripendranath Mandal (Immunotechnology) have attended and delivered a talk on "Disease resistant microsatellite DNA marker of Giant black tiger shrimp, *Penaeus monodon*" at National Symposium on Cross-Talk between Zoology and Technology, November 16-17, 2006 organized by Department of Zoology, University of North Bengal, Siliguri - 734013, West Bengal.

Dr. Nripendranath Mandal (Immunotechnology) has presided over as chairman of a session and delivered a talk on "Sustainability of disease resistant shrimp (*Penaeus monodon*) aquaculture" at 4th International Symposium on Biocontrol and Biotechnology, November 27-29, 2006 organized by Department of Zoology and Biotechnology, at Lady Doak College, Madurai, Tamil Nadu, India.

Prof. A. N. Lahiri Majumder (PMCG) delivered invited talk in the symposium "Frontiers of Molecular Biology in the New Millennium" during April 11-12, 2006 at the School of Life Sciences, Jawaharlal Nehru University, New Delhi.

Prof. A. N. Lahiri Majumder (PMCG) delivered an invited lecture at the International Symposium "Genomics and shaping the future of food and nutritional security" during September 21- 22, 2006 at National Centre for Plant Genome Research, New Delhi.

Prof. A. N. Lahiri Majumder (PMCG) having been nominated by the Indian National Science Academy in a six-member INSA delegation, delivered an invited talk in the Indian-Hungarian Binational symposium on "Biology of Biotic and Abiotic Stress in Higher Plants" in Szeged, Hungary during September 26 -30, 2006.

Prof. Amita Pal (PMCG) delivered a lead lecture on the 2nd March, 2007 at the National Seminar on Recent Advances in Plant Sciences, held at the Acharya Nagarjuna University, Andhra Pradesh. The title of the talk was "Molecular markers: A trendy approach for bamboo identification".

Prof. Sampa Das (PMCG) delivered an invited talk on 9th September, 2006 at Agri-Horticulture Society of India, Kolkata on a theme of 'Present trend in Plant Biological research and its relevance in Indian Agriculture'.

Prof. Sampa Das (PMCG) participated and presented in an interactive meeting organized by DBT, India on "Improvement of Oilseed Crops through Application of Biotechnology Tools" at the Directorate of Oil seed Research on 30th and 31st October, 2006.

Prof. Sampa Das (PMCG) participated and presented the progress report in Indo Swiss Collaboration in Biotechnology, Pulse Network meeting at Delhi University during 2-5th December, 2006.

Dr. S.R. Sikdar (PMCG) presented a paper on "Development and characterization of somatic hybrid lines raised through protoplast fusion between edible mushroom strains *Pleurotus florida* and *Calocybe indica* APK2" in the International Conference on "Mushroom biology and biotechnology" organized by the Mushroom Society of India and National Research Centre for mushroom, Solan, Himachal Pradesh, India from 10th -11th February, 2007.

Dr. T.C. Ghosh (BIC) participated in the International Conference on Bioinformatics, InCoB 2006, New Delhi, December 18-20, 2006.

S. Sonavane (BIC) presented paper at the Indo-French Bioinformatics Meeting, NCBS, Bangalore, June, 12-14, 2006.

Surajit Basak, Pamela Mukhopadhyay, Bratati Kahali, S. Sonavane and Sangeeta Kundu (BIC) presented papers at the International Conference on Bioinformatics, InCoB 2006, New Delhi, December, 18-20, 2006.

Invited talks delivered at various Organizations

Prof. A. Lohia (Biochemistry) Delivered a talk entitled "Endoreduplication and irregular division leads to Genome heterogeneity in *E. histolytica*" at Bruce Rappaport Faculty of Medicine, Technion, Haifa, Israel, January 31, 2007. Delivered a talk entitled "Endoreduplication and irregular division leads to Genome heterogeneity in *E. histolytica*" at Department of Microbiology and Infectious diseases, University of Virginia, Charlottesville, USA, March 8, 2007.

Dr. P. Parrack (Biochemistry) Delivered a talk on "Structural studies on lambda cII and cIII proteins: correlation with their functions" at Special Centre for Molecular Medicine, Jawaharlal Nehru University, New Delhi, January 9, 2007.

Dr. Gautam Basu (Biophysics) delivered a talk on AOPCS07: Assembly, Organization and Propulsion in Complex Systems 2007, 22-24 February, 2006, IIT, Madras.

Dr. Gautam Basu (Biophysics) delivered a talk on Structure and Dynamics: From Micro to Macro, Calcutta University.

Dr. Sabita Bhattacharya (Botany) delivered an invited lecture in (i) the National Symposium on 'Medicinal Plants: Role of Biotechnology and Bioinformatics, held on August 3-5, 2006 at Birla Institute of Technology, Mesra, Ranchi. (ii) Delivered a lecture in the National Symposium on 'Medicinal and Aromatic Plants for Economic Benefit of Rural People' held on February 16-18, 2007 at Ramkrishna Vivekananda Mission - Institute of Advanced Studies, Kolkata.

Dr. Swati Gupta-Bhattacharya (Botany) delivered an invited lecture in the Botany Dept. Kalyani University on 22nd November 2006.

