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BOSE INSTITUTE
ANNUAL REPORT
1994-95

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From the Director's Desk

I take much pleasure to present before you the Annual Report of the Bose Institute for the financial year 1994-95. I am quite sure, you must have already experienced a lot of activity in the Institute for upgradation, modernisation and renovation of its facilities. It is very heartening for me to mention that several new brilliant young scientists have joined the Institute during the past year. Many of them have come from abroad. The Institute had initiated a scheme of awarding Rs. 2.00 lakhs to each new members of the faculty to help them initiate their work without much of a lapse of time. I am quite sure that they all have found it very useful. With the introduction of the new faculty members we have been successful to strengthen our research activities in the field of Biophysics, Molecular Biology, Structural Biology and related areas. A group of young scientists with advanced knowledge in the field of Signal Transduction, Plant Molecular Biology and Biotechnology have initiated their new endeavours in the frontier areas of both basic and applied research. The Institute had formally entered into a Memorandum of Understanding with the Saha Institute of Nuclear Physics and Variable Energy Cyclotron Centre of Bhabha Atomic Research Centre at Calcutta, for collaborative studies along with the Calcutta University to initiate high altitude research in the field of Astrophysics and Cosmology. The Institute has signed an agreement with the Eastern Centre for Research in Astrophysics and has recently conducted some useful investigation during the total Solar Eclipse period.

Several of our scientists have received appreciations, recognitions and acclaims for their scientific contributions from various places. Dr. Dipankar Home of the Department of Physics has been awarded the prestigious R.D. Birla National Award in recognition to his contribution in the field of wave particle duality phenomena of light. He has also been nominated an Associate Member of the International Centre for Theoretical Physics (ICTP), Trieste, Italy. Prof. B. Bhattacharyya of the Department of Biochemistry has been awarded the prestigious Fellowship of the Indian National Science Academy. Prof. P.K. Ray, Director, Bose Institute has been awarded the R.S. Sinha Memorial Oration Award for the year 1994 by the Indian Physiological Society for his contribution in the field of Tumour Immunology, Immunopharmacology, and Immunotoxicology. Prof. N.C. Mandal of the Department of Biochemistry has been nominated by the Indian National Science Academy as a Member of the National Committee for International Union of Biochemistry and Molecular Biology for the period 1994 to 1997.

Nine Ph.D.s have been awarded to young scientists during the year and the Institute had published more than 102 full length research papers in National and International Journals. It may be of much interest to note that majority of these publications are in high impact factor journals of the world.

The Institute made significant efforts to increase the Institute's budget in one hand and also to obtain funds directly from the Planning Commission, Government of India, for the upgradation and modernisation of the Institute facilities. In that effort generous increase in the plan budget for the year 1994-95 had been made by the Department of Science & Technology, Government of India, which had further been elevated to the level of about Rs. 6.50 crores in the following year (1995-96). I am recording our sincerest thanks to the authorities in the Planning Commission, Government of India, who had been kind enough to allocate to Bose Institute an one time ad-hoc grant to the extent of Rs. 8.00 crores for the upgradation and modernisation of the facilities of the Institute. An elaborate plan has been checked out to accomplish the targetted task within the stipulated time. In this context, I would personally like to record our sincerest thanks and gratitude to Dr. P. Rama Rao, former Secretary, Department of Science & Technology, Government of India, and to other members of DST, Government of India, for their nice gesture, co-operation and support that they have accorded to this Institute for the furtherance and promotion of its targetted objectives. We are extremely grateful to Dr. S.Z. Quasim, Member (Science), Planning Commission and to Shri Pranab Mukherjee, Deputy Chairman, Planning Commission, for providing support to Bose Institute. I would also like to record our appreciation to the West Bengal Government through which this fund has been allocated to this Institute.

The Institute organised a very successful International Satellite Symposium on "Protein Structure, Function and Engineering" immediately before the IUBMB Congress, which was held at New Delhi. The Institute observed the National Science Day with an elaborate programme, such as Science Quiz Competition, Science Modelling, Lecture Competition, etc. A large number of school students participated in this. As a part of its science awareness programme the Institute also organised science exhibitions and competition in two Districts of West Bengal, at the premises of Uttarpara Government High School, (Hooghly) and Kalyani University Experimental High School (Nadia) making them as the nodal centres of activity in those Districts. A seminar entitled "Science for Health" was also organised by the Institute to inform the general public and students about the role of science in various aspects of health related problems we face now and then.

The 78th Foundation Day was celebrated with its usual sanctity and solemnity. Dr. S.Z. Qasim, Member, Planning Commission, Government of India, delivered the 56th Acharya J.C. Bose Memorial Lecture entitled "Some Achievements of Indian Science in the Post-independence Period". On this occasion the Institute released a Book entitled "PATRABALI" which is a compilation of letters between the two stalwarts of Bengal who had greatly influenced the Indian scientific and literary sceneries during late nineteenth and early twentieth century, and were the source of inspiration, to thousands of young scientists and literary figures. This book is a collection of ideas and thoughts exchanged between Poet Rabindranath Tagore and Acharya Jagadis Chandra Bose at a very critical juncture of the development and progress of our nation.

I am pleased to inform you that a number of Patent Applications have been submitted by the scientists of the Institute for various innovative products.

Our Library is in the process of modernisation and new arrangements are being made with INSDOC, New Delhi, to computerise the library facilities. The Institute had formally made an arrangement to obtain books and journals on loan from the British Council Library.

I am very happy to be able to say that this premier Institute is marching forward with the sole objective in mind that it has to fulfil the expectations of the citizens of the nation, who are supporting directly and/or indirectly in multifarious ways the research activities of this Institution.

At last, but not the least of importance, I am extending my thankfulness to all the members of staff of Bose Institute without whose co-operation, active and hard work and sincerest performance we would not have been able to make the progress the Institute has already witnessed.

Prof. P. K. Ray
Director



Acharya Jagadis Chandra Bose
Founder - Director
(1858 - 1937)

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CONTENTS

	Pages
PHYSICS	1
CHEMISTRY	7
BOTANY	15
MICROBIOLOGY	22
BIOCHEMISTRY	28
BIOPHYSICS	35
ANIMAL PHYSIOLOGY	38
PLANT MOLECULAR & CELLULAR GENETICS	42
IMMUNOTECHNOLOGY SECTION	45
ENVIRONMENTAL SCIENCES SECTION	46
LIBRARY	47
WORKSHOP	48
R.S.I.C.	49
J.C. BOSE UNIT AND MUSEUM	51
D.I.C.	52
PUBLICATION	53
ADMINISTRATION	54
J.C. BOSE MEMORIAL LECTURE	55
LECTURES	55
OBITUARY	56
ACKNOWLEDGEMENT	57
MEMBERS OF THE COUNCIL	57
MEMBERS OF THE GOVERNING BODY	57
MEMBERS OF THE FINANCE COMMITTEE	58
MEMBERS OF THE CENTRE MANAGEMENT	
COMMITTEE—R S I C, BOSE INSTITUTE, CALCUTTA	58
STATEMENT OF ACCOUNTS	1-40

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PRESENT RESEARCH ACTIVITIES

During the 8th five year plan, the institute chose the following projects keeping in view the over-all objectives of the institute, with the main objectives to find solutions to the basic problems in **Agriculture, Health and Environment** in one hand, and more understanding in the fundamental aspects of Physical, Chemical and Biological sciences on the other in order to meet the Challenge of time. The areas identified included.

- I *Improvement of plant productivity, nitrogen fixation and photosynthesis using modern biotechnology and plant breeding.*
- II *Chemical and biological studies of plant and marine organisms.*
- III *Studies on structure, function and dynamics of biomolecules.*
- IV *Studies on ecology, environmental pollution and related problems.*
- V *Studies on microbes and parasites for industrial and medical applications.*
- VI *Problems in condensed matter ; intermediate energy physics and related interdisciplinary areas.*

Research activities of the institute are carried in 6 departments and 4 sections. Notable contributions have been made to many scientific disciplines, and extensive interdepartmental, inter institutional and international scientific collaborations exist in related areas of research. The institute has MOUs with a number of organizations and industries for entering into collaborative work, product and process development viz. School of Tropical Medicine, I.I.T, Kharagpur, Calcutta Port Trust, M/s. Shaw Wallace & Co, M/s. Tata Tea, Rockefeller foundation, U.S.A. etc.

Physics

Faculty : Prof. S.C. Roy (Chairman from 1.1.1995) Prof. M.H. Engineer (Chairman till 31.12.1994) Dr. A.K. Chatterjee, Dr. S.N. Changdar, Dr. S. Raha, Dr. I. Bose, Dr. D. Home, Dr. B. Roy, Dr. B.K. Chatterjee, Dr. S.K. Saha

INSTITUTIONAL PROJECT VI

A. Acoustics.

New viscous fingering type instability at the interface of liquid layers

B. Roy and M.H. Engineer

Work is being continued on viscous fingering type instability with the system of two immiscible liquids. With water/CCl₄ petroleum ether mixture, the experiment was performed both in a vertical narrow mixture, the experiment was performed both in a vertical narrow cylindrical tube and in a wider container. The shape of the instability was observed to be like a funnel with its finger-like stem pointing from low viscous liquid to the high viscous liquid. With an increase in the driving acoustic power the finger-like instability increased in height and after attaining a critical height, the tip of the finger broke into droplets.

B. Nuclear Physics

B.1. *Investigation on compton profile of Arsenic Oxide and Cuprous oxide*

A.K. Chatterjee and A. Deb.

The compton profile of polycrystalline arsenic oxide has been measured using 59.54 Kev gamma radiation. The obtained experimental Compton profiles were compared with the Hatree-Fock free atom values.

A self-consistent calculation using the linear combination of Gaussian orbital methods has been carried out. The density of states, Compton profiles and partial charges have been calculated. The obtained theoretical results showed a good agreement with the earlier reported experimental results.

B.2. *Positron annihilation life-time measurement in polymer substances*

A.K. Chatterjee and A. Deb.

A coincidence arrangement consisting of fast scintillators, fast photomultiplier tubes and conventional electronics has been made and its resolution studied with Co⁶⁰ source. Polymer

samples are now used for the study of their characteristics such as free volume, dielectric constants, molecular weight etc. An arrangement for measurement of angular distribution of positron annihilation radiation using the same electronics has been made.

B.3. *Charge exchange effect in scattering of analog nuclei*

Swapan K. Saha, A. Roy, A.K. Sinha (Nuclear Science Centre, New Delhi)

It has been suggested by Vary and Nagarajan that strong resonance can be found in the elastic scattering between analog nuclei at energies near Coulomb barrier as a consequence of the exchange, of last nucleons in the two nuclei. A project has been submitted at the Nuclear Science Centre, New Delhi where elastic scattering between ⁷Be and the analog nuclei ⁷Li will be studied at energies near Coulomb barrier. This will also serve as a pilot project to design experiments to measure nuclear reaction cross-section of astrophysical significance using radioactive nuclear beam. This project has been accepted by the Accelerator Users Committee at the Nuclear Science Centre, New Delhi.

B.4. *⁷Li (α, p) (α, d) (α, t) reactions at 20 and 40 Mev*

Swapan K. Saha and S. Saha (SINP)

A proposal for studying ⁷Li (α, p) (α, d) (α, t) reactions has been accepted at VECC, Calcutta for utilising the α beam from the Cyclotron. This will provide information on the cluster structure of ⁷Li and the reaction mechanism over a wide range of energy. Fabrication of the targets and the defector has been done.

C. Applied radioactivity and Liquid Dynamics.

S.N. Changdar.

The sliding cell method based on radioactive tracer technique was used to measure diffusion co-efficients in some liquid systems using Hg-203

as the tracer. Diffusion co-efficients in ternary systems were also measured to observe the effect of coupled flow on the motion of the diffusing ion.

D. Radiation Physics and Condensed matter

D.1. Effect of suspended particles on the viscosity of fluids.

B.K. Chatterjee and Nirmal Halder

In a model proposed earlier by us to explain the gelation of gamma irradiated polydimethyl siloxane a proposal that viscosity divergence due to hydrodynamic interaction precedes actual "gelation" (cluster size divergence) was made. To test that model the effect of varying concentrations of suspended particles in polydimethyl siloxane to simulate dimers produced by gamma ray induced cross linking was carried out. It has been observed that the experimental data agrees excellently with the theoretical model.

D.2. Ionic transport and reaction processes in nonpolar liquids :

B.K. Chatterjee

Continuous transport (drift) of K^+ and Mn^{2+} ions in 200 cS PDMS fluid have been achieved.

D.3. Study of stability of Superheated liquid drops.

B.Roy and S. C. Roy

A differential system of water manometers have been developed to test the stability against spontaneous nucleation of the superheated drops of freon -12 suspended in a degassed gel. The change in volume of air and vapour in a closed vial (containing sample) due to drop nucleation was measured by noting the differential change in height in the water manometers. The volume change in the prepared drop samples of different batches were observed as a function of time for measuring the life time of the drop samples. The observed drop decay indicated two groups of drops existing in our samples — one very short lived and the other having a long life.

D.4. Measurement of v -scattering cross sections :

Swapan K. Saha, B.K. Chatterjee and S.C. Roy.

A set up for measuring v -scattering cross section is made. Resolution of the detector has been tested.

D.5. Measurement of photon attenuation in

some high Z elements and determination of photoelectric cross sections :

S.C. Roy, Nanak Bhattacharyya, N. Chaudhuri (North Bengal University)

Photon mass attenuation of some 11 elements in the range of atomic number $41 \leq Z \leq 92$ for photon energies 59.5 keV and 43.0 keV have been measured. From the measured attenuation, the photoelectric cross sections of these elements have also been determined by subtracting the other contributions. Some of the measured values are new as has been observed from the recent compilations of total mass attenuation coefficients of all elements and photon energies. For some elements, these energies are close to absorption edges.

D.6. Tabulations of photon-atom elastic scattering cross sections.

B.K. Chatterjee and S.C. Roy.

Using the state-of-the-art precise theoretical Rayleigh scattering cross sections data base available, an interpolation method to obtain scattering cross sections in the photon energy range 59 keV to 1332 MeV and in the range of Z between 13 to 103 and for any scattering angle has been developed. The programme has now been used to generate a table of cross sections for all elements in the above photon energy range.

E. Theoretical Physics

E.1. High Energy Physics, Astrophysics and Cosmology

E.1.1. Studies on Quark-Gluon Plasma
Sibaji Raha in collaboration with Jan-e-Alam, Pradip Roy and Saurav Sarkar of VECC, Calcutta and Bikash Sinha of VECC and SINP, Calcutta).

Approach to chemical equilibration in ultrarelativistic heavy ion collisions within the framework of a QCD based kinetic theory developed earlier by Alam, Raha and Sinha is being studied.

E.1.2. Nonlinear Aspects of Multiparticle Production Process.

Sibaji Raha in collaboration with Debapriyo Syam of Presidency College, Calcutta.

Various features of the nonlinear map derived earlier from the collective model of multiparticle production processes in strong interaction are being investigated.

E.1.3. Phenomenological applications of Finite Temperature Field Theory

Sibaji Raha, and Abhijit Bhattacharyya.

The temperature dependence of hadron masses and decay widths from different effective hadronic models have been calculated. As QCD cannot describe the hadronic interaction one has to depend on models. The linear σ -model has been extended to include the ρ and a_1 mesons and the temperature dependence of π, ω, ρ and a_1 meson masses have been calculated from this model. The temperature dependence of meson masses have been non-linear σ -model. Effective meson masses have been calculated from Walecka model containing Δ baryon.

E.1.4. QCD Phase Transition in the Early Universe :

Sibaji Raha in collaboration with Jan-e-Alam of VECC, Calcutta, Pijushpani Bhattacharjee of IIA, Bangalore and Bikash Sinha of VECC and SINP, Calcutta.

In continuation of earlier work on the evolution of the strange quark nuggets formed in the putative first order cosmic QCD - hadron phase transition, the role neutrino inflation in governing the baryon inhomogeneity due to the evaporation from strange nuggets is being investigated.

E.1.5. Observational Astrophysics and Cosmology :

Sibaji Raha and M.H. Engineer in Collaboration with Bikash Sinha of VECC and SINP, Calcutta, A.K. Sen of Institute of Radiophysics and Electronics, Calcutta University, D. Syam of Presidency College, Calcutta, under the auspices of the Eastern Centre for Research in Astrophysics.

Under the aegis of the recently constituted Eastern Centre for Research in Astrophysics (ECRA) which Bose Institute joined on invitation as a full participating member in 1994, a detailed experimental programme on various aspects of high energy astrophysics, solar astrophysics and astronomy and cosmic ray studies at a high altitude station has been started. This project, conceived and co-ordinated by S. Raha and M.H.Engineer, involves the participation of and sharing of resources between several member institutions of ECRA as well as collaborators from other institutions from India and abroad. The experimental sites at Darjeeling and Tiger Hill have been indentified. Initial measurements are planned for late 1995 to look for solar neutrons and charged particles. Cosmological searches for exotic objects are planned for initiation in early 1996.

Measurements of radio and particle emission from the sun during the total solar eclipse on Oct.24th 1995 have also been planned using a log periodic antenna and plastic detectors as already designed.

E.2. Foundations of Quantum Mechanics.

E.2.1. Wave function collapse as a nonlocal quantum effect :

Dipankar Home, Ranjit Nair.

A variant of the EPR-Bohm example is used to argue that, in general, the notion of "wave function collapse" as an actual physical transition from a pure state to a mixed state leads to a conceptually significant (albeit unobservable) nonlocal effect at the level of individual events. This effect is independent of the interpretation of the wave function ("single particle" or "ensemble") and the details of the "collapse" process.

E.2.2. Position and contextuality in Bohm's causal completion of quantum mechanics : **Dipankar Home.**

It is shown that in Bohm's formulation, the assumption stipulating the position probability density to be $|\psi|^2$ is both necessary and sufficient for satisfying the requirement of "noncontextuality" (absence of any dependence on the specifics of the measurement procedure) of the observable probabilities at the ensemble level.

E.2.3. On boson trajectories in the Bohm model :

Dipankar Home and Partha Ghosh.

It is shown by using the relativistic wave equation of Kemmer that relativistic bosons have Bohmian trajectories, a notion which was hitherto thought to be impermissible.

E.3. Condensed Matter and Statistical Physics

E.3.1. Strongly correlated systems :

Indrani Bose and Saurabh Gayen

The coupled-chain (CC) model, described by a t-J-type Hamiltonian, has been studied when doped with two and more than two holes. The results described are exact and show that two holes can form bound states. The formation of anti-bound states of holes (number > 2) is shown using the exact Bethe Ansatz analysis. The result on the binding of holes is of relevance to high-T cuprate superconductivity and it is shown that a t-J-type Hamiltonian can lead to hole binding.

E.3.2. Magnetism :

Indrani Bose, Uma Bhaumik and Asinkumar Ghosh

The study of a frustrated spin-1/2 quantum antiferromagnet (AFM) in two dimensions has been completed. Using two different types of boson mean-field theories, it has been shown that in a particular parameter regime, the columnar dimer states appear to be the exact ground states. The excitation spectrum has also been derived.

The transverse dynamical correlation function for fully anisotropic $S = 1/2$ Ising-like Heisenberg AFM has been calculated in first-order perturbation theory and the results have been compared with the experimental data for CsCoCl_3 .

E.3.3. Condensed Matter and statistical physics :

M.H.Engineer

The Born Oppenheimer dynamics of one dimensional many electron-phonon systems has been worked out, and the effects of the geometric phase assessed; the geometric phase strongly affects the Peirels-Frohlich state and its excitations. Subgap photon absorption becomes possible which cannot be explained by the theory of Frohlich, though subgap photon absorption has been observed in a wide variety of quasi one-dimensional systems. It has also been shown that the ground state is degenerate (non-degenerate) depending on whether the total number of electrons is odd (even).

In collaboration with Pof. S.N. Behera and his students Harnath Ghosh and Manadipa Mitra the theory of geometric phase for a single electron interacting with a pair of phonon modes (wave vectors arbitrary, but equal and opposite) has been worked out.

PUBLICATIONS

1. Application of rate kinetic model of lyoluminescence of heat treated samples, B.K. Chatterjee, T.Sur and S.C. Roy, *Physical Review B* **50**, 708, 1994.
2. A neutron sensor based on superheated droplets, S.G. Vajapurkar, R.T. Patarkar, R. Raman, P. K. Bhatnagar and S.C. Roy, *Nuclear Tracks and Radiation Measurements*, **23**, 753, 1994.
3. Validity of form factors, modified from factors and anomalous scattering factor approximations in elastic scattering calculations, Lynn Kissel, B. Zhou, S.C. Roy, S.K. Sengupta

and R.H. Pratt, *Acta Crystallographica A* **51**, 271, 1995.

4. Compton profile of cuprous oxide, Santa Bandyopadhyay, A.K. Chatterjee, S.K. Saha A. Chatterjee, *Radiat. Phys. Chem.* **44**, 517, 1994.
5. Development of a sensitive hanging wire velocitimeter, B.Roy, B.K. Chatterjee and Swapan K. Saha, *Meas. Sci. Technol.*, **5**, 1159, 1994.
6. Single-hole dynamics in a coupled-chain model, Indrani Bose and Saurabh Gayen, *J. Phys. : Condens. Matter*, **6**, L405, 1994.
7. Heisenberg Hamiltonian with a Dzyaloshinski-Moriya interaction, Indrani Bose and Uma Bhaumik, *J. Phys. Condens. Matter* **6**, 10617, 1994.
8. Size distribution of different types of sites in Abelian sandpile avalanches, S. Banerjee, S. B. Santra and I. Bose, *Z. Phys. B* **96**, 517, 1995.
9. Dimerization of frustrated quantum antiferromagnet, Uma Bhaumik and Indrani, Bose *Proceedings of the DAE Solid State Physics Symposium*, Jaipur (Rajasthan), **37C**, 181, 1994.
10. Domain-wall pairing in the antiferromagnet CsCoCl_3 , Asinkumar Ghosh and Indrani Bose, *Proceedings of the DAE Solid State Physics Symposium*, Jaipur (Rajasthan), **37C**, 182, 1994.
11. Finite temperature effects on quark gluon plasma diagnostics, Abhijit Bhattacharyya, Jan-e Alam, Sibaji Raha and Bikash Sinha, *Proc. DAE Nuclear Physics Symposium*, (Ed. R.K. Choudhury and A.K. Mohanty), p.397, Bhubaneswar, 1994.
12. One, two or many steps of equilibration in quark-gluon plasma? Jan-e Alam, Sibaji Raha and Bikash Sinha, *Proc. DAE Nuclear Physics Symposium*, (Ed. R.K. Choudhury and A.K. Mohanty), P.353, Bhubaneswar, 1994.
13. Inelasticity fluctuations and finite size effects on factorial moments in multiparticle processes, Debapriyo syam and Sibaji Raha, *Proc. DAE Nuclear Physics symposium*, (Ed. R. K. Choudhury and A. K. Mohanty), p. 355, Bhubaneswar, 1994.
14. Primordial quark nuggets and their cosmological evolution. Jane Alam, Pijushpani Bhattacharjee, Sibaji Raha and Bikash sinha, *Proc. DAE Nuclear Physics Symposium*, (Ed. R. K. Choudhury and A. K. Mohanty), p. 421, Bhubaneswar, 1994.
15. Tunneling in magnetic fields, Abhijit Bhattacharyya and Sayan Kar, *International Journal of Theoretical Physics*, **33**, 1995

Annual Report

16. Successive equilibration in quark-gluon plasma, Jan-e Alam, Sibaji Raha and Bikash Sinha, *Physical Review Letters*, **73**, 1895, 1994.
17. Parameter dependence in the EPR-Bohm type experiment, D. Home and M.A.B. Whitaker, *Physics Letters A*, **187**, 227, 1994.
18. Wave function collapse as a nonlocal quantum effect, D. Home and R. Nair, *Physics Letters A*, **187**, 224, 1994.
19. Position and contextuality in Bohm's causal completion of quantum mechanics, D. Home, *Physics Letters A*, **190**, 353, 1994.
20. On Boson trajectories in the Bhom model, D. Home and P. Ghose, *Physics Letters A*, **191**, 362, 1994.
21. Exploring some quantum peculiarities in phenomena involving scattering and absorption, D. Home in : Dirac and Feynman — *Pioneers in Quantum Mechanics*, edited by R. Dutta and A.K. Ray (Wiley Eastern, new Delhi, 1994).
22. Berry's phase and the one Dimesional Superconducting state, M.H.Engineer published in the book "Polarons and Applications (ed. V.D.Lakhno; J.Wiley & Sons; Chicster(1994), Proc. in Non linear science pp 365-370.

BOOKS / ARTICLES

1. Riddles in Your Teacup : D. Home and P. Ghose, Institute of Physics Publishing, Bristol, 1994.
2. Einstein and Tagore - The Mathematician and the Mystic : D. Home and A. Robinson, The Times (London) Higher Education Supplement, 24 February, 1995.

Participation in Conferences/Symposia/ Training Programmes/Awards and Honours received.

Prof. S.C. Roy Presented papers in the 6th International Symposium on Radiation Physics held in Rabat, Morocco in July 1994. He also chaired one technical session of the symposium; visited the University of Pittsburgh to work on the continued programme on photon-atom scattering; elected member of the Executive Council of the International Radiation Physics Society; participated in the International Meeting on Boron Capture Neutron Therapy held in Chiang Mai, Thailand November 1994. He also delivered an invited talk on neutron dosimetry in the Chaing Mai University; attended the IPS Diamond

Jubilee Symposium held at IACS, Calcutta, in March 1995.

Prof. M.H. Engineer acted as a member of the panel of judges at the 12th young physicist Colloquium of IPA, 1994 on invitation; delivered an invited talk at SINP as past of their Colloquium series, 1994 ; visited the Inst of Physics, Bhubaneswar on invitation to collabornate on Problems in electron - Photon Physpics with Prof. S.N. Behera and his group for two weeks in OV 1994 ; delivered an invited talk on "status of the Geometric phase" in Bhubaneswar in OV, 1994.

Prof. M.H. Engineer delivered an invited talk and **Dr. A. K. Chatterjee**, **Dr. I. Bose** participated at the national conference of complex system held at IACS in January 1995.

Dr. Sibaji Raha visited the International Centre for Theoretical Physics at Trieste, Italy as a Senior Guest Scientist during February 1995; delivered colloquim at the Institute of Physics, Bhubaneswar ; served as Vice President of the Indian Physical Society; delivered an invited talk at the Diamond Jubilee Celebration Symposium of the Indian Physical Society, Calcutta, in March 1995.

Dr. A. K. Chatterjee participated and **Dr. I. Bose** served as a member of the Organising Committee on Current Trends in Condensed Matter Physics (S.I.N.P. Calcutta, August, 1994) and presented three papers ; Dr. Bose delivered a talk on strongly correlated systems organised by S.I.N.P., in August, 1994; delivered two lectures on Strong Correlation and High Temperature Superconductivity at the Physics and Applied Mathematics Unit Indian Statistical Institute, Calcutta in September, 1994; delivered an invited talk at the Winter School on Some Recent Developments in Quantum Many-Body Physics held in the Indian Institute of Science, Bangalore in Dec.94 - Jan.95; delivered an invited talk in the Diamond Jubilee symposium of the Indian Physial Society in March 1995 ; has become a member of the New York Academy of Sciences, U.S.A.

Dr. D. Home visited Queen's Univeristy of Belfast, Mathematical Institute Oxford, University of Durham and Birkbeck College, London). during September - October 1994 for research collaboration and lectures; delivered invited talk at the High Energy Physics Symposium (Department of Atomic Engrgy) at Santiniketan during December'94 - January 1995; delivered invited talk at the International Conference on

Differential Equations at Hyderabad during February 1995.

Dr. B. Roy participated in the "Second West Bengal State Science Congress" held at Science College, Calcutta, in February - March, 1995.

A. Dev. Saurabh Gayen, Uma Bhaumik and Asimkumar Ghosh presented papers in the Current Trends in Condensed Matter Physics (S.I.N.P., Calcutta, August, 1994).

Uma Bhaumik and Asimkumar Ghosh presented papers at the Annual DAE Symposium, Jaipur (Rajasthan), December 1994.

Abhijit Bhattacharyya participated in BCSPIN summer school on High Energy Physics and Cosmology - held in Kathmandu (Nepal) during May/June 1994; DAE Nuclear Physics Symposium held at Bhubaneswar during December 1994.

Ph. D. Awarded

Name	University/subject	Year	Title	Supervisor
Aparna Das	Jadavpur/Physics	1994	Application of a sliding Cell technique for the study of diffusion phenomenon in some liquid system	Dr. S. N. Gangdar
Sitanshu Bikas Santra	Calcutta/Physics	1994	Effect of rational constrain on the scaling behaviour of some lattice statistical models	Dr. I. Bose.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATION/POST-DOCTORAL FELLOW/SENIOR RESEARCH FELLOW/JUNIOR RESEARCH FELLOWS :

N.K.Halder (upto June 30,1994) S. Dutta (upto July 31,1994) A.Bhattacharyya, S.Gayen, A.Deb, U.Bhaumik, A.K.Ghosh.

OTHER SUPPORTING STAFF MEMBERS

B.Bhasdar, R.K.Roy, G.R.Paul, K.P.Das, C.R.Paul, N.C.Dey, A.K.Ghoshal, K.C. Dey, S.P. Sinha, B.P.Ram, D.Deo, B.Dutta, D.K.Thakur, S.K.Basu, Kissan Das

GRANTS - IN - AID SCHEMES

Principal Investigator	Project
Prof. S.C. Roy	S.D.D
Prof. S.C. Roy	Atomic Energy Regulatory Board (AERB).
Dr. B.K. Chatterjee	C.S.I.R.