Dr. Tapas Ghose (Botany) was invited to talk on DNA Markers: Genetic Diversity Analysis and QTL Mapping in Rice, Bengal Engineering and Science University, October, 2006.

Dr. D. Basu (Botany) was invited to talk on 18th S. M. Sircar Conference, "Present Trend in Plant Biological Research and its relevance on Indian Agriculture" held on 9th September, 2006 organized by Plant Physiology Forum.

Moumita Gangopadhyay (Botany) delivered a talk at the National Symposium on 'Medicinal and Aromatic Plants for Economic Benefit of Rural People' held at Ramkrishna Vivekananda Mission Institute of Advanced Studies, Kolkata held on February 16-18, 2007.

Prof. Manas Chakrabarty (Chemistry) delivered an Invited Talk on "Green Chemistry: Concept, Understanding and Relevance to Undergraduate Chemistry" in the "UGC-sponsored State Level Seminar on Recent Trends in Chemistry" held at Bethune College, Kolkata, on November 15, 2006.

Prof. K.P. Das (Chemistry) delivered an invited talk (i) on "Applications of mass spectrometry in the study of biological macromolecules" at the refreshers course organized by the Department of

Chemistry, Jadavpur University, on January 22, 2007; (ii) on "Fundamentals of proteomics – applications of mass spectrometry" at the refresher course organized by the Department of Botany, Calcutta University, on February 22, 2007.

Prof. Indrani Bose (Physics) delivered an invited colloquium on Entanglement Properties of Magnetic Solids at the Condensed Matter Physics Division, Saha Institute of Nuclear Physics on 21.8.06; delivered on invitation three lectures on Low-Dimensional Magnetism at the SERC School on Condensed Matter Physics at University of Hyderabad during 5-6.12.06; delivered two lectures on invitation (Dynamical Systems: Deterministic and Stochastic Aspects) at the Refresher Course in Physics for College Teachers at the Physics Department, Calcutta University held during 6-25.11.06; invited to participate in the Panel discussion on Research and Teaching in Biochemistry: Future Prospects at the Valedictory Session of the Golden Jubilee Celebration of the Department of Biochemistry, Calcutta University on 13.1.07; delivered a set of lectures in the Systems Biology Course (Elective) in the BioChemistry Department of Calcutta University.

Dr. S. K. Ghosh (Physics) delivered an invited talk on "Model study of speed of sound and Susceptibilities in QGP" in DAE-BRNS Workshop on Physics and Astrophysics of Hadrons and Hadronic Matter Vishvabharati University, Shantiniketan, during November 6 - 11, 2006. Delivered an invited talk on "Gamma Ray Burst from Quark-hadron phase transition in compact stars" in 21st International Workshop on Weak Interactions and Neutrinos (WIN07), Saha Institute of Nuclear Physics, Kolkata, during January 15-20, 2007. Delivered an invited talk on "Search for Strange Matter" in the Golden Jubilee Workshop on Astroparticle Physics, at Ooty during December 18-19, 2006. Delivered an invited talk on "Astrophysics of compact objects : search for strange matter" in the First Winter School on Astroparticle Physics, at Ooty, during December 20-28, 2006.

Dr. Nripendranath Mandal (Immunotechnology) was invited and has delivered three talks on "Molecules of Living things" in Staff development programme at Periyar Maniammai College of Technology for Women, Periyar Nagar, Villam, Thanjavur-613403, on June 20-21, 2006, entitled: i) microRNA: A magic molecule in the living world; (ii) Herbal medicine and its importance in 21st century; (iii) Gene therapy: Concepts and applications.

Dr. Nripendranath Mandal (Immunotechnology) has delivered a talk on "Disease resistant microsatellite DNA marker of Giant black tiger shrimp, *Penaeus monodon*" at National Symposium on Cross-Talk between Zoology and Technology, November 16- 17, 2006 organized by Department of Zoology, University of North Bengal, Siliguri - 734013, West Bengal.

Dr. Nripendranath Mandal (Immunotechnology) has delivered a talk on "Sustainability of disease resistant shrimp (*Penaeus monodon*) aquaculture" at 4th International Symposium on Biocontrol and Biotechnology, November 27- 29, 2006 organized by Department of Zoology and Biotechnology, at Lady Doak College, Madurai, Tamil Nadu, India.

Dr. Nripendranath Mandal (Immunotechnology) has delivered a guest lecture on February 17, 2007 entitled on "Molecular mechanism of White Spot Virus (WSV) in Shrimps" at P.G. Department of Biotechnology, Utkal University, Bhubaneswar, Orissa.

Prof. A. N. Lahiri Majumder delivered an invited talk entitled "Plant DNA manipulation –strategies & prospects" in the INSA- JBNSTS joint workshop on "Beautiful DNA" during February 16-18, 2007.

Prof. Amita Pal (PMCG) delivered an invited lecture on the 7th April, 2006 at the Centre of Advanced Study in Cell & Chromosome Research, Department of Botany, University of Calcutta, Kolkata in the Valedictory Session of the meeting on 'Plant Tissue Culture and Genetic Transformation'. The title of the talk was "MYMIV resistance in *Vigna*: molecular breeding and genomic approaches".