Chemistry

Faculty : Prof. A. Ghosh (Chairman) Prof. N.K. Sinha, Prof. P. Chakrabarti, Prof. A.K. Barua (C.S.I.R. E.meritus Scientist) Prof. P. Bhattacharyya, Prof. D. Ghosh, Dr. P. C. Sen, Dr. S. Mishra (from 16.3.1995) Dr. M. Chakraborty, Dr. K.P. Das, Dr. J. Basu, Dr. M. Kundu (Assigned from Microbiology department) Dr. P. Das (from 14.2.1995)

INSTITUTIONAL PROJECT I

A. Application of biotechnological methods for the improvement of oil in oil seeds *Brassica campestris* and *Brassica juncea* with respect to quality.

Dolly Ghosh, Ashis Bhattacharyya, Manas Pathak, Krishnakali Niyogi, Sharmila Chattopadhyay and Aniruddha Aich.

Palmitoyl ACP thioesterase from *Madhuca* and Stearoyl ACP thioesterase from *Mango Kernel* as reported earlier has been further purified upto 2500 folds and 100 folds respectively. The molecular weight determination study on Superose 12 column indicates that the enzyme exists in a high multimeric form in native state

Oleoyl ACP thioesterase from *Brassica Campestris* has been purified and the enzyme is found to exist in dimeric form.

Very low glucosinolate has been found in the leaves of various wild and hybrid *Brassica* plants.

INSTITUTIONAL PROJECT II

A.1. Chemical & biological screening of a marine Polychaete

P. Bhattacharyya A.K. Barua, S.Roy, K. Basu.

The extract of a marine polychaete, *Lembrinreis sp.* having antibacterial properties showed the presence of three aromatic compounds. One of these has been isolated in a pure Crystalline state and a tentative structure has been arrived at.

A.2. Development of scale up technology for EPA & DHA.

A. Ghosh, D. Banerjee, T.K. Patra in collaboration with Dr. S. Misra and Prof. A. Chowdhury (Department of Marine Science, University of Calcutta)

A highly concentrated form (99%) of EPA and docosahexaenoic acid have been prepared. Quality of both the products meets international standards and suitable for export substitution. Initiative has now been taken to supply these two important fatty acids to users.

A.3. Ether linked acylglycerols and phospholipids from *Dasyatis bleekeri* (Blyth)

A Ghosh, T.K. Patra, D. Dal, D. Bajerjee in collaboration with Dr. S. Misra and Prof. A. Chowdhury (Department of Marine Science, University of Calcutta).

Several novel 1-o-alkyl - 2,3 diacylglycerols, 1,2-di-o - alkyl - 3- acylglycerols as well as phospholipids have been isolated, purified and their structures have been determined.

INSTITUTIONAL PROJECT III :

A. Physical, Chemical and Structural Studies on Proteins

A.1. Studies on protein folding

N.K. Sinha and Tapan K. Chadhuri.

The conformational changes with the progress of refolding of fully reduced, denatured trypsin-subtilisin inhibitor from turtle eggwhite have been studied by circular dichroism and fluorescence measurements and the spectra of refolded inhibitor obtained in 30 minutes are almost identical with those of native inhibitor.

A.2. Studies on low molecular weight trypsin inhibitors - Amino acid sequence:

N.K. Sinha and Umesh Ch. Halder.

The LA-2 inhibitor isolated from the seeds of *Luffa acutangula* contains 29 amino acid residues including 3 disulphide bonds. Its disulphide bonds have been reduced and pyridylethylated with 4-vinyl pyridine. The amino acid sequence of the

pyridylethylated derivative of the inhibitor has been determined by an automatic gas phase sequencer. It shows strong sequence homology with other squash family inhibitors.

A.3. Interactions of proteins with grafted solid surfaces :

K.P. Das and Anuradha Bhaduri.

Solid surfaces like silica and alumina have been fabricated by chemical modification. 13 types of L-amino acids have been grafted to these surfaces by means of CNBr and glutaraldehyde activation. On these amino acid grafted surfaces, interactions of β -Lactoglobulin and its modified counterpart have been studied. Adsorption isotherms have been constructed on each of these varied surfaces. The most striking feature lies with the tryptophan grafted surfaces.

A.4. Physico-chemical studies on protein stability and formation of microcapsules therefrom

K.P. Das and Chaitali Bhattacharjee.

The physico-chemical basis for the unusually high stability of the protein β -Lactoglobulin is being investigated by spectroscopic techniques.

A.5. Chemical modification of some low molecular weight proteins and some standard proteins

K.P. Das and Anupa Bhattacharya.

The inhibitors MC-1 and MC-2, two low molecular weight proteins isolated from *Momordica charantia* alongwith β -lactoglobulin were acetylated at the L-amino groups of Lysine residues. The extent of acetylation varies from 70 - 80% in each case. Fluorescence spectra of modified proteins reveal that the environment around the tryptophan residues in the proteins become exposed upon acetylation. CD spectra of the modified proteins showed that the secondary structures are substantially different from those of the native ones.

A.6. Lyotropic Liquid Crystal Polymorphism in F-actin

P. Das

Characterisation of the liquid crystal (LC) polymorphism in filamentous actin has been undertaken in an effort to understand the role of the state of aggregation of the protein muscle mechanics. The correlation of the structure of the

individual polymer chains with the observed symmetry of the LC phases is being scrutinized. Polarizing microscopic and rotatory dispersion studies, performed elsewhere by the investigator, will be supplemented by small angle X-ray diffraction and fluorescence depolarization studies in future.

B. Chemistry of Plant Products.

M. Chakraborty, Shampa Khasnobis, A.C. Nath.

A thorough chemical investigation of *Murraya koenigii* led to the isolation of two new C_{13} -Carbazole alkaloids. The structures of the alkaloids have been established by spectral analysis and synthesis. In this connection an expedient method for the N-formylation of carbozoles is being developed.

From the seeds of *Polyalthia longifolia* the major butenolide diterpene and from bark 2-oxo-kolavenic acid have been identified.

C. Synthesis of heterocyclic and organo sulfur compounds.

M. Chakraborty, Shampa Khasnobis P. Bhattacharyya, A.K. Maity and K. Basu.

A new synthetic avenue to pyrrolo carbazoles is being developed through the employment of Batcho-Leimgruber's aminovinylation sequence to indoles.

In continuation of previous work on hetero Diels-Alder reactions, newer azadienes are being attempted to be synthesized for their subsequent cycloaddition with standard dienophiles with the aim to evolve newer annulated heterocycles of pharmacological and academic interest.

A simple method for the preparation of β -hydroxy sulfone and β -hydroxy sulfide from different oxiranes under neutral condition in fairly good yield has been developed by the application of polyethylene glycol 4000, a phase transfer agent and solvent for promoting variety of reactions. The reaction was extended for the preparation of alkylsulfones and β -oxo sulfones from alkyl halides and β -oxohalide respectively.

D. Studies on Prostaglandin Biosynthesis :

D. Ghosh, Mallika Roy and Anirudha Aich

To examine that cyclo-oxygenase and not the peroxidase or isomerase is the target site of Ca^{+2}

action, the membrane bound PG synthetase complex of goat Vesicular microsomes were solubilised and the cyclooxygenase separated, purified to homogeneity. Kinetic studies of this pure cyclooxygenase fraction in presence of Ca^{+2} (2 mM) showed the same type of modulation of the enzyme as with crude microsomal fraction. Presence of Ca^{+2} exerted induction of an initial lag followed by a stimulation of the enzyme activity.

To explore the role of the trienoic acid, the precursor of monoenoic prostaglandins on the production of the dienoic prostaglandins in goat seminal vesicles, the presence of the trienoic acid, in the vesicular gland was confirmed by Argentation TLC, followed by GLC and Mass spectroscopy. The K_m and T_{max} values of both the substrates of PGS were compared. The PGE_2 synthesis using C 20:4n6 as substrate was inhibited by C 20:3n6 fatty acid supporting the contention that C 20:3n6 fatty acid has a controlling effect on the PGE_2 biosynthesis by PG synthetase complex.

Analysis of the percentage of C 20:4n6 and C 20:3n6 fatty acids and the PGE_2 synthetase activity in GSV glands showed that there are two reproductive cycles of goat in a year.

E. Studies on Biomembranes : Structure and function of the human erythrocyte membrane,

Manikuntala Kundu, Parul Chakrabarti, and Joyoti Basu, Amit. K. Das, Raja Bhattacharya, P.T. Srinivasan.

Factors contributing to premature removal of erythrocytes from the circulation in chronic myelogenous leukemia (CML) have been analyzed leading to the anemia. Band 3, a major erythrocyte membrane glycoprotein, was found to undergo topographic redistribution leading to enhanced clustering, in CML, probably due largely to the binding of oxidatively damaged heme compounds to the CML erythrocyte membrane. In addition, lipids of the CML erythrocyte membrane were more susceptible to oxidative damage than in the normal erythrocytes, and band 3 as well as key cytoskeletal proteins such as spectrin, ankyrin and protein 4.1 were degraded to a far greater extent than the normal proteins, upon application of exogenous oxidative stress.

Thalassemic human erythrocytes undergo increased erythrophagocytosis. This is probably a consequence of externalization of

aminophospholipids leading to loss of phospholipid asymmetry, and/or increased susceptibility to oxidant stresses leading to breakdown of membrane proteins, in particular of band 3.

Anion transport function is also impaired in thalassemia, probably due to the marked association of heme compounds with the cytoplasmic domain of band3 leading to conformational alterations of band 3.

F. Beta-lactam resistance in Shigella dysenteriae

Jyoti Basu Manikuntala Kundu, Parul Chakrabarti, Anindya Sunder Ghosh, Alak Kanti Kar, Seababrat Mahapatra, and Jasimuddin Ahmed.

F.1. Cloning of the PBP7 gene of Shigella dysenteriae

The 2-6kb region of the EcoRI- digested *S. dysenteriae* chromosomal DNA was cloned in Agt11. The amplified Agt11 library was screened by immunoblotting with the antibody against PBP7. Recombinant DNA was isolated from the positive clones, digested with SstI, and a 2.7 kb insert was subcloned in pK19. The subcloned insert when hybridized using a non-degenerate probe designed from the N-terminal sequence, gave a positive signal.

F.2. Penicillin-binding proteins and beta-lactam susceptibility in Shigella dysenteriae

Cefoxitin-resistant mutants (one clinical isolate and one laboratory Mutant) showed overproduction of PBP5. Moreover, PBP5 in these two mutants was more susceptible (500-fold) to cefoxitin than in the case of the sensitive strain C152. PBP5 is a DD-carboxypeptidase and a non-essential beta-lactam target. Over production, alongwith increased sensitivity of this target towards cefoxitin, leads to a "scavenging effect", i.e. the beta-lactam binds preferentially with this high affinity target rather than the essential targets. Moxalactam and aztreonam resistance in *S. dysenteriae* was found to be associated with decreased affinity of PBP3 for these antibiotics, in both a clinical isolate and a laboratory mutant.

F.3. Outer membrane proteins and beta-lactam susceptibilities

Shigella dysenteriae contains five major outer membrane proteins, Moxalactam resistance could be correlated with the level of OMP1 (Mutant 2). A laboratory mutant, with decreased

amount of OMP1 was also moxalactam-resistant. Both were identical in terms of the sensitivity of PBP3 towards aztreonam. However, increased aztreonam resistance in Mutant 2, suggests that OMP1 is also probably associated with aztreonam permeability. Moxalactam resistance was associated with concomitant imipenem sensitivity in Mutant 2. Since mutant 2 contained elevated amounts of OMP2, this sensitivity may be linked to the increased amount of this particular OMP. This is further supported by the fact that the laboratory mutant, Mutant 7 which also contained increased amounts of OMP2, was imipenem-sensitive.

G. Structure, function and interaction of proteins

G.1. Characterization of a partially purified protein kinase from goat spermatozoa

Parimal C. Sen, Rita Sikdar, Atin K. Mandal and Kausik Ray.

A protein kinase has been identified, partially purified from the cytosolic fraction of goat spermatozoa. The kinase is found to be inhibited by staurosporin, insensitive to W_3 and stimulated by phorbol ester suggesting it be Protein Kinase - C. Though some activity is found in the membrane but the level is lower than that in the cytosol. The enzyme uses histone as a substrate. The presence of PK-C in goat spermatozoa may be involved in the phosphorylation of certain proteins including ion transport proteins which may play important role in fertility regulation.

G.2. The phase behaviour of L- α -phosphatidylcholine in the presence of chlorpromazine under different experimental conditions

Parimal C. Sen, Gautam Adhikary, Sucheta Chandra and Rita Sikdar.

The phase behaviour of L- α -phosphatidylcholine liposomes has been studied as a function of temperature, pH, ionic strength etc. in the presence and absence of chlorpromazine by polarization method using 1,6 diphenyl 1,3,5-hexatriene as a fluorescence probe. The gel crystalline to liquid crystalline (TC), liquid crystalline to cubic (T11) and cubic to hexagonal (HII) transition temperatures in multi layers liposomes have been detected and are found to be affected by chlorpromazine under different experimental conditions.

G.3. Characterization of Na, K-ATPase inhibitor proteins from rat brain

Parimal C. Sen Dipankar Bhattacharyya, and Jitendra Gupta.

A number of low and high molecular weight proteins have been purified and found to inhibit Na, K-ATPase with varying I_{50} values. However, a few of them were found to inhibit Ca, Mg-ATPase also with higher I_{50} values. They strongly inhibited the phosphorylation of histone GPK-C.

H. Investigations of the detailed lipid composition of various organs of goat

A Ghosh, G. Chattopadhyay, and D. Banerjee.

Detailed lipid composition of various organs of goat, viz, liver, lung, kidney, heart, pancreas and body flesh have been determined, utilising chemical, enzymatic, chromatographic and spectroscopic techniques. The alkyl and alkenyl chains of various phospholipids of goat sperm plasma membrane have been determined using GC and GCMS.

INSTITUTIONAL PROJECT IV

A.1. Field trial of encapsulated bio-immunomodulator

A.K.Barua, D. Ghoshal in collaboration with K.P.Das

The encapsulated BIM, given through water to adult broiler poultry, could prevent mortality and morbidity during disease outbreak. Comparison with nasal dose indicated that the nasal form of delivery was statistically more efficient than the oral one

A.2. Immunomodulation of Enteric infection

P. Bhattacharyya, D. Ghoshal, and S. Dutta.

The immunomodulatory effect of bone marrow derived cytokine, was studied in mice immunized with Salmonella typhi "H" antigen. After immunization the secretion of bone marrow cytokine fr 1 shows a initial suppression in Basal diet fed mice followed by stimulation whereas the cytokine secretory pattern showed only stimulation in malnourished mice. Injection of Bone Marrow cytokine fr 1 in malnourished immuno compromised animal improved their neutrophil function and antibody response to Salmonella typhi "H" antigen, which indicates that the cytokine acting as and immunomodulator is much more effective in malnourished animals than basal diet fed where a feed back inhibitory effect may be present.