Dr. Arun Kumar Chakraborty (Library) delivered the following invited talks

Acted as a Chairperson in the IASLIC 282nd Study Circle held on 4th May, 2006 in the IASLIC Seminar Room, Kolkata on CSIR : Electronic Journals Consortia : Electronic Access to Journals at CGCRI Library; a) on "Digital Libraries" on May 24, 2006 hosted by the Gothe-Instituut, Max Muller Bhawan, New Delhi; b) on "Digital Archiving System for Academic Libraries" in the Refresher Course, Academic Staff College, University of Calcutta on 12th August, 2006; c) on "Digital Archiving System for Libraries" in the IASLIC 285th Study Circle on 28th August, 2006 in the IASLIC Seminar Room, Kolkata; d) on "Digital Archiving System : US Experience" on 15th September, 2006 in the USIS, Kolkata; e) invited to deliver lecture as a panel member in the seminar on 'e-Books: the Changing Dimensions in e-Learning' held on 3rd November, 2007 at Hotel Hyatt Regency Kolkata; f) invited for Round Table Workshop on "Evaluation of LIS Curricula of Rabindra Bharati University, Kolkata held on 9th March, 2007; g) invited for the Workshop on "Consortia for E-resources at ISI Kolkata" held on 30th March, 2007; h) invited to deliver lecture on "Social Science Information Resources and its impact on Institutional Repository" for the IASLIC-JU Workshop sponsored by NASDOC, New Delhi on March, 20, 2007 in the Jadavpur University, Kolkata; i) invited to deliver lecture on "Social Science Information Resources and its impact on Institutional Repository" for the IASLIC-JU Workshop sponsored by NASDOC, New Delhi on March, 20, 2007 in the Jadavpur University, Kolkata.

Honours received

Prof. P. Chakrabarti (Biochemistry) was awarded the J.C. Bose National Fellowship by the Department of Science and Technology. Has been elected Fellow of the National Academy of Sciences, India (Allahabad) in 2006.

Prof. A. Lohia (Biochemistry) was elected Fellow, Indian Academy of Sciences, Bangalore (2006).

Prof. P.K. Saha (Botany) was elected member, National Science Academy, Allahabad, 2006.

Jyotshna Mandal (Botany) received the "P. H. Gregory Award" (from the Indian Aerobiological Society) for original research paper and oral presentation at the 14th National Conference on Aerobiology at Pt. Ravi Shankar Shukla University, Raipur, Chattisgarh, India from 15-17th January 2007.

Prof. Manas Chakrabarty (Chemistry) has become a Fellow of the Royal Society of Chemistry (F.R.S.C.), U.K. since the beginning of 2007.

Ms Lily Goswami (PMCG); B.B. Biswas Outstanding Students Award, Bose Institute, 2006.

Dr. T.C. Ghosh (BIC) was awarded the Biotechnology Overseas Associateship for the year 2005-06 by the Department of Biotechnology, Government of India.

Symposia Organized at Bose Institute

Dr. P. Parrack (Biochemistry) Co-organised and attended the "Tenth Transcription Assembly" meeting at Vedic Village, Kolkata, and delivered a talk on "Cyclic AMP dependent properties of CRP from three bacterial systems", December 14-16, 2006.

A Seminar on "Molecular Genetics of Sulphur Chemolithotrophy" was held at Bose Institute on May 10, 2006 to commemorate the first death anniversary of Late Dr. Pradosh Roy under the auspices of Microbiology Department. The seminar was inaugurated by the Director, Bose Institute. Lectures were delivered by the distinguished scientists from different institutes and universities along with his students.

Prof. A. N. Lahiri Majumder (PMCG) co-ordinated the following workshops held at Bose Institute:

1. On "Safety assessment of Foods derived from Genetically modified crops" sponsored by ICMR and the Biotechnology Consortium of India Ltd during January 29 -February 2, 2007.
2. On "Biotechnology for Food security and medicine" for the media people organized by the Press Institute of India during March 9- 10, 2007.

Prof. Sampa Das (PMCG) organized a DST sponsored meeting of the Expert Committee for Women Scientists Scholarship Scheme (WOS-B) at Bose Institute during July 18-19, 2006.

Bose Institute Library organised seminars on :

- "Open Access and Institutional Repository" by Prof. S. Arunachalam from M.S. Swaminathan Foundation on 3rd August, 2006
- SCIFINDER SCHOLAR — on 1st November, 2006.

The Bioinformatics Centre organized a National Workshop on Proteomics and Bioinformatics (March 1-2, 2007).

Service Departments

The Bioinformatics Centre

A server for the analysis of the physicochemical features of protein-protein interfaces (Prof. P. Chakrabarti)

The protein-protein interfaces have been dissected into a core region surrounded by a rim. Some larger interfaces can be made of multiple patches. Various descriptors, such as the interface area, the non-polar content, the number of fully buried atoms, hydrogen bonding, local density of atoms, etc. have been used to characterize the interface. A web-based server ProFace, has been developed for the analysis of protein-protein interfaces and is available at <http://www.boseinst.ernet.in/resources/bioinfo/stag.html>.