A.3. A bidirectional communication between bone marrow and thymus

P. Bhattacharyya, D. Ghoshal and S. Dutta.

The immunomodulatory effect of both the bone marrow and thymus secretory protein was studied in mice. Injection of bone marrow cytokine fr 1 in both Balb/c animal stimulates the thymus secretory protein, whereas the injection of thymus cytokine fr1 showed a similar pronounced effect in the bone marrow secretory protein level. This effect is statistically more significant in malnourished immuno compromised mice than Balb/c control.

INSTITUTIONAL PROJECT V

A. Beta-lactam resistance and penicillin-binding proteins (PBPA) of Mycobacteria

Manikuntala Kundu, Jyoti Basu, Parul Chakraborti, Ganesh Gopal, Seababrita Mahapatra, Tapan Mukherjee, Dhiman Basu, Sanjoy Mukherjee.

A.1. Expression of the PBP1A of Mycobacterium leprae in Escherichia coli : (in collaboration with the University of Liege, Belgium)

A cosmid library of the *M. leprae* genome has been partially sequenced and introduced into the EMBL Databank. Computer-aided homology search helped to identify the PBP1a gene in cosmid B577. PBP1a possessed all the signature sequence which are characteristic of the known high molecular mass (HMM) PBPs of class A. A fragment of 6100 bp containing the PBP1a gene was cloned into pUC18 giving the plasmid pDML 901. A 2710 bp fragment containing the PBP1a gene was isolated from pDMP 901 and cloned in pET 28a generating pDML 905 which was introduced into *E. coli* BL21 DE3. Cells were grown to an optical density of 0.7, followed by induction with 1mM IPTG. Membranes were prepared and subjected to [14 C]penicillin binding. Expression of a new PBP of Mr 82,000 was evident after fluorography of these membranes. This PBP was highly resistant to penicillin, showing saturation at a penicillin concentration of 10^{-6} M.

A.2 Cloning of the gene for the 49 kDa of *M. smegmatis*

Two degenerate probes were designed based on the N-terminal sequence of the 49 kDa PBP. A BamHI library of *M. smegmatis* chromosomal DNA was generated in the vector pK19. The two probes were used to screen this library by colony hybridization. Two positive clones were picked up. Plasmids from these clones were digested with BamHI and screened by hybridization again. Positive bands were subcloned in pK19.

A. 3. Kinetic studies on the interaction of the 49 kDa PBP with peptide and thioester substrates

The 49 kDa PBP hydrolyzed both the tripeptide AC₂-L-lys-D-ala-D-ala and the pentapeptide UDP-MurNAc-L-isogln-meso-diaminopimelic acid-D-ala-D-ala. The k_{cat}/K_m values were comparable, suggesting that both the substrates were hydrolyzed with equal efficiency.

Among the thioester substrates, benzoyl-D-ala-thioglycolate was the preferred substrate for this PBP. Increasing concentration of the acceptor D-ala caused an increase of the k_{cat} and the K_m so that the k_{cat}/K_m values remained constant. At a fixed concentration of the donor, and under conditions where less than 10% of the thioester was consumed, the transpeptidation (T)/hydrolysis (H) ratio was directly proportional to the D-ala concentrations. At fixed concentration of D-ala, the T/H ratios were independent of the thioester concentrations.

A.4 Characterization of beta-lactam resistant mutants of *M. smegmatis*

Resistance to beta-lactam antibiotics in *M. smegmatis* has been found to be associated with altered permeability of the beta-lactams suggesting changes in the beta-lactam channels in these resistant mutants. Resistance to cephalothin was accompanied by a four-fold decrease in permeability in the resistant mutants compared to the wild type.

B. Mycotin-a lectin involved in the adherence of Mycobacteria to macrophages Jyoti Basu, Manikuntala Kundu, Parul Chakraborti and Swapnajan Goswami,

M. smegmatis, *M. tuberculosis*, *M. leprae*, *M. kanosarii*, and *M. avium* contain on the cell surface molecules immunogenically related to mycotin-a mannan-specific lectin of M_r 12-14 kDa isolated from the culture filtrate of *M. smegmatis*. Mycotin binds to macrophages in a dose-dependent manner. The binding is inhibited by manna. All the above five species adhere to macrophages, and this adherence is inhibited by mannan and by anti-mycotin antibody. Anti-mycotin antibody gives only one positive band in Western blots using cell wall proteins of *M. avium* (67 kDa) and *M. tuberculosis* (35 kDa). Studies demonstrate for the first time that lectin-sugar interactions are probably involved in attachment of pathogenic mycobacteria to macrophages. Intervention of mycotin-macrophage interaction may open avenues for combatting Mycobacterial diseases.

PUBLICATIONS

1. Human erythrocyte membrane protein 4.2 is palmitoylated : Amit K. Das, Raja Bhattacharya, Manikuntala Kundu, Parul Chakrabarti and Joyoti Basu, *Eur. J. Biochem.* **224**, 575-580, 1994.
2. Characterization of a 38 kDa penicillin-binding protein and its possible involvement in maintaining stationary-phase cells of *Shigella dysenteriae*: Seabrat Mahapatra, Joyoti Basu, Josef van Beeumen and Manikuntala Kundu, *Microbiol.* **140**, 3177-3182, 1994.
3. Mycotin : a lectin involved in the adherence of Mycobacteria to macrophages : Swapnanjan Goswami, Saurav Sarkar, Joyoti Basu, Manikuntala Kundu, Parul Chakrabarti, *FEBS Letters*, **355**, 183-186, 1994.
4. NMR Studies of 4 (3H)-Quinazolinones and 4 (3H) Quinazolinethiones : M. Chakrabarty, A. Batabyal, M.S. Morales-Rios and P. Joseph-Nathan, *Monatsh. Chem.* (Austria), **126**, 789-794, 1995.
5. Surface properties of some low molecular weight proteins : U.C. Halder, S. Saha, N.K. Sinha and K.P. Das, *J. Disp. Sci. Technol.* **15**, 671-685, 1994.
6. Adsorption interaction of native and chemically acetylated beta-lactoglobulin at the alumina-water interface : Anuradha Bhaduri and K.P. Das, *J. Disp. Sci. Technol.* **15**, 165-188, 1994.
7. The amphiphilic drug induced tryptophan fluorescence change of ion transporting ATPases : Gautam Adhikary, Sucheta Chandra, Rita Sikdar and Parimal C. Sen, *Biochem. Biophys. Acta*, **1188**, 220-226, 1994.
8. Alteration of the micro viscosity of plasma membranes of rat enterocytes by a heat stable enterotoxin of *Escherichia coli* : A. Ghosh Chaudhury, Parimal C. Sen and Uma Ganguly, *Biochem. Biol. Inter.* **35**, 567-574, 1995.
9. Carbazole alkaloids from *Murray koenigii* : P. Bhattacharyya, A.K. Maiti, K. Basu and B.K. Chowdhury, *Phytochemistry*, **35**, 1085, 1995.
10. Production of 1, 2-Azidoalcohols by regioselective ring opening of oxiranes catalysed by Amberlite resin : G.K. Biswas, A.K. Maiti and P. Bhattacharyya, *J. Chem. Research (s)*, 380, 1994.
11. Polyethylene glycol (PEG) 400 catalysed regioselective nucleophilic ring opening of oxiranes - a new and convenient synthesis of β -hydroxysulfone and β -hydroxysulfide : A.K. Maiti and P. Bhattacharyya, *Tetrahedron*, **50**, 483, 1994.
12. Immunomodulation of malnourished mice bearing Dalton's lymphoma : D. Ghoshal and S. Manna, *Asia Pacific J. Chem. Nut.* **1-4**, 1995.
13. Haemoglobin as an indicator of immunocompetence of children from low economic group under mass vaccination programme : D. Ghoshal, R. Majumder, R. Dey, G. Ghosh and A.K. Barua, *Trans. Bose Res. Inst.* **56**, 1, 1993.
14. Naturally occurring ether-linked phosphatidylcholine activates phosphatidylinositol 3-kinase and stimulates cell growth : S. Misra, A. Ghosh and L. Varticovski, *J. Cell. Biochem.*, **55**, 146-153, 1994.
15. Oil content and fatty acid composition of seed of various ecotypes of *Arabidopsis thaliana* : A search for useful genetic variants : Manas K. Pathak, Dolly Ghosh, Mrinal K. Maiti and Sudhamoy Ghosh, *Current Science*, **67**, 470-472 1994.
16. Crystal structure of 2, 4-Diamino pyrimidine sulfate C₈H₁₆N₈.SO₄H₂O. G. Biswas, S.P. Biswas, A.C. Gomes, D. Ghosh, Y. Iitaka and A. Banerjee, *Acta Crystal. C*, 50, 1994.

Ph. D. Awarded

Name	University/Subject	Year	Title	Supervisor
Rathin Chattopadhyay	Calcutta/Biochemistry	1995	Studies on penicillin interactive proteins of <i>Mycobacteria</i> .	Dr. Joyoti Basu

Ph. D. Awarded

Name	University/Subject	Year	Title	Supervisor
Archana Batabyal	Jadavpur/Chemistry	1995	Chemistry of Marine Natural Products and Synthesis and reactions of heterocycles	Dr. Manas Chakrabarty

Participation in Conferences/Symposia/ Training Programme/Award and Honours

Prof. Parul Chakrabarti was Co-convenor and chaired the session on "Membrane Structure and Dynamics" in the XVIth IUBMB Congress held in New Delhi and delivered a lecture in the same session ; visited the Department of Biochemistry and Molecular Biology, Pennsylvania State University, in connection with the INDO-US collaborative project ; delivered a talk at the Schering Plough Corporation, New Jersey ; participated in the symposium on Lipid peroxidation in I.I.Sc., Bangalore.

Dr. Joyoti Basu, Dr. Manikuntala Kundu Sri Seabrat Mahapatra completed a six month visit to the Centre for Protein Engineering, University of Liege, Belgium, in connection with the INDO-EC collaborative project; Dr. Basu presented a paper at the FEBS Special Meeting on Biomembranes held in Helsinki in June-July, 1994.

Dr. Parimal C. Sen delivered an invited talk in the Satellite Symposium on *Cellular Calcium Homeostasis* at IICB, Calcutta in 16th IUBMB Congress in 1994 ; Prof. D. Ghosh, Dr. R. Sikdar presented papers and organised a one-day seminar on Trends in Immunology, under the auspices of Society of Biological Chemists (I), Calcutta Branch.

Amit K. Das, Raja Bhattacharya, Tapan Mukherjee presented papers at the XVIth IUBMB Congress in New Delhi.

Dr Manas Chakrabarty presented a paper in the 10th International Conference on Organic Synthesis held in December, 1994 at the I.I. Sc., Bangalore ; Chaired two sessions 'Organic Chemistry' and 'Biochemistry and Medicinal Chemistry' in the 31st Annual Convention of Chemists, held in December 1994 at Banaras Hindu University, Varanasi; elected a Member of the Publication Committee and Finance Committee of the Indian Chemical Society, Calcutta, 1994; elected Member, Board of Associate Editors of the J. Indian Chem. Soc. Calcutta; delivered an invited lecture in Symposium on the occasion of 65th anniversary of Prof.A.K. Barua.

Dr. Jitendra Gupta, Dipankar Bhattacharyya Kausik Ray and Atin K. Mandal participated in the meeting of Society of Biological Chemists, I.A.C.S., Calcutta on Modern Trends of Immunology, 1994 ; participated in Young Scientist Symposium on Frontiers of Reproductive Biology, I.C.M.R., held at University of Hyderabad, February, 1995 ; presented a poster in First Congress of FIPS held at New Delhi, March 1995.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dr. Krishnakali Niyogi, Dr. Sarmila Roy, Dr. Sarmila Chattopadhyay, Dr. S. Subramaniam, Dr. D. Ghosal, Dr. Ganesh Gopal, Dr. Gautam Chattopadhyay, Dr. Rita Sikdar, Dr. Jitendra K. Gupta, Dr. Anupa Bhattacharyya, Dipankar Banerjee, T.K. Patra, (Guest Worker), Swapnanjan Goswami, Sanjoy Mukhopadhyay, Seabrat Mahapatra, Raja Bhattacharyya, P.T. Srinivasan, Tapan Chowdhury, Umesh Chandra Haldar, Amit K. Das, Dhiman Basu, Alok Kanti Kar, Chaitali Bhattacharyya, Kausik Ray, Atin K. Mandal, Anindya Sunder Ghosh, Jasimuddin Ahmed, Archana Batabyal, Amiya Kr. Maiti, Anuradha Bhaduri, Ashis Bhattacharyya, Tapan Mukherjee, Mallika Ray, Dipankar Bhattacharyya, Alex C. Varghese, Sarmistha Dutta, Sampa Khaushol, Anindya Sunder Ghosh.

OTHER SUPPORTING STAFF MEMBERS

Kalyan Basu, Nirmal K. Das, Prasanta Pal, Anirudha Aich, Debaprasad Roy, Sukumar Maitra, Gopinath Mukherjee, Mritynjoy Gayan, Paresh Bhattacharya, Alok K. Kundu, Pranab K. Dey, Bhabani Banerjee, Gour Ch. Biswas, Brindaban Ghosal, Chittaranjan Santra, Chittaranjan Ghosh, Sk. Ekhas Ali, Debadas Nandy, Rama Mukherjee, Gopal K. Biswas, Amar Nath Bhatta, Subhas Ch. Pal, Kodan Das

Grnats-in-Aid Scheme

Investigator/Co-investigators	Title	Financed by
Dr. Joyoti Basu	Studies on the role of palmitoylation of human erythrocyte membrane proteins	D.S.T.
Dr. Mani Kuntala Kundu	β -lactam antibiotics and Shigella : Studies on penicillin-binding proteins of Shigella	I.C.M.R.
Dr. Joyoti Basu	Effect of Oxidative stress on erythrocyte membrane structure and function in chronic myelogenous leukemia	C.S.I.R.
Dr. Parimal C. Sen	Regulation of ion transporting enzymes by protein kinase, stimulator or inhibitor proteins in goat spermatozoa	C.S.I.R.
Prof. Parul Chakrabarti/Dr. Joyoti Basu, Dr. Mani Kuntala Kundu	Penicillin binding proteins and β -lactamase of Mycobacteria	Indo-EC
Prof. Parul Chakrabarti/Dr. Joyoti Basu, Dr. Mani Kuntala Kundu	Functional significance of abnormalities of erythrocyte membrane in myeloproliferative disorders	Indo-US
Prof. A.K. Barua	Search for bioactive compounds from Bay of Bengal	C.S.I.R.
Prof. A. Ghosh	Development of scale up technology for the production of biologically active fatty acids and lectins from marine organisms	DBT

Botany

Faculty : Prof. S. N. Ganguly (Chairman), Prof. B. Ghosh, Prof. A.N. Lahiri Majumder, Prof. S. Chanda, Dr. S. Gupta, Dr. B.B. Mukherjee, Dr. K.K. Mukherjee, Dr. S. Sen Mandi, Dr. P.K. Saha, Dr. D.N. Sengupta, Dr. S. Bhattacharyya, Dr. S. Gupta - Bhattacharyya, Dr. T.K. Ghose.