Homology modeling of proteins to understand their function (Prof. P. Chakrabarti)

The three-dimensional model of *V. cholera* transcription regulator, HlyU shows that it does not have the metal-binding sites in the homodimeric interface, which exist in the other members in the SmtB/ArsR family. This may explain why HlyU is an activator, whereas the other members are repressors.

The signature of calcium-dependent protein kinases (CDPKs) is a C-terminal calmodulin-like domain (CaMLD) with four consensus Ca-binding sites. A junction domain (JD) joins the kinase with CaMLD and interacts with them through its autoinhibitory and CaMLD binding subdomains, respectively. In collaboration with Dr. M. DasGupta we have modeled the 3-dimensional structure of the three domains of the protein from groundnut and its binding to the nuclear transport factor of the importin family.

Synonymous codon usage analysis at high temperature (Dr. T. C. Ghosh)

Synonymous codon usage of homologous sequences between thermophilic *Methanococcus jannaschii* and mesophilic *Methanococcus maripaludis* has been analyzed. It has been demonstrated that optimal growth temperature imposes selective constraints on synonymous codon choice depending upon the functionality of the genes. We have also demonstrated that selection pressure also varies between different synonymous group of amino acids and the greater constraint in the selection of synonymous codons of GC-rich amino acids and aromatic amino acids for information processing genes favors the potential formation of mRNA secondary structures which contribute to folding stability.

Codon and amino acid usage of *S. cerevisiae* genome (Dr. T. C. Ghosh)

Taking advantage of publicly available gene expression data for *S. cerevisiae*, a systematic analysis performed for the codon and amino acid usages in two different coding regions corresponding to the regular (helix and strand) as well as the irregular (coil) protein secondary structures. Our results suggest a new paradigm that apart from tRNA abundance, mRNA folding stability is another major

evolutionary force in shaping the codon and amino acid usage differences between the highly and lowly expressed genes in *S. cerevisiae* genome and surprisingly it depends on the coding regions corresponding to the secondary structures of the encoded proteins. This study supports the hypothesis that the tRNA abundance is a consequence of and not a reason for the biased usage of amino acid between highly and lowly expressed genes.

Analysis of synonymous codon usage under GC compositional gradient of Human and Rice genome (Dr. T. C. Ghosh)

Heterogeneity in base composition is a causative factor of codon usage bias in warm blooded vertebrates where natural selection drives the formation of GC-rich isochors. Similar elevation in GC content has also been reported in Gramineae leading to the formation of two classes of genes (GC-rich and GC-poor) in this family of plant. It was observed that synonymous codon families showed increase in non-randomness in codon usage in four different protein secondary structural classes of Human crystallized protein with increase in GC3 content of genes. It was also demonstrated that the evolutionary forces favoring translational selection differ between GC-rich and GC-poor classes of genes in Rice genome.

Thermo stability of a type III antifreeze protein: Insight from molecular dynamics simulation (Dr. Debjani Roy)

Type III antifreeze proteins (AFP) are found in certain fish inhabiting polar seawater. These proteins depress the freezing points of blood and body fluids below that of the surrounding seawater by binding to and inhibiting the growth of seed ice crystals. AFPs have many potential applications, including their use as additives to improve the quality and shelf-life of frozen food, as cryoprotective agents for organ and cell cryopreservation, as chemical adjuvants to cancer cryosurgery and in the development of transgenic plants and animals with increased tolerance to cold. In order to gain a deeper insight into the structural features responsible for thermo stability of the antifreeze protein we employed molecular dynamics simulations (on the available crystal structure) for 10 ns each at five different temperatures. We investigated the structure-stability relationship with focus on possible differences in the thermal unfolding pathway. The unfolding process has been carefully monitored both at an overall and a detailed structural level. We have especially analyzed the structures to see if there are important molecular contacts, which could explain the observed difference in thermal stability of this protein as well as to identify the intermediate conformational states that the protein might visit during the unfolding process. Our study may help to engineer AFPs with increased thermal stability that is more desirable than natural AFPs for some industrial and biomedical purposes.

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. It is being

Annual Report

upgraded / equipped with state-of-the-art facilities and technology infrastructure. It endeavors to provide 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 and as well as West Bengal. Faculty / researchers from Eastern India use the library extensively for reference. The library has total collection of 37,942 reading materials out of which 26101 Bound journals, 11462 Books, 379 Theses as on 31.03.2007. During this year library subscribed to 235 numbers of foreign and Indian periodicals out of which print 93, online 142. A few Print Journals also available Online. In the current year the library has added 19 new journals, Science@direct of Elsevier, Science online and all Nature Group Journals Online. Library also subscribed to online-only full-text journals of different academic societies such as ASM, ACS, Life Sciences Reviews, Cell Press journals of Elsevier etc. The library has also subscribed to full text databases of H. W. WILSON and SCOPUS : the largest abstract and citation database of research literature and quality web sources of Elsevier. Nature Group of Journals and Scencedirect titles are available online since 1997. BI Library has taken Open Access membership of the following in 2007 (i). Nucleic Acid Research of Oxford University Press, (ii). Biomed Central (BMC) and (iii.) Public Library of Science (PLOS). This membership allows discount on paper handling charges for our faculty members and research scholars who wish to publish in these journals.

During the year, 1790 readers used the Library (both campus) for their reference work. 38 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 500 documents were scanned for faculty members as well as research scholars and more than 1500 hours computer / internet used for accessing in full-text subscribed / free journals by the scholars from the Library itself. Library also provided article services to its faculty members from different institutions in India and abroad. Library also provided citation services to its faculty members. Apart from Interlibrary loan Library has consortia with FORSA (Forum for Resource Sharing in Astronomy and Astrophysics). Through FORSA, we are subscribed to Nature Journals. This year the library made consortia with IACS for subscribing sciencedirect. Library also arranges trail access for different databases. In 2006, library arranged trail access for Scifinder Scholar databases of ACS, Protein Lounge database and ISI Web of Science of Thompson. In 2006, the library has subscribed to networked version as well as stand alone version of ENDNOTE Software — for managing references.

Photocopy services are provided to outside users. A total 1,09,555 pages of photocopying (Xerox) services were given to our faculty and outside users. Some 699 bound volumes of book / journals and 181 loose periodicals were issued by our research scholars and faculty members throughout the year for their reference work.

Till date library has created following databases (i) Theses : Database of thesis at BI Library, (ii) BIL-JR : Database of Journal holdings at BI Library (iii) Books. The journal database is up-to-date.

Publication

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 Report; folders; Posters and Leaflets of different Symposia, Seminars and Training Programmes and works of Sir J. C. Bose. Soft copy of Annual Report and BI News are available in the net (boseinst@ernet.in).

The following books are now available for sale. J.C. Bose and Microwaves-A collection Rs. 200.00; Secence 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 Rs. 1500.00; Vol-V Rs. 550.00; Patrabali (Bengali) Rs. 150.00; Acharya Jagadis Chandra Bose (Bengali) Rs. 12.00 and Picture Post Cards (five sets) Rs. 125.00 and Abyakta (Bengali book written by Sir J.C. Bose) Rs. 50.00.

Sophisticated Analytical Instrument Facility (SAIF)

The Sophisticated Analytical Instrument Facility (SAIF) (formerly known as Regional Sophisticated Instrumentation Centre) at Bose Institute is one of the first four such facilities established by the Department of Science & Technology, Government of India in the 1970s and is now 30 years old. During the year this facility continued providing instrumental services to different users from educational Institutions, Government R&D and Industry. The consultancy to the R&D personnel from academia and industry has also been provided by the facility.

In the current financial year, a new drive has been initiated by the Bose Institute authority in the way of improving the infrastructures and providing funds for the procurement of a number of sophisticated instruments like SEM, FPLC, HPLC, RT-PCR, PROTEIN SEQUENCER etc. The process for procurement of the same is in progress and the instruments are going to be installed and commissioned shortly.

Instrument Utilization

Name of Instrument	No. of Samples		Revenue Earned Rs.
	External	Internal	
Atomic Absorption Spectrometer	485	Nil	33,300/-
Spectrofluorimeter	53	Nil	2,400/-
Transmission Electron Microscope	11	22	9,900/-
Gas Liquid Chromatograph	48	9	6,250/-
Single Crystal X-ray Diffractometer	3	Nil	4,600/-**

*An additional revenue of Rs. 3,150/- has been earned from training programme.

** Rs. 4,400/- to be realized.

Workshop

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

UNITS	REQUISITION RECEIPTS	JOB DISCHARGED	CONTINUING JOB
ELECTRICAL	877 (M.C. & N.C.)	95%	5%
MECHANICAL	83	95%	5%
CARPENTRY	57	98%	2%
REFRIGERATION	50	95%	5%
DRAFTING	35	100%	Nil
LECTURE, SEMINARS & course work class attended	Above 350 (M.C & N.C.)	100%	Nil
EPABX UNIT	120	100%	Nil

The electrical work of various ongoing projects of the Institute at various campuses like Salt Lake Astro Particale Physics Lab. Darjeeling experimental Farm, Maypuri Campus and Cent. Bldg. are being supervised and monitored by the workshop.

Some preventing maintenance jobs of electrical has been completed during year 2006-07 in both the campuses. The rest of these jobs shall be completed in the next financial year with the guide line of Energy Audit Report & the said report has been submitted PCRA recently.

Workshop has successfully completed the 2 nos special type Gel Apparatus construction for West Bengal University of Technology at a project cost of Rs.30,000/- only, BF-142, Salt lake, Sector-1 Kolkata - 700064.

List of personnel

Administration

Prof. Sibaji Raha (**Director**)

Sri Tushar Kanti Ghorui (**Registrar**)

Dr. Utpal Sadhu (**Deputy Registrar**)

Kazal Chaudhuri (Asstt. Registrar I), Ram Krishna Kundu (Asstt. Registrar II), Debidas Saha (Asstt. Registrar III), Satyananda Pal (Accounts Officer), Parimal Ch. Das (Audit & Finance Officer).