INSTITUTIONAL PROJECT I

A. Plant responses to abiotic stresses

B. Ghose, A.N. Lahiri Majumder, S. Gupta, B.B. Mukherjee, D.N. Sengupta, M. Chattopadhyay, B.S. Tiwari, A. Bose, M. Roy, A. Saha, A. Roychoudhury, S. Bagchi, S. Bhattacharjee, R. Deb, N. Hait, G. Gangopadhyay, S. Basu, S.R. Gupta.

Studies of polyamine metabolism under environmental stress in crop plants have been carried out for a number of years in this Department. Current work involves cloning of the gene for arginine decarboxylase (ADC) from rice. Thermal stress induces accumulation of both free and conjugated polyamines in the calli of thermotolerant rice varieties, with increase in polyamine oxidase. Mutants of polyamine metabolism have been generated in *Arabidopsis thaliana* with a view to develop a genetic system.

Net photosynthesis in rice under salinity or thermal stress shows a decreasing trend in various sensitive cultivars - the tolerant cultivars being less affected. Salinity or Salt-stress induce gradual decrease in PSI and PS II activities, PS II transport being more sensitive to saline-stress. Regulation of Rubisco at different stages of maturation in different cvs of rice with varying degrees of thermotolerance shows greater thermal stability of the enzyme from the flowering stage in comparison to those isolated from the premature or milky stage.

Increased salinity also affects the chloroplastic fructose-1, 6-bisphosphatase activity adversely, the effect being more pronounced in the salt-sensitive varieties of rice. Activity of the purified fructose-1, 6-bisphosphatase *in vitro* shows consistent decline under salt-environment, which seems to be protected by several known cyclitol osmoprotectants.

Salinity stress profoundly influences inositol metabolism in plants. Activity of both chloroplastic and cytosolic inositol synthase(s) (Ino 1) are enhanced several-fold in salt-tolerant rice cul-

tivars producing increased amount of inositol but no ononitol or pinitol (methylated inositol), suggesting probable absence of inositol methyl transferase (Imt) function. In *Mesembryanthemum crystallinum*, both Ino 1 and Imt are coordinately expressed under salt-environment, suggesting that the entire pathway from glucose-6-phosphate to ononitol/pinitol is under salt-regulation [Partly in collaboration with Prof. Hans Bohnert (U.S.A)]. Biochemical characterization and comparison of the homogeneous chloroplastic and cytosolic inositol synthase(s) from *Euglena*, and *Oryza* have been done.

NaCl-adapted callus lines of three indica varieties of rice (Basmati 370, Meghna and SR 26B) were isolated and regeneration media for all three varieties were standardized. The NaCl-adapted calli grew efficiently in media containing iso-osmotic concentration of mannitol and accumulated proline. Further screening based on biochemical parameters for salt-tolerance among the regenerated somaclones is underway.

NaCl- and mannitol-tolerant lines from *Nicotiana tabacum* and *Brassica juncea* were initially isolated by plated cell suspension technique and calli derived by progressive selection. Adapted tissues acquired potentiality to retain maximum amount of proline and showed elevated peroxidase activity probably associated with osmotic adjustment.

Studies on expression of genes for the transcription factor EmBP-1 (which binds to the abscisic acid responsive element, ABRE), salt and actin under salinity-stress in roots, sheaths and leaves in salt-tolerant (Pokkali) and salt-sensitive (IR 29) rice show induction of EmBP-1 and actin in roots and salt in sheaths after 3 days of NaCl-stress, as revealed in Northern blots. Two transcripts of EmBP-1 and actin were detected in roots of both cvs. during 6hr. salt stress. Conditions for gel mobility shift assay for ABRE DNA and extracts of nuclei prepared from control and

salt stressed roots and leaves, have been standardized.

B. Plant Breeding and tissue culture

B.1. Breeding for submergence tolerance and androgenesis in Rice.

Sukumar Gupta, Nirmal Mondal, and Aniruddha Das.

Interspecific and intervarietal hybridization between submergence susceptible (Pankaj and Mashuri) and tolerant (Fr 13A and *O. rufipogon*) varieties showed that the average dominance was within the range of incomplete dominance. The hybrids involving Fr 13A with Pankaj and Mashuri and those of rufipogon with Pankaj and Mashuri appeared to be promising.

PAGE analysis of esterase, peroxidase, alcohol dehydrogenase, PEP carboxylase and Malic dehydrogenase of the parental and hybrid lines suggested some significant variation among the genotypes.

Callus induction and green plant regeneration abilities of four parental diallel crosses were evaluated. Wr-Vr graphic analysis suggested that these two characters were controlled by same set of recessive genes. Another culture of hybrid lines resulted in isolation of recombinants having better yield in combination with submergence tolerance ability.

B.2. Breeding of aromatic rice suitable for West Bengal.

T.K. Ghose, P.K. Saha, B.B. Mukherjee, S. Gupta, K.K. Mukherjee. J. Sen,

Aromatic rice (Basmati and others) genotypes (270 in number) were tested and 83 lines were identified to retain aroma for four seasons in the agroclimatic condition of W.B. Hybridization between non aromatic, high yielding dwarf cultivars with lines maintaining aroma resulted in production of non aromatic F_1 S. The hybridity was established through morphological and biochemical markers. F_2 population showed a segregation ratio of non aromatic: aromatic 3:1. The non aromatic nature of F_1 and the F_2 segregation pattern indicate monogenic recessive nature of gene controlling aroma.

Conditions suitable for generation of androgenic plants from F_1 s anther, parental types and green plants regeneration were established. While the callusing frequency was similar the green plant regeneration ability of the non aromatic lines were better over the aromatic lines. Anther derived

regenerants have been transferred to field for their yield assessment.

B.3. Cytogenetical investigations on *Beta* spp. and naturally occurring diploid and hexaploid *Chenopodium* and wild gene pool of *Ipomoea* spp.

K.K. Mukherjee, S. Das and S.K. Mitra

The genomic diversity of the recombinants between *Beta vulgaris* and *B. palonga* are being partially analysed using isozyme as markers. Observed variability among the recombinants indicated the necessity of further selection to obtain homozygous recombinant lines.

PAGE analysis of few isoenzymes from seed of three cytotypes of *C. album* demonstrated both genetic diversity and homology within the diploids and between the diploids and polyploids showing relationships among the three cytotypes.

Phenolics and the isosyme profile in pollen of twelve species of *Ipomoea* studied through UPGMA method revealed the presence of two broad groups or clusters. The trend of clustering and species composition of each group were close to each other with minor variation and almost in accordance with phylogenetic interpretation.

B.4. Improvement of oil seed *Brassica*.

P.K. Saha and Amitava Roy.

The stages of pollen development *in vitro* were studied in *Brassica juncea*. Mid and the late nucleate stage were suitable for obtaining higher calusing frequency. After 2 weeks of culture, pollen became multinucleate and after the 3rd week microcalli appear. Shoots emerged after 6-8 weeks of culture. Those formed roots were multiplied and maintained in B5 basal medium. A few only survived in the field.

C. DNA damage and repair

Swati Sen Mandi, D.N. Sengupta, Somen Nandi and M. Sanath Kumar

A direct correlation between state of DNA integrity and seed age during postharvest storage has been established. Southern blots of genomic DNA from high and low vigour seeds, probed with a partial β -amylase cDNA suggest that the integrity of this gene family is adversely affected during seed ageing.

A DNA polymerase, similar to the mammalian DNA polymerase β type known to be involved in DNA repair, has been purified from rice to homogeneity with an enrichment of 4800-

Annual Report

fold and has been biochemically characterised. The enzyme is not inhibited by aphidicolin and shows distributive type of DNA synthesis.

D. Germplasm screening and seed Biology

Swati Sen-Mandi, P.K. Saha, Gitali Das, Smritimala Ganguly Somen Nandi, Biswajit Das and S. Biswas (Guest Worker)

Dependable markers of seed vigour in rice varieties have been established. The parameters include β -amylase activity, DNA integrity and balance between active oxygen and active oxygen scavenging enzymes.

To evolve desirable high yielding cold-tolerant strains for extensive boro cultivation in Eastern India, the line x tester analysis was employed, with selected high-yielding susceptible varieties as lines and tolerant varieties as testers. 4 susceptible and 6 tolerant varieties were subjected for biomolecular studies. Seeds of these varieties were subjected to cold shock (0, 1, 3, & 5 days, 4+ 1°C) and sown for evaluation of field performance.

Studies on cellular events associated with free radical attack on cell membrane and macromolecules during post-harvest storage of rice seeds by EPR reveals high levels of free radicals/active oxygen in freshly harvested seeds. With time the content of free radical declined presumably due to decay of active oxygen coincident with a massive impairment of DNA integrity.

Improved seedling growth under cold environment is significantly associated with enhancement in *de novo* protein synthesis. Esterase and alcohol dehydrogenase activities are positively and negatively correlated respectively with seedling growth.

Direct seeding technology for rice cultivation has been developed through a simple hydration-dehydration technique, now ready for field trial. Development of cold/heat tolerance at the seedling stage has been established in sensitive cvs of rice and wheat by simple seed-pretreatment methods.

In studies on dormancy and viability of some Leguminous seeds (*Abrus* spp. and *Sesbania cannabina*), it was possible to classify the seeds based on the morphological marker characters in the same population. SEM studies of the seed surface to identify the marker morphological characters have been carried out. Phenotypic

characters also helped classification of seeds of *Dolichos* sp. within the same population. The germination percentage, amount of water absorbed and activation stages vary in these classified seeds. SEM studies revealed the difference in the ultrastructure like micropyle, hilum and lens (strophiole) in the categorized seeds, characters which may have correlation with the dormancy status of the seeds.

E. Micropropagation of economically important/ornamental plants

Sabita Bhattacharya and Sanghamitra Bhattacharya.

In vitro shoot multiplication directly from axillary and explants of *Nyctanthes arbor-tristis* L. (Fam. Oleaceae), regeneration protocol for shoots from callus tissue derived from leaves and young nodal segments has been standardized. Better results were obtained from culture with nodal segments than that from leaf segments. Growth and elongation of individual shoots and rooting of shoots has been obtained by standardizing proper combination and concentration of growth hormones. In *Jasminum* sp. shoot bud multiplication has been induced in the existing axillary buds of young nodes.

F. Chemistry of Natural Products

F.1. Aroma composition of Oolong, Black and Darjeeling tea.

S.N. Ganguly and Jayshree Banerjee

Volatile components of various brewed Oolong tea and black tea were analyzed by GC and GC/FTIR spectrometry/mass spectrometry. Black tea infusion contains a good amount of vitamin C and other vitamins. The GC pattern in extract of brewed tea differs from that prepared by steam distillation and extraction method. The Darjeeling extract consists of geraniol, linalool, four linalool oxides and methyl salicylate. The brewed extract of Chan Pin Oolong contains high amount of 2,6-dimethyl 3,7-Octa-diene-2,6-diol which seems to be the precursor of 3,7-dimethyl -1,5,7-octatrien-3-ol and appears to be the most important factor in Darjeeling tea.

F.2. Characterisation of a side product during hydrogenolysis of 2-(Benzo(b) thiophen-2-yl) propan-2-ol

S.N. Ganguly, B.B. Maji, and K.L. Ghatak : In collaboration with Department of Biophysics, Bose Institute.

The hydrogenolysis of 2(benzo (b) thiophen-2-yl) propan-2-ol with triethyl silane and trifluoroacetic acid afforded in a high yield (58.8%) of 2-isopropyl benzo(b) thiophene. Also a side product viz. a dimeric benzo (b) thiophene derivative as a racemic mixture (41.2%) was obtained, the structure of which was confirmed by x-ray analysis.

From the acidic fraction of the methanolic extract of the defatted leaves of the plant a triterpene acid was isolated as its methyl ester. On the basis of physical and chemical evidences the structure of the compound was suggested which was further confirmed by x-ray analysis.

INSTITUTIONAL PROJECT III

A. Regulatory properties of brain fructose-1, 6-bisphosphatase.

A. N. Lahiri Majumder, Sriparna Bagchi, Sanghita Bhattacharyya.

The brain fructose, 1, 6-bisphosphatase has been identified as a Zn^{+2} / Mn^{+2} containing protein, the former residing at or near the allosteric 5'-AMP binding site. Removal of Zn^{+2} from this site by chelators induce allosteric inhibition by 5'-AMP, while removal of Mn^{+2} in EDTA-system renders the enzyme divalent cation dependent.

INSTITUTIONAL PROJECT IV

A. Mangroves of sunderbans

B.B. Mukherjee

From seasonal studies on the phytosociology in Central core forests were conducted and topography dependent plant association pattern were recorded. Salinity and pH of soil were checked in respect to the change in position of the study. Plant association changed with decline of salinity towards the east.

Effects of afforestation in the 6 meedflats of the reclaimed islands were also studied. There was remarkable decline in sediments load in water bodies associated with the aforesaid region in comparison to those near the darken flats. Aquatic productivity also increased due to afforestation.

B. Environmental biopollution in relation to human and plant health

Sunirmal Chanda, Swati Bhattacharya, Pampa Chakraborty, Atin Adhikari and Moonmoon Sen.

Airborne pollen and spore calendar has been prepared in the rice field of Madhyamgram Experimental Farm. Among 30 recorded pollen type 18 were applied in skin prick test. Maximum response showed in skin prick test for 30-60% range of $(NH_4)_2 SO_4$ saturation fractions of the soluble proteins. Analysis of SDS-PAGE shows the protein bands in range of 34-123 kD. Among 27 types of fungal spores *Helminthosporium oryzae*, *Nigrospora oryzae* & *Alternaria padwickii* are found to be pathogenic to rice.

The prevailing fungi in different indoor environments are *Alternaria sp.*, *Nigrospora sp.*, *Gomphus Sp.*, common in all places but some uncommon types are also present.

Ecofloristic study of Burdwan district showed the occurrence of dominant angiosperms along with non dominant pteridophytes & Gymnosperms.

Honey samples from different sources of W.B. have been analysed palynologically and chemically. These showed the occurrence of saturated fatty acids as the dominant types over the unsaturated types.

Five mangrove palynomorph bearing samples after radiometrically dating, strongly point towards the existence of "big swamp phase" inhabited largely by mangroves during Ca 8000 to 5000 YBP.

Other than Institutional projects

A. Use of ultrasonic techniques for investigation of microstructure of metal alloys :

S.N. Ganguly and Debashree Dutta in collaboration with VECC, Calcutta.

A model has been proposed which investigates the nature of the interface in two phase polycrystalline materials using scattered ultrasonic wave. The interface is highly irregular and structurally complex, and difficult to describe. The nature of the interface in 2-phase polycrystalline materials has been evaluated. From the expression of the scattered spectrum a fractal for the interface has been evaluated with certain dimension.

PUBLICATIONS

1. Effect of heat stress on Ribulose 1,5-bisphosphate carboxylase in rice. Anindita Bose and Bharati Ghosh. *Phytochem.* **38**,1115-1118 1995.