Supporting Staff : Centenary Campus: PAs to Director: Arup Kr. Sengupta, Sankar Nath Sinha, Sukumar Moitra ; Accountants: Tushar Kanti Mukherjee, Subir Sen, Ashis Chakraborty; Cashier: Tapan Chakraborty, Officer Superintendents : Ankur Dutta, Nikhilesh Roy Ghatak, Madhusudan Mitra, Amit Kr. Ghosh, Baldeb Goswami; Others: Rina Roy, Raj Pandey, Elizabeth Pal, Swapn Kr. Sinha, Dhruvajyoti Sen, Bidyut Kr. Mondal, Manick Ch. Das, Sisir Chakraborty, Rubi Sarkar, Sudam Jana, Rina Das, Somnath Das, Prodip Kr. Mullick, Rita Chakraborty, Sanjoy Krishna Chaki, Debasis Koley, Angshuman Bhowmik, 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 Molla, Nagnarayan Yadav, Kuddush Ansari, Kanai Hazra, Prafulla Bhunya, Kanak Baran Hazra, Duryodhan Nayak, Bablu Mandal, Sukanta Chakraborty, Subrata Banerjee, Dulal Turi, Amarnath Hela, Ranjit Das, Sarada Devi, Sukumar Mandal, Bulaki Das, Amartya Sen, Sanat Kr. Dhara, Jagabandhu Nayak, Jagannath Das, Kashinath Pal.

Supporting Staff, Main Campus: Office Superintendent: Arun Kr. Dasgupta, Others: Rabindra Nath Karmakar, Chandra Kanta Sasmal, Tarun Chakraborty, Sanat Kr. Dey, Mahendra Nath Shee, Madhusudhan Marick, Harekrishna Thoyal, Fulchanda Sardar, Kalicharan Turi, Kissan Das, Munna Turi, Kodan Das, Sk. Mohammad Ilias, Manju Turi, Nagaswar Das, Rajbrat Ram, Rajkumari Balmiki, Tapas Chakraborty.

Animal Physiology Section

Faculty : Prof. A.K. Ray (Head), Dr. Gaurisankar Sa, Dr. Tanya Das.

Students : Dr. Baisakhi Saha (from September 4, 2006), Dr. Sreya Chattopadhyay (from September 4, 2006), Ms. Sumedha Roy (upto April 30, 2006), Ms. Samita Kundu (upto July 31, 2006), Mr. Debaprasad Mandal (upto November 6, 2006), Ms. Laksmishri Lahiri (upto September 25, 2006), Mr. Sankar Bhattacharyya, Mr. Subhomay Banerjee, Mr. Pallab Roy, Ms. Juni Chakraborty, Ms. Nabanita RoyChattopadhyay (from June 22, 2006 to January 16, 2007), Ms. Suchismita Mohanty (from August 7, 2006) and Mr. Arghya Adhikary (from October 16, 2006).

Supporting Staff : Mr. Indrajit Ray, Mr. Sujit Ghosh, Mr. Uttam K. Ghosh and Ms. Kanan Singh (from August 01, 2006).

Biochemistry Department

Faculty : Prof. B. Bhattacharyya, Prof. Pratima Sinha, Prof. Pinakpani Chakrabarti, Chairman (upto 10.07.2006), Prof. Anuradha Lohia, Chairperson (from 11.07.2006), Dr. Rajagopal Chattopadhyaya, Dr. Pradeep Parrack, Dr. Subrata Sau.

Students : Rima Chattopadhyaya, Subhra Majumdar, Malabika Das, Atasi Pal, Mainak Guha Roy, Sourav Sarkar, Rudra Prasad Saha, Dipak Dutta, Gopa Mitra, Sudeshna Lahiri, Mithu Banerjee, Promita Ghosh Dastidar, Bhaskar Dasgupta, Sankar Prasad Das, Sumit Biswas, Lalita Das, Sabyasachi Halder, Atanu Banerjee, Pabitra Kr. Parua, Suvroma Gupta, Ranjit Prasad Bahadur, Partho Chattoraj, Chandrama Mukherjee, Tridib Ganguly, Soumitra Sau, Suparna Laha, Palas Kr. Chanda, Arumay Pal, Somasri Pal, Krishnendu Chakrabarti, Dipak Manna, Manjari Tharad, Kaustav Bandyopadhyaya, Suroopa Chakrabarti, Amitava Bandhu, Debadrita Mukherjee, Prabal Kr. Chakrabarti, Dr. Tanaya Chatterjee.

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

Bioinformatic Centre

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

Supporting Staff : Mr. Tushar K. Bhattacharya, Ms. Sujata Roy, Mr. Sanjib Kumar Gupta, Mr. Jibananda Mandal.

Students : Dr. Rajasri Bhattacharya, Mr. Surajit Basak, Mr. Shrihari Sonavane, Ms. Pamela Mukhopadhyay, Ms. Madhurima Das, Ms. Sangeeta Kundu, Ms. Bratati Kahali, Mr. Bhaskar DasGupta, Mr. Rudra Prasad Saha.