2. Effect of salt stress on polyamine metabolism in *B. Campestris* B5. Sankar Das, Anindita Bose and Bharati Ghosh. *Phytochemistry* **39**, 283 - 285, 1995

3. Divalent cations and chelators as regulators of brain fructose - 1, 6-bisphosphatase. Sanghita Chatteraj Bhattacharyya and Arun Lahiri Majumder. *Arch. Biochem. Biophys.* **316**, 63-69,1995.

4. Callus culture and plantlet production in *Carica papaya* (var. Honey dew). M. Mandal, S.Gupta, and B.B.Mukherjee, *Plant cell Report* **13**, 390, 1994.

5. Rapid cloning of elite teak (*Tectona grandis* Linn.) by multiple shoot production *in vitro*. Sunitibala Devi, Y., B.B. Mukherjee and Gupta, S. *Ind. Jour Expt. Biol.* **32**, 668, 1994.

6. Morphological and biochemical variation in monoecious and dioecious *Trichosanthes spp.* A.K. Sardar, A. Sarkar and K.K. Mukherjee. *Phytomorphology*, **44**, 177 - 186, 1994.

7. Seed Technology for cold Tolerance in Rice, Somen nandi, Smritimala Ganguli and Swati Sen-Mandi, *International Rice Research Notes* **20** : 20-21, 1995.

8. β -amylase activity as an index for germination potential in rice. Somen Nandi, Gituli Das and Swati Sen Mandi, *Annals of Botany* **75**, 463 - 467, 1995.

9. Screening and breeding of aromatic rice suitable for South Bengal (West Bengal), J. Sen, R. Poddar, J. S. Murthy, C. Roy, P.K. Saha and T. K. Ghose ; *Rice Biotech. Quart.* **21**, 15-16, 1994.

10. On the Holocene Palaeoecological changes in coastal Digha based on floral and faunal record. A.K.Hait, H.K.Das, S.Chakraborty, A.K.Roy, and S. Chanda, *Indian Journal of Earth Sciences* **21**, 192-198, 1994,

11. On the occurrence of mangrove biota & some faunal remains from the sediments of Haldia, West Bengal in relation to its past environment. A.K. Hait, H.K. Das, A.K. Roy & S. Chanda. *Journal of Palynology*, 30, 1994

12. Carolus Linnaens (1707-1778) - The father of Taxonomic Botancy. *Science Courier* S. Chanda & A.K. Hait. **5**, 3-6, 1994,

13. Constituents of *Pavetta indica* leaves, S.N. Ganguly, *Fitoterapia*, 65, 477, 1994.

14. Fractal characterization of ultrasonic back scattered signals from Aluminium, Debashree Dutta, P. Barat, and S.N. Ganguly *Ind. Jour. Phys.* 69A. 141 1995.

15. Fractal characterization of ultrasonic signals from Polycrystalline Materials, Debashree Dutta, P. Barat, P. Mukherjee, S.K. Bandyopadhyay, Pintu Sen and S. N. Ganguly, *FRACTALS*, **3**, 1, 1995

16. Aroma composition of Oolong Tea and Black Tea by Brewed Extraction Method and characterisation compounds of Darjeeling Tea Aroma, Michiko Kawakami, Subhendu N. Ganguly, J. Banerjee, and Akio Kobayashi, *J.Agric. Food Chem.*, **43**, 200, 1995

17. Crystal structure of the product from acid-catalysed Dimerisation of the intermediate formed during hydrogenolysis of 2 (benzo (b) - thiophene-2-yl) propan-2-ol, G.K. Biswas, S. Pain B.B. Maji, K.L. Ghatak, S.N. Ganguly, A. Banerjee and Y. litaka Jour. Chem. Res.(s), 60, 1995.

Participation in Conferences/Symposia/ Training Programme/Awards and Honours received.

Prof. S.N.Ganguly was elected Fellow of Academy of Science & Technology, West Bengal in 1995. **Prof. B. Ghosh** attended 16th Int. Congress of Biochemistry & Molecular Biology and presented a poster paper. She was selected as one of the members in the editorial board of the Int. Journal of Pl. Physiol. and Mol. Biology, (Texas, USA and Bareilly, U.P.).

Prof. A.N. Lahiri Majumder has been awarded the Prof. Shadaksharaswamy lecture Award from the Society of Biological Chemists, 1994. Delivered an invited talk at the United States Dept. of Agriculture, Beltsville, USA ; Worked in the, University of Arizona, USA, as a short-term DBT Overseas Associate between October 1994 to January 1995.

Aniruddha Ray Choudhury was selected to participate in the Mahabaleswar Symposium on Modern Biology (Plant Reproduction) held in Dec, 1994, at Whitefield, Bangalore,

Aniruddha Ray Choudhury, Sriparna

Bagchi, and Kajari Lahiri participated in the Satellite Symposium on Protein, Structure function and engineering" held at Calcutta, in September, 1994.

Prof. Sunirmal Chanda delivered D.N. Shivpuri Memorial Oration, 1993 in the 27th Annual Convention of Indian College of Allergy & Applied Immunology (AICON-94) from April 1994 at the Centre for Biochemical Technology, Delhi. Chaired two scientific sessions in the 5th International Conference on Aerobiology at Bangalore in August, 1994 and delivered a Key-note addresses delivered an invited lecture at the National Institute of Oceanography, Goa on "Environmental Pollution : Course & Remedy" in August 1994; Visited Germany from October, 1994, to January 1995. On invitation from the government of Germany (DAAD) worked at the university of Honenhein, Stuttgart (Institute of Bee Research); delivered invited lecture at the University of Munich, Konstanz; Delivered an invited lecture at the University Clinic of University of Vienna, Austria; attended a symposium of "Pollen and Pollinosis : Current Problems" at the University of Lublin, Poland; delivered an invited lecture in the Botany Dept., Utkal University, Bhubaneswar; Attended presided over annual general meeting of the National Botanical Society at Ballygunge Science College and delivered presidential address; Visited IARC-Rothamsted, Harpenden, U.K. from March to April 1995, sponsored by the British Council.

Dr. Swati Gupta-Bhattacharya, Pampa Chakraborty and Arati Malakar participated in the Conference on Aerobiology in August, 1994 at Bangalore University and presented papers.

Dr. B.B. Mukherjee attended (i) symposium on "Community Ecology and Conservation Biology" Held in Bern, Switzerland, August, 1994; and (ii) International Congress of Ecology held in Manchester, U.K. August, 1994.

Dr. S. Sen Mandi has been nominated as Hony Secretary Fulbright Alumini Association Calcutta Chapter for the year 1995-97.

Somen Nandi has received Jawaharlal Nehru Scholarship for the year 1995-96, to work with Dr. Ning Huang, Molecular Genetics Laboratory of International Rice Research Institute (IRRI), Manila, Philippines.

Dr. P.K. Saha, Dr. Sabita Bhattacharya Amitaya Roy & Biswajit Das & Sanghamitra Bhattachajee participated in the International Seminar on Management of Minor Forest Products at Deradun in November, 1994 and presented papers.

Dr. Sabita Bhattacharya participated and presented paper at the National Symposium on "Tissue Culture of Medicinal Plants" organised by the Centre of Advanced Study held at the Department of Botany, University of Calcutta in February 1995.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Sudhi Ranjan Gupta, Aniruddha Ray Choudhury, Somen Nandi, Manas Kumar Chattopadhyay, Jayashree Banerjee, Nirmal Mondal, Sangita Basu, Sanghamitra Bhattacharya, Pampa Chakraborty, Anindita Bose, Malabika Roy, Biswajit Das, Amal Kumar Sarkar, Gaurab Gangopadhyay, Amitabha Roy, Srijeet Kumar Mitra, Dr. Prabir Chakraborty, Ashim Saha, Rashmi Deb, Netai C Hait, Atin Adhikary, Moon Moon Sen, Dr. Arinuddha Das, Dr. B.B.Tewari, Dr. Alope Bera, Dr. Syamali Chakraborty, Saubhik Das, Dr. Sangihta Bhattacharya, Dr. Kajari Lahiri, Dr. Gitali Das, M. Sanath Kumar, Dr. Madhuchhanda Chatterjee, Dr. J.S.R. Murthy, Dr. Jayanti Sen, Anindita Bose, Amitava Roy, Sriparna Bagchi, Arati Malakar, Devashree Dutta.

OTHER SUPPORTING STAFF MEMBERS

N. N. Chaudhuri, S. K. Chakraborty, D.K.sanyal, Sankar Basu, Sukumar Majumder, Ramit Poddar, Chanchal Chakraborty, S. P. Banerjee, Subrata Basak, D. K. Chakraborty, N.B.Roy, Shyamapada Halder, Kanailal Chatterjee, Sukadeb Das, Sudhir Jana, Sasanka S. Bera, S.N. Debnath, Dhiren Kr. Das, R.N.Roychaudhuri, Bipul Kr. Nag, Kanan Singh, Munna Turi.

GRANTS - IN - AID SCHEMES

Investigator/Co-investigator	Title	Financed by
Prof. B.Ghosh	Thermal Regulation of Riulose 1,5-bisphosphate Carboxylase	C.S.I.R.
Prof. A.N. Lahiri Majumder	Chloroplastic myoinositol synthase from <i>Euglena gracilis</i> . Molecular studies and photoregulation.	D.S.T.
Dr. S. Gupta	Introgression of disease resistance from local cultivar to improve sesameun through hybridisation and Anther Culture	C.S.I.R.
Dr. D.N. Sengupta	Plant DNA polymerase : possibility of cloning cDNA (s) for characterisation and expression in <i>E.Coli</i>	C.S.I.R.

Microbiology

Faculty : Prof T. B. Samanta (Chairman), Prof. A. C. Ghose, Prof. G. Nanda, Dr. K. Sen, Dr. P. K. Chakrabartty, Dr. R. Chakarverty, Dr. P. Roy., Dr. M. Kumdu (Assigned to the Dept of Chemistry) Dr. S. Mazumder, Dr. S.K. Dasgupta.

INSTITUTIONAL PROJECT NO. I

A. Efficient nodulation by rhizobia

P.K. Chakrabartty, Nupur Roy

Efficiency of nodulation of leguminous plants by nitrogen fixing bacteria is important for crop productivity. Several mutants of *Rhizobium sp. (Cicer arietinum)* BICC 651 have been isolated which overproduce siderophores and at the same time show increased nodulation of the host *Cicer arietinum*. It appears that scavenging of trace amounts of iron in soil by siderophores produced by these mutants has an important role to play in increased nodulation efficiency.

In a separate study it was found that nodulation of host plant by rhizobia was influenced by several associative microorganisms including *Azospirillum brasilense*. The presence of such associative organisms during nodulation increases nodule weight per plant although number of nodules per plant decreased. It was further observed that the length and weight of the host plant increase following nodulation in presence of these associative bacteria.

INSTITUTIONAL PROJECT NO IV

A. Fungal allergens associated with agricultural practices

Roma Chakraborty, Papia Mitra

During harvesting and threshing operations, farmers are exposed to heavy spore dust contributed by certain fungal types such as *Alternaria sp.*, *Helminthosporium oryzae*, *Drechslera sp.* and few others. In order to identify potential allergens associated with these fungal types extracts have been prepared from culture filtrates of these organisms. These will be used to indentify specific fungal allergens using skin tests.

INSTITUTIONAL PROJECT NO V

A. Molecular and cellular basis of bacterial and parasitic diseases :

A.1. Cholera

A.C.Ghose, Tapas K. Sengupta, Ranjan k. Nandy, Sarmistha Mukhopadhyay, Chandadipa Ghosh

Serological differences between 01 and 0139 epidemic isolates of *V. cholerae* was established by using immunised rabbit and convalescent cholera patient sera. The two strains did not show cross protection although both possessed cholera toxin, toxin regulated pilus (TCP) and other virulent factors that are believed to be correlates of their epidemic potential. Interestingly some non-01, non-0139 *V. cholerae* strains were also shown to possess one or more virulence markers. The findings are likely to be useful in evaluating the epidemic potential of *V. cholerae*.

A.2. Leishmaniasis (Kala-azar)

Immunobiological studies :

A.C. Ghose, Mrinal K. Ghosh, Ashis k. Ghosh, Subhajit Dasgupta, Krishanu Sengupta

Peripheral blood lymphocytes of Kala-azar patients showed proliferative responses to *in vitro* stimulation with PHA or ConA. Similar results were also obtained with splenic lymphocytes of hamsters during the initial phase of infections with *Leishmania donovani*. However splenic lymphocytes from infected hamsters showed decreased stimulation with ConA indicating an overall impairment of their T cell responsiveness. The data correlated well with the histopathologic findings which showed gradual obliteration of their splenic follicular architecture. Similar results were obtained with lymph node sections of Kala-azar patients with lymphadenopathy.

A.3. Host Response

T.B. Samanta, Rittika Chanda

Changes in the cytochrome P450 profile of golden hamsters infected with *Leishmania donovani* was investigated. A maximal drop in

Annual Report

cyt P-450 level was observed after 20 days, following an initial infection with 2×10^7 amastigotes, when the liver parasite load was maximum. The depression of cyt P-450 levels could be isozyme specific as envisaged by the observed difference in aminopyrine dimethylase activity and aniline hydroxylase activity of cyt P-450. The former was found to be less.

A.4. Signal transduction events in neutrophils in associated with bacterial and parasitic infection :

S.Majumdar, Sonali Das

Neutrophils from Kala-azar patients have been investigated for their ability to generate superoxide anions, which are key components of the host defence mechanism against infections. It was found that upon stimulation with fMLP, IL-8 and ConA, superoxide anion generation as well as Protein Kinase C (PKC) activity in human Neutrophils obtained from patients was less, compared to those unchanged as indicated by Western Blots therefore it appears that dephosphorylation of PKC by phosphatases may be the cause of such diminished activity.

Changes in the Ca - ATPase activity, which controls intracellular Ca release in human neutrophils was also investigated following stimulation with fMLP and TNF (Tumor necrosis factor). TNF (at a dose of 200 u/ml) but not fMLP stimulated Ca ATPase indicating a key role of TNF in the signal transduction events that lead to Neutrophil activation.

A.5. Molecular genetics of mycobacteria

S.K. Das Gupta, Shreyashi Chatterjee, Mamta Chawla

Mycobacterial diseases such as Tuberculosis and Leprosy are major scourges of mankind. Several species of mycobacteria contain plasmids which can be used as vectors to genetically engineer mycobacteria for preventive and diagnostic purposes. The mechanism of replication of one such plasmid pA1500 (5Kb) is being investigated. Using several restriction enzymes it was possible to isolate small fragments (about 2 Kb) from the parent plasmid which could support autonomous replication. This will provide insight into the minimum domain of pA15000 which is necessary and sufficient for autonomous replication in mycobacteria.

A.6. Monobactams as antimicrobial agents

T.B. Samanta, Debjani Dutta

Monobactams are unique molecules which are mostly effective against gram - negative infections. Using an enrichment technique four monobactam producing strains have been isolated from soil samples. The monobactams produced were characterised by UV, IR, mass and NMR spectroscopy.

B. Industrially important Microbial enzymes and products.

B.1. Invertase and Penicillin acylase

T.B.Samanta, Deb Prasad Sikdar.