Biophysics Department

Faculty : Dr. Gautam Basu

Students : Soumya Dasgupta, Madhurima Das

Supporting Staff : Amitava Bhattacharyay, Basudeb Marick, Barun Majumder, Bijoy Munshi, Swapn Jogsharma.

Botany Department

Faculty : Prof. Kalyan Kr. Mukherjee, Prof. Swati Sen-Mandi, Prof. Prabir Kr. Saha, Prof. Dibeyendu Narayan Sengupta (Chairman), Dr. Sabita Bhattacharya, Dr. Swati Gupta-Bhattacharya, Dr. Tapas Ghose, Dr. Debabrata Basu

Students: Dr. Gaurab Gangopadhyay, Dr. Subhash Kanti Roy, Dr. Dola Boral (up to 14.09.06), Dr. Kakali Mukherjee, Mr. Bithin Roy Chowdhury, Mr. Annanda Mohan Sau, Mr. Swarup Roy Chaudhury, Mr. Bhaskar

Gupta, Mr. Sudip K. Sinha, Ms. Progya Paromita Saha, Mr. Sanjay K. Singh, Mr. Supratim Basu, Mr. Kaushik Ghose, Ms. Madhuvanti Chatterjee, Ms. Sanjukta Dey (up to 31.10.06), Mr. Avik Ray, Ms. Moumita Gangopadhyay, Mr. Anirban Bhattacharya, Miss Jyotshna Mandal, Mr. Himadri Shekhar Chakrabarti, Ms. Basabdatta Das, Suranjana Roy.

Supporting staffs: Dr. Romit Poddar, Mr. Sukumar Majumder, Mr. Shymal Kr. Ghosh, Mr. Chanchal Chakraborty, Ms. Chaitali Roy, Sri Binoy K Modak, Mr. Jadab Kr. Ghosh, Ms. Kaberi Ghosh, Mr. Sasanka sekhar Bera, Sri Manimohan Ghosh (Up to 31.01.2007), Siddhartha Roy, Mr. Bipul Kr. Nag, Sambhu Debnath, Mrs. Sarama Pradhan, Ms. Moumita Basu Roy.

Central Instrumentation Facility

Faculry : Prof. B. Bhattacharyya (Chairman)

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

Chemistry Department

Faculty : Prof. Parimal C. Sen, Prof. Manas Chakrabarty, Prof. Kali Pada Das (Chairman), Prof. Joyoti Basu, Prof. Manikuntala Kundu, Dr. Parames C. Sil, Dr. Pradip Das.

Students : Randhir Sinha, Pratik Datta, Madhuchhanda Kundu, Sk. Rajesh Ali, Mrinal Kr. Sarkar, Taraknath Kundu, Tanusree Sengupta, Srabasti Ghoshal, Rajesh Bhattacharyya, Ayantika Ghosh, Partha Mukherjee, Tushar K. Dhara, Sulakshana Karmakar, Ajanta Mukherji, Ratna Mukherjee, Sanchita Basu, Prasenjit Manna, Tofajjen Hosain, Supratim Dey, Arnab Banerjee, Mahua Sinha, Rabindranath Bera, Sanjib Dey, Kamala Gupta, Srabani Karmakar, Shresh Pathak, Kamakshi Sureka, Sushil K. Pathak, Kunal Kr. Basu, Pinki Nandi, Kuldeep Kamawat, Parikshit Bagchi, Partha Pratim Bag, Mahua Sinha, Dr. Suroopa Chakrabarty.

Supporting staff : Prasanta Kumar Pal, Aniruddha Aich, Pranab Kumar Dey, Bhabani Prasad Banerjee, Debdas Nandy, Rama Chatterjee, Gopal Kumar Biswas, Amarnath Bhatta, Tapas Ghosh, Arindam Basu, Dipak Chandra Konar, Subhas Chandra Paul, Ashoke Kumar Maity, Sachchidanand Ram, Kalyan Das.

Immunotechnology Section

Faculty : Dr. Nripendranath Mandal (Senior Lecturer)

Students : Mr. Kuntal Mukherjee (SRF), Mr. Santanu Biswas (JRF), Mr. Tathagata Chakraborty (JRF).

Supporting Staff : Mr. Amartya Sen and Mr. Ranjit Das

Library

Dr. Arun Kumar Chakraborty (**Libraian**)

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

Microbiology Department

Faculty : Dr. Subrata Majumdar, Dr. Sujoy K. Dasgupta, Dr. Tapan K. Dutta

Students : Avik Saha (upto 31.05.06), Archana Sharma, Sujoy Chatterjee, Ranadhir Dey (upto 28.12.06), Subhankar Chatterjee, Nivedita Majumdar, Bejoy Sekhar Datta, Twishasri Das Gupta, Sukhendu Mandal, Somnath Mallick (upto 13.02.07), Bomba Dam, Bidisha Bhattacharya, Nabanita Giri, Suchandra Majumdar, Subhadipa Sengupta (upto 22.05.06), Joydeep Chakrabarty, Surajit Bhattacharjee, Madhumita Roy, Arnab Basu, Soumi Chakraborty

Supporting Staff : Biswanath De Sarkar, Barindranath Mandal, Provat K. Chattopadhyay, Prabal Gupta, Saifullah Gazi, Debashis Sarkar, Babli Marrick, Prabir Halder, Debashis Mazumder, Nityananda Patra, Jamuna Prasad, Dilip Bhattacharyya, Ramesh Prasad, Birendra K. Bari (transfer to PMCG Sec. w.e.f. 24.07.06), Saral Das (transfer to Environ. Sec. w.e.f. 24.07.06), Robin Paul, Sankar Bari, Purnendu Manna, Narayan Patali.

Physics Department

Faculty : Prof. Barun K Chatterjee (Chairman), Prof. Suprakash C Roy (till Nov 30, 2006), Prof. Sibaji Raha (on lien; joined as Director on 27.2.2006), Prof. Indrani Bose, Prof. Dipankar Home, Dr. Swapan K Saha, Dr. Tripurari P Sinha, Dr. Sanjay K Ghosh.

Students : Dr. Basudhara Basu Nandi (Women Scientist Scheme of DST), Rajesh Karmakar (till Dec 1, 2006), Tamal K Mukherjee, Alok K Pan, Bhaswar Ghosh, Rupa Sarkar, Alo Dutta, Amit Tribedi, Ritam Mallick, Prasanna K Mondal.

Supporting Staff : Narayan C Dey (till Dec 31, 2006), Amit K Ganguli, Kamal C Das, Sankar P Singha, Shyamsundar Mallick, Subhasis Banerjee, Manas Dutta, Subrata Das, Tarun K Maji, Bharat P Ram, Bansi Dutta, Dayakant Thakur, Sujit K Basu, Rajkumar Mourya, Prabir Halder.

Plant Molecular & Cellular Genetics Section

Faculty : Prof. A. N. Lahiri Majumder, Prof. Amita Pal, Prof. Sampa Das, Dr. Samir Ranjan Sikdar.

Students : Krishnarup Ghosh Dostidar, Susmita Maitra, Prasenjit Saha, Anindya Sarkar, Dipankar Chakraborty, Lily Goswami, Sudipta Ray, Samik Bhattacharya, Utara Bhattacharya, Sruti Dutta, Sonali Sengupta, Barunava Patra, Sumanti Gupta, Hossain Ali Mondal, Radharaman Bar, Nilanjana Banerjee, Soumitra Maity, Subhra Mondal, Jayadri Sekhar Ghosh, Arunava Chakraborty, Subhadipa Sengupta, Arnab Ganguli, Jolly Chatterjee, Paramita Nandi, Lekha Bandopadhyay, Nutan Pal **DST Women Scientists** : Dr. Aparajita Mitra,

Supporting Staff: Puspita Mukherjee, Asim Kumar Nath, Subal Basak, Motilal Singh, Arup Kumar Dey, Nadiram Kayal, Thakur Gond, Birendra Singh.

Publication

In-Charge : Mr. Arun Kumar Das Gupta

Supporting Staff : Sri Chandra Kanta Sasmol

Sophisticated Analytical Instrument Facility

Mr. Tapan Datta, Mr. Shyam Sundar Kundu, Mr. Gobinda Das, Mr. Amit Kumar Mahinder, Mr. Jaideb Kumar Chattopadhyay, Mr. Pathik Ranjan Ray, Mr. Alokanda Sarkar, Mr. Arup Kumar Sen, Mr. Samir umar Mukherjee, Mr. Pradip Kumar Karmakar, Mr. Subhas Chandra Maikap, Ms. Tanima Modak (Dhar) Ms. Manisha Banerjee, Mr. Ranjit Kumar Ghosh, Mr. Debabrata Polley, Mr. Sankar Santra, Ms Saraswati Sarkar Sen.

Workshop

Mr. A.K. Mukherjee (Workshop Supdt.)

Supporting Staff (Main Campus) : Dipak Dutta, Ashutos Sarkar, Samar Dutta, Sisir Ghosal, Tarapada Das, Dipen Sen, Bankim Dutta, Sk. Md. Ehia Hossain, Basanta Kr. Shit, Bholanath Saren, Abdul Rahaman Molla, Panchanan Santra, Panchugopal Karak, Gopal Ch. Das, Sk. Md. Farruck, Kishori Mohan Saha, W.D. Rozario, Kalachand Sen, Rajkumar Das, Pranab Banerjee, Brahmdeo Prasad, Subrata Basak, Sanjoy Santra.

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

National Science Day Celebrated



National Science Day was observed on February 28, 2007. The theme of this years was **More Crop per Drop**. As part of the celebration Institute conducted Quiz and Debate competition among the school students at Chowishia High School, Barachampa, Basirhat, 24 Parganas North on February 14, 2007. On 28th February, 2007 a popular lecture was delivered by Prof. S.K. Sen at Bose Institute Lecture Hall on the particular theme. Students from different schools and interested people from different walks of the city attended the celebration. The day considered as Open House for the participating students and visitors. In addition to prizes to the winning students certificates were awarded to all the participants.

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THE REVEALER
The invisible waxing and waning of the life revealed by the moving trail of light
By the courtesy of the artist, Gaganendranath Tagore