Invertase which catalyses the hydrolysis of sucrose was purified (42 fold). It is a glycoprotein containing mannose. Its molecular weight 120 KDa. The enzyme has high affinity towards sucrose (K_m 3.5 nM). The amino acid composition of the purified invertase exhibited high amount of methionine.

Penicillin acylase (PA) reversibly catalyses the deacylation of penicillin G and acylation of 6-aminopenicillanic acid (6-APA). An overlaying technique using the test organism *Serratia marcescens* was applied to isolate a novel strain DSP2 from soil that produces PA.

B.2. Saccharolytic enzymes

G. Nanda, Mousami Ghosh, Rina Rani Roy, Subhas Chandra Jana

Xylanase is an important microbial enzyme which is required for the production of Xylose. *Aspergillus ochareus* 42 grown in liquid medium, containing spelt xylan as carbon source, produced appreciable amounts of Xylanase from pulverised jute stalk could be subsequently converted to xylitol by yeasts such as *Pachysolen tanophilis*, *Candida tropicalis*, *Candida guilliermondii* as well as bacteria such as *Corynebacterium liquifaciens*. This strategy could be adapted in developing an effective strategy for the wastes for the production of Xylose/Xylitol from agricultural wastes.

Xylanase was also purified from *Aspergillus sydowii* to homogeneity. A Zymogram analysis revealed the presence of a single xylanase of molecular weight 30 KDa which was optimally active at pH 5.5 and at a temperature of 60°C. The product of hydrolysis of xylan, by the purified en-

zyme, was found to be xylobiose indicating that it is an exosplitting xylobiohydrolase.

Amylases which hydrolyse starch was purified to homogeneity from *Bacillus megaterium*. The purified enzyme was optimally active at a pH of 6.9 and a temperature of 60°C and utilised specifically soluble starch as substrate. The thermostability of the enzyme was further enhanced by using exogenous thiols and Mn⁺⁺. The enzyme when immobilised on starch or entrapped in gelatin was found to acquire increased resistance to thermal and chemical denaturants.

B.3. Keratinase

A.L. Chandra, S. Mazumder

A new Keratinolytic actionmycetes belonging to morphological section Rectiflexibilis (RF), cluster group A, cluster number 1, subcluster IB was isolated. The keratinolytic activity of this isolate was demonstrated using wool, hair, nail, feather and silk. The enzyme was purified to homogeneity and was found to have a molecular weight of 30 KDa. Furthermore a plate method for keratinase assay and also an enzymographic method for visualising keratinase on keratin polyacrylamide enzymogram were developed.

B.4. Microbial Proteases

R. Chakraverty

To circumvent hazardous chemical methods used for dehairing skins in leather industry, a microbial technology is being developed using actionmycete proteases. Two soil isolates AC₈₀ and AC₉₀ were investigated for the production of extracellular proteases. It was found that AC₈₀ and AC₉₀ culture filtrates gave 2.49 and 2.42 units of activity (one unit is the amount of enzyme required to release one µg of tyrosine/min/mg protein from casein used as substrate) whereas a partially purified ammonium sulphate fraction gave 4.4 and 4.98 units respectively.

B.5. Lichen metabolites

K.Sen

A gelatin like substance has been isolated from lichen which can be potentially used as food additive. Extraction of the gel is cost effective and the process involves indigenous technology. Micobiont symbiont of the lichen has been cultured in isolation. The culture broth showed the presence of plant growth substances (PGN).

Detailed analysis indicated the presence of IAA and kinetin in the mycobiont metabolite.

C. Molecular Genetics of Thiobacillus

P.Roy, Chirajyoti Deb, Ranadhir Chakraborty, Pratap. N. Mukherjee, Anjan Sengupta, Keya Banerjee, Anupama Saha.

Thiobacillus ferrooxidans is a gram negative bacteria which uses ferrous iron and inorganic sulphur in its energy yielding metabolism. It is being currently used in Biohydrometallurgy for the extraction of copper, uranium, zinc, nickel, gold etc.

An intact insertion element (1.28 Kb) has been cloned from *T. ferrooxidans* NCIB 8455. It has been restriction mapped and its existence in genomes of various other strains of *T. ferrooxidans* strains investigated by Southern hybridisation. The results indicate that this element constitutes a new family of insertion elements.

In a parallel study a novel *Thiobacillus* phage earlier isolated has been characterised by restriction mapping and electron microscopy. The morphological features of the phage as determined by electron microscopy indicate that it is a member of a group C1 of Podoviridae family. The size of the genome (44Kb) was compared with the mean contour length of the phage DNA and it was observed that the phage DNA molecules visible by electron microscopy were all linear.

The phenomenon of chemotaxis in *T. ferrooxidans* is being investigated. To clone the chemotaxis (che) genes from *T. ferrooxidans* a Southern Blot was done using *E.coli* che / mocha genes as probes. The results indicated that a 4.9 Kb Eco RI fragment of *T. ferrooxidans* genomic DNA contains sequences homologous to the *E.coli* probe.

The phenomenon of swarming in bacteria is being studied using *E. coli* as a model. Tn - 5 mutagenesis has been done on *E. coli* C2110 (PolA minus strain) and several swarming defective mutants have been obtained. This will help in indentifying the genetic loci responsible for swarming.

PUBLICATIONS

1. Effect of Cyanate on nitrate reduction by *Rhizobium meliloti* SU47, N.Roy, A. Chowdhury, S. Roy and P.K. Chakrabartty, *J. Basic Microbiol.* **16**, 259-264, 1994.

2. Iron acquisition during growth in an iron-deficient medium by *Rhizobium sp.* isolated from *Cicer arietinum*. N.Roy, P. Bhattacharyya and P.K. Chakrabartty, *Microbiology.* **140**, 2811-2820, 1994.

3. Research trends in rhizobial nitrogen fixation, P.K. Chakrabartty and A.K. Halder, In: Advances in Ecology and Environmental Sciences (eds. P.C. Mishra et al P1-15, Ashish Publishing House, New Delhi, 1995.

4. Airborne fungal load in agricultural environmental during threshing operations, Naim Uddin and Roma Chakraverty, *Micopathologia.* **127** 145-150, 1994.

5. Serodiagnosis of kala-azar (visceral leishmaniasis) and post kala-azar dermal leishmaniasis, A.C. Ghose, A.K. Ghosh, M.K. Ghosh, J.P. Halder, M.Addy & A. Nandy, in "Tropical Diseases - Molecular Biology and Control Strategies" (Ed. by Shushil Kumar and others), Publications and Information Directorate, CSIR, New Delhi, pp. 429-448, 1994.

6. Subpopulation of T-lymphocytes in the peripheral blood, dermal lesions and lymph nodes of post kala-azar dermal leishmaniasis patients, M.K. Ghosh, A. Nandy, M. Addy, T.K. Maitra and A.C. Ghose : *Scand. J. Immunology*, **41**, 11-17, 1995.

7. Expression of antigenically distinct fimbriae with hemagglutination and Hela cell adherence properties by an enteroaggregative *Escherichia coli* strain belonging to the enteropathogenic serogroup : R.K. Nandy, S.K. Barai & A.C. Ghose, *FEMS Immunology & Medical Microbiology*, **9**, 143- 150, 1994.

8. Epidemic isolates of *Vibrio cholerae* 0139 express antigenically distinct types of colonization pili, T.K. Sengupta, D.K. Sengupta, G. Balkrish Nair and A.C. Ghose, *FEMS Microbiology Lett.* **118**, 265-272, 1994.

9. A comparative study of the properties of *Vibrio cholerae* 0139, 01 and other non-01 strains, R.K. Nandy, T.K. Sengupta, S. Mukhopadhyay & A.C. Ghose; *J. Medical Microbiology*, **42**, 251-257, 1995.

10. Adsorption of β-amylase from *Bacillus carotum* B₀ onto different nature starches, R.R. Ray, S.C. Jana, G. Nanda, *Letters in Applied Microbiology*, **19**, 454-457, 1994.

11. Saccharification of indigenous starches by β-amylase of *Bacillus megaterium* R.R. Ray, S.C. Jana, and G. Nanda. *World Journal of Microbiology and Biotechnology* **10**, 691-693, 1994

12. Biochemical approaches of increasing thermostability of β-amylase from *Bacillus Megaterium* B₀ : R.R. Ray, S.C. Jana and G. Nanda, *FEBS Letters*, **356**, 30-32, 1994.

13. Purification and properties of a xylanase from *Aspergillus sydowii* MG 49, Mousumi Ghose and Geeta Nanda. *Applied and Environmental Microbiology*, **60**, 4621-4623, 1994,

14. Bovine parainfluenza-3 virus selectively depletes a Ca-independent, phospholipid-dependent protein kinase C and inhibits superoxide anion generation in bovine alveolar macrophage : Robert M. Dyer, Subrata Majumdar Steven D. Douglas and Helen M. Korchak, *J. Immunology*, **153**, 1171-1179, 1994

Participation in Conferences/Symposium/Training programme/ Awards and Honours received.

Prof. A.C. Ghose acted as a member of the Scientific panel of PRC's of Indian Council of Medical Research, New Delhi; acted as a member of the SAC of National Institute of Cholerae & Enteric Diseases, Calcutta chaired a session in the one day symposium organised by SBC (Calcutta) on 'Trends in Immunologic Reserach' held at the IACS, Calcutta, in December, 1994 participated in the expert group meeting on 'cholera' held at the Dept. of Biotechnology, New Delhi in June, 1994 participated and delivered a lecture on the 7th Asian Congress on Diarrhoeal diseases held at Dacca, Bangladesh in Sept., 1994 delivered first 'A.K. Chandra memorial lecture' in November 1994 at the Dept. of Botany, University of Calcutta, delivered a lecture on 'Cholera epidemics' in the symposium on 'Modern Trends in Biology' organised by the Indian Association of Biological Scientists at the Bose Institute, Calcutta, in Dec., 1994.

Prof. Timir B. Samanta attended and presented a paper at the 16th International Congress of Biochemistry and Molecular Biology held at New Delhi in September, 1994, acted as a member of the Executive Committee of Microbial Type Culture Collection and Gene Bank at Institute of Microbial Technology (IMTECH), Chandigarh.

Prof. Geeta Nanda attended and presented a paper in the National Symposium on Prespective in Biodiversity held in March, 1995 at Indian Institute of Chemical Biology, Jadavpur, Calcutta.

Dr. Roma Chakraverty attended and presented a paper at the 5th International Conference on Aerobiology, held in 1994, at Bangalore.

Miss Papia Mitra attended the 82nd Session of the Indian Science Congress, held at Jadavpur, Calcutta and presented a paper. Dr. Debjani Dutta attended and presented a paper in MICON International-94 and 35th Annual Conference of Association of Microbiologists of India.

Nupur Roy participated in and presented a poster in the 16th International Congress of Biochemistry and Molecular Biology, held at New Delhi, in 1994. She was awarded a grant for Young Scientists to join the congress.

Sumana Majumdar attended and presented exhibits at Science Exhibition 'Lab to Man' organised by Dept. of Biotechnology, Govt. of India at 82nd Session of Indian Science Congress, 1994.

Ranjan K. Nandy presented a paper in the one day symposium on "Trends in Immunologic research" organised by SBC (Calcutta) held at IACS, Calcutta in 1994.

Ph. D. Awarded

Name	University/Subject	Year	Title	Supervisor
Dilip K. Sengupta	Calcutta	1994	Immunological studies on the outer membrane protein of <i>V. cholerae</i>	Prof. A.C. Ghose

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dr. Mrinal Kanti Ghosh, Nupur Roy, Ranadhir Chakraborty, Sumana Majumder, Subhajit Dasgupta, Kajori Ghosh, Mamta Chawla, Papia Mitra, Sonali Das, Dr. Ramprasad Mukhopadhyay, Dr. Debjani Datta, Anjan Pal, Ashis K. Ghosh, Ranjan K. Nandy, Anupama Saha, Rittika Chanda, Mousumi Ghosh Shreyashi Chatterjee Dr. Deb Prasad Skdar, Dr. Anjan Sengupta, Dr. Jharna Dutta, Dr. Mousumi Das, Krishanu Sengupta.

OTHER SUPPORTING STAFF MEMBERS

B.N. Bose, B. Banik, A.N. Pal, R.R. Sanyal, S.K. Das (I), S.K. Das (II), G. Dey, R. Das, N.K. Malakar, D. Saha, B.N. DeSarkar, B.N. Mandal, P.K. Chattopadhyay, P. Gupta, S. Gazi, B. Ram, A. Santra, B. Bahali, J. Prasad, B. Bhattacharyya, S. Das, N. Patra, B. Das, R. Prasad, B.K. Ram, A.K. Shaw.

Grants - in - aid Scheme

Investigator/Co-investigator	Title	Financed by
Prof. Geeta Nanda	Microbial production of enzymes-Xylanase and β -amylase	DBT

Grants - in - aid Scheme

Investigator/Co-investigator	Title	Financed by
Dr. Pradosh Roy	Genetics of <i>Thiobacillus ferrooxidans</i> and strain improvement by advanced genetical techniques	DBT
Prof. A.C. Ghose	Development of a non-replicating Vaccine against Cholera based on protective antigen on <i>Vibrio cholerae</i>	DBT
Prof. A.K. Mishra	Biotechnological enrichment of bauxite ore	Burn Standard Co. Ltd.
Prof. A.K. Mishra	Biotechnological enrichment of magnesite ore with antibiotics as by-products	DBT-Burn Standard Co. Ltd.
Dr. Sujoy Kumar Dasgupta	Investigations into the mechanism (s) of extra-chromosomal replication of mycobacterium plasmid pAL500	C.S.I.R.

Faculty : Prof. S. Biswas (Chairperson, from 2.5.95), Prof. R.K. Mandal (Chairman upto 30.4.95), Prof. N.C. Mandal, Prof. B. Bhattacharyya, Dr. P. Sinha, Dr. P. Gupta, Dr. A. Lohia, Dr. R. Chattopadhyaya, Dr. P. Parrack.

INSTITUTIONAL PROJECT I

A.1. Seed protein quality improvement and production of transgenic plants.

R.K. Mandal, Santanu Dasgupta, Sudip Ghosh, Somnath Bhattacharyya, Nrisingha Dey, Biswajit Roy, Pallab Kundu and Surekha Mandal

The promoter of mustard 2s seed storage protein has been finemapped; several positive and negative regulatory elements and silencer sequence have been identified.

A trypsin inhibitor has been identified and isolated from *Brassica species* and has been shown to be the precursor of seed storage protein. Transgenic tomato plants have been produced with TV MV (tobacco vein mottle virus) coat protein gene and seed from to generation plants potted in soil have been obtained.

A.2. Expression of reporter gene β -glucuronidase (GUS) under seed specific *Arabidopsis thaliana* promoter (2S) in *Agrobacterium*, yeast and plant.

S. Biswas, Samarpan Mazumder, in Collaboration with Prof. **B.B. Biswas**, Biophysics Dept., Calcutta University.

Expression of GUS reporter gene under a seed specific promoter has been undertaken. The full length promoter has been fragmented and 0.8 Kb 2S promoter fragment along with GUS gene has been cloned and transferred into *agrobacterium*. This 2S promoter can be used for the expression of particular genes in both prokaryotes and eukaryotes.

A.3. Studies on a novel ATPase/NTPase from *Mimosa pudica* leaflets.

S. Biswas, Rinku Ghosh in collaboration with **Dr. P.C. Sen** (Chemistry Department B.I.).

Two isoforms of the novel NTPase enzymes have been detected which are strongly associated with polysaccharide and Ca^{2+} , activity of the enzymes being dependent on the ternary complex. The polysaccharide moieties of the two isoforms of NTPase were found tightly associated in their Ca^{2+} -

induced conformation necessary for the enzyme activity. The enzyme, however, can be reconstituted upto 70-80% under proper condition.

INSTITUTIONAL PROJECT III

A.1. Studies on the structure and Function of Lambda Repressor.

N.C. Mandal, Nandan K. Jana, Sumita Sinha, **S. Roy**, and **B. Bhattacharyya**

Studies with the λ 2 repressor having lysine replaced by glutamic acid at 224th position show that unlike wild type repressor, there is one out of three Cys residues at the C-terminus is exposed even at 25°C. CD study shows that the secondary structure of this mutant repressor is different from the wild type one.

CD and tryptophan fluorescence studies of another mutant lambda repressor with a change of Serine to Aspartine at 228th position showed that there is not difference between this repressor and the wild type one in respect of the secondary structure and the tryptophan environment but other workers showed that this mutant repressor is defective in monomer-monomer interaction.

Certain mutant cl gene of lambda having amber mutations around the C-terminus have been studied in different suppressor host which substitutes different amino acids at the amber position. These amber mutant genes have been cloned in pBR322.

A.2. Studies on the Lethal Interaction of Bacteriophage Lambda with its Host *Escherichia coli*.

N.C. Mandal, Lopa Adhikary, and Pradeep Sen.

In an attempt to confirm that the rpl mutation is in the *dnaA* gene of *E. coli*, the wild type *dnaA* gene from *E. coli* 594 has been cloned. Both wild type and the rpl mutant *dnaA* genes have been

subcloned in M13mp10 and 11 vectors for determining the nucleotide sequences. This will confirm whether the DnaA protein is the actual target of the *P* gene lethality.

A.3. Studies on Gene Regulation in *Mycobacteria*.

N.C. Mandal, Santanu Ray Chaudhuri, Madhumita Basu, and Saurabh Pal.

In an attempt to understand the role of glutamate in the regulation of *galK* expression in *M. smegmatis*, the *galK* gene from one of the *Eingut* mutants have been cloned in *E. coli* and also the *E. coli* *crp* gene has been subcloned in *E. coli*-mycobacteria shuttle plasmid.

A.4. Studies on Developmental Regulation of *Mycobacteriophage* L1.

N.C. Mandal, Hirock J. Datta, Subrata Sau, Biswendu Chaudhuri, Prajna Mandal, Chandrani Chattopadhyay, Rajat Bhattacharyya,

Studies on the developmental regulation of mycobacteriophage L1, it has been shown that the expression of the phage late genes is dependent on its DNA replication and is rifampicin insensitive, while the expression of early and delayed early genes are rifampicin sensitive. The early and late regulatory genes of L1 have been identified. L1 coded exonuclease has been detected and partially purified. Evidences show that the formation of the functional enzyme is possibly dependent on its processing at protein level. Alignment of the genetic map with the physical map of L1 has been done. Some of the promoters of L1 originally cloned in *E. coli* have been studied in *M. smegmatis*.

A.5. Tubulin Substructure and Identification of its Structural, Functional and Regulatory domains :

B. Bhattacharyya, Nabanita Sarkar, Gopal Chakraborty, Pampi Basu, Suranjana Guha, Pradip Mahapatra, Suroopa Banerjee, Shalmali Chakraborty.

Studies focussed on Tubulin, its interaction with colchicine and analogous compounds, as well as fluorescence and Circular dichroism of tubulin. Kinetic and thermodynamic parameters of binding of β -ring analogs of colchicine to tubulin were determined. The results suggest that the β -ring side chain of these compounds contact dimeric tubulin molecules.

The unfolding reaction of the dimeric protein tubulin, isolated from goat brain, was studied using

fluorescence and circular dichroism techniques. The unfolding of the tubulin dimer was found to be a two-step process at pH 7. The first step leads to the formation of an intermediate conformation stable at around 1-2 M urea, followed by a second step that was due to unfolding of the intermediate state. At pH 3, the urea-induced biphasic unfolding profiles obtained at pH 7 became a one-step process indicating that a stable intermediate was also formed at this pH. The intermediate at pH 3 was more stable toward urea denaturation than that at pH 7. The intermediate state has about 60% secondary structure, partially exposed aromatic residues, and less tertiary structure as compared to the native state. Also, hydrophobic surfaces were more exposed in the intermediate than in the native or unfolded states. These results indicate that the intermediate state observed during tubulin unfolding is not only distinct from both the native and unfolded forms but also possesses some properties characteristic of a molten globule.

A.6. A study on Chromosome replication and segregation in the yeast *S. Cerevisial*.

P. Sinha, N. Roy, P. Venkatiah, M. Maitra, and A. Poddar

The group is studying mom (minichromosome maintenance) mutants of yeast which destabilize small circular minichromosomes, each carrying an ARS (autonomously replicating sequence) and CEN (Centromere DNA). In earlier work it was shown that the mutant *mcm2* affects plasmid and chromosomal DNA replication by causing underinitiations at their replication origins, leading to DNA damage at chromosomes and their subsequent loss from the cells. Attempts to isolate chromosomal *ts* or *Cs* (to facilitate cloning) suppressors of the *mcm2-1* mutation, was not successful, probably because the *mcm2-2* allele, a compensating suppressor mutation in another interacting gene may not confer temperature or cold sensitivity on a cell.

Other mutants such as *mcm12* and *mcm17* affect centromere directed segregation of minichromosomes in a size dependent manner without affecting DNA replication. In order to understand better the way by which *MCM12* and *MCM17* proteins affect segregation of chromosomes, cloning the wild-type has been initiated.

A.7. Crystallographic studies of modified DNA oligomers.

Rajagopal Chattopadhyay, Bhaswati Goswami.

Synthesis using organic synthetic methods of modified DNA oligomers resulting from oxidative damage is under way. Incorporation of these modified nucleosides into otherwise normal DNA would be done, followed by crystallization and structure solution.

A.8. Crystallographic studies of lipase from *A. niger* :

Rajagopal Chattopadhyaya, V.M. Haridasan Namboodiri.

An assay system for studying lipases was established and enzyme purification is progressing. Currently three different lipases were detected. These will be purified further and used for crystallization.

A.9. Crystallographic studies of lambda repressor mutants.

Rajagopal Chattopadhyaya, Kausik Ghosh.

Two mutants of lambda repressors protein have been purified and crystal growth will be attempted shortly.

A.10. Structural basis of Control of Transcription Initiation in *E. Coli*.

P.K. Parrack, Jayanta Mukhopadhyay and Runa Sur.

Work is being carried out on the cyclic AMP receptor protein (CRP). Two forms of CRP, selected functionally as crp and crp, have been obtained as high-expression strains. The former cannot activate transcription even if cAMP is bound; the latter is cAMP independent and functions even in its absence.

INSTITUTIONAL PROJECT V

A.1. Ca^{2+} homeostasis in *Entamoeba histolytica* :

Susweta Biswas, Bhudev Bhattacharyya, Mita Sen, (In collaboration with Dr. Sanghamitra Raha, Saha Institute of Nuclear Physics, Calcutta).

Calcium mobilization from internal stores of the parasite, *E. histolytica* was studied by fluorescence measurement of Ca^{2+} indicator quin 2 in saponin permeabilized amoeba. Both $Ins(1, 4, 5)P_3$ and $Ins(2, 4, 5)P_3$ could release Ca^{2+} equally well from permeabilized *E. histolytica*. On an average, about 40% the A23187 releasable Ca^{2+} pool could be mobilized by $2 \mu M InsP_3$. Neither GTP nor cAMP could influence $InsP_3$ mediated Ca^{2+} mobilization. $InsP_3$ -mediated Ca^{2+} release from internal stores

of *E. histolytica* occurred in an $InsP_3$ receptor dependent manner. Differential interference contrast microscopy revealed that increased motility and pseudopod formation could be produced in *E. histolytica* through $InsP_3$ treatment.

$Ins(1, 4, 5)P_3$ -mediated calcium release occurred from a vesicular store, was sensitive to prior treatment by heparin and was attenuated by prior addition of a lower concentration of $Ins(1, 4, 5)P_3$. A saturating concentration of $Ins(1, 4, 5)P_3$ could release 50% of a radiolabelled calcium sequestered by energy-dependent mechanisms in *E. histolytica*. Our results suggested that $Ins(1, 4, 5)P_3$ mediated calcium release from internal stores of *E. histolytica* most probably occurred in an inositol triphosphate receptor-dependent manner.

A.2. Molecular genetics of *Entamoeba histolytica*.
Anuradha Lohia, Sibsanakar Ray, Sanudra Saurabh Gangopadhyay, Saumen Bhattacharyya

The group has focused on the identification and characterisation of genes involving growth and proliferation of that protozoan pathogen. Clones produced were distinguished from each other through their growth habits. A 180 bp PCR product homologous to *cdc 21+* (*S. pombe*) gene was produced. AGC-rich repetitive DNA sequence was discovered; this may be useful as a marker for *E. histolytica* gene, since other amoeba lack it. DNA was collected from stool samples obtained at pathology clinics and analysed.

A.3. The expression of malaria parasite genes in yeast: Development of *Saccharomyces cerevisiae* as an expression system for foreign genes :

Pratima Sinha, Kaustav Sanyal in collaboration with Dr. Shobona Sharma (T.I.F.R. Bombay)

Eight cDNA clones of novel *Plasmodium falciparum* (human malaria parasite) genes have been isolated in Dr. S. Sharma's laboratory at TIFR. These will be expressed in *S. Cerevisiae*. Development of new expression vectors using constitutive (PYKI) and conditional (GAL1-GAL10) promoters of yeast is being initiated. The isolation of malarial parasite proteins from yeast should be useful in the future for the design of a malaria vaccine.

A.4. Thalassaemia in Eastern India : Molecular characterisation for prenatal diagnosis and genetic counselling.

Prabhakar Gupta in collaboration with Dilip Ghosh Dastidar and R.N. Datta (Dept. of Pathology and Haematology, Assembly of God Church Hospital and Research Centre, Calcutta-700 017)

Analysis of 108 unrelated β -thalassemic carriers from eastern India using DNA amplification techniques identified a total of 8 different mutations.

INSTITUTIONAL PROJECT IV

A.1. Fish genetic stock identification and Conversion.

R.K. Mandal and B.K. Paddi

Limited studies using RFLP and RAPD techniques have been used to differentiate genetic stocks of Indian major carps. The harmful effects of mixed spawning practices due to gene mixing by hybridization have been established.

A.2. Repetitive and polymorphic genetic markers in farm animals

P. Gupta, Golam Faruk, Sankar K. Ghosh, Sudit S. Mukhopadhyay.

The group has applied the RAPD technique using 20 different 10-mers as primers for authentication and differentiation of eight different breeds of Indian goat; and identified the reproductive trait (litter size) associated polymorphic DNA-products in 'Garole' breed of microsheep of Bengal.

A.3. Production of bovine embryos and their sex determination using polymerase chain reaction (PCR) :

P. Gupta, A.K. Ray, G. Ganguly and A. Indra.

The objective of this study was to obtain good quality bovine embryos and to establish a reliable method for sex determination prior to cryopreservation and transfer to surrogates. Using the standard IVM protocol 80-82% maturation of oocytes was achieved. Further to achieve uninterrupted cleavage the *in vitro* matured oocytes were compared after fertilization under three different conditions. 1) Fertilization medium (modified Tyrode's) as control 2) Fertilization medium + Pencillamine, Hypotaurine and Epinephrine (PHE) and 3) Fertilization medium + PHE and Bovine Oviductal Epithelial Cell Co-culture (BOEC). The 48 hour post insemination cleavage rate for the treatment groups (2 (56%) and 3 (63.6%)) were greater than control 1 (45%).

Four to sixteen cell embryos were collected and single blastomere was carefully recovered using micromanipulator and the sex of each blastomere was determined using bovine satellite sequence specific primer which is common to both sex (control) and Y-chromosome specific primer which

amplified a fragment of 301 bp only in males. Pre-sexed embryos will be of immense use to Indian livestock industry and also for production of biomedically important proteins in the milk of transgenic farm animals.

A.4. Studies toward production of proteins of biomedical importance in the milk of farm animals.

Prabhadar Gupta, Arup Kumar Indra, Gitali Ganguli, Purba Konar (nee Mal).

Transgenic animals are routinely being used as bioreactors for the production of biomedically important proteins in their milk, blood or urine. Pilot experiments were conducted in mice mainly to standardize this technology of molecular pharming.

A large number of 1-cell bovine zygotes have been produced by *in vitro* maturation (IVM) and fertilization (IVF) of bovine oocytes obtained from the ovaries of slaughtered cows. Using elite and pedigreed bulls frozen-thawed semen and standard IVF protocols a fertilization rate of 80% has been achieved. Some of the 8-16 cell stage embryos have been transferred to the oviducts of the surrogate cows maintained at local dairies, viz., Express Dairy Co. Ltd. and Haringhata Farm, Nadia, West Bengal. Besides, a bank of pre-sexed embryos has been generated through cryopreservation.

PUBLICATIONS

1. Some physiological parameters and seed lipid composition of transgenic tobacco. S.K. Ghosh, N. Dey, R.K. Mandal, J. Dasgupta and I.B. Maiti *J. Plant Biochem. Biotech.* **3**, 141-143, 1994.

2. Expression of 2S seed storage protein gene of *Brassica juncea* in transgenic tobacco plants under constitutive and seed specific promoters. S.K. Ghosh, J. Maiti, I.B. Dasgupta, A.G. Hung, and R. K. Mondal *J. Pl. Biochem. Biotech.* **4**, 1-4, 1995.

3. Bypassing successive cloning of two fragments by one step cloning using polymerase chain reaction. S.K. Ghosh, N. Dey, R.K. Mondal, *Ind. J. Exptl. Biol.*, **32**, 676-678, 1994.

4. Cryopreservation of spermatozoa of freshwater catfishes *Clarias batrachus* and *Heteropneustes fossilis*. B.K. Padhi, R.K. Mandal, *J. Aqua. Trop.*, **10**, 23-28, 1995.

5. Genetic resource mapping and fisheries management, B.K. Padhi, R.K. Mandal, *Curr. Sci.*, **68**, 490-493, 1995.
6. Reciprocal hybridization between two freshwater catfishes: *Heteropneustes fossilis* and *Clarias batrachus*, B.K. Padhi, P. Dutta, and R.K. Mandal, *Ind. J. Exp. Biol.* **33**, 433-436, 1995.
7. Restriction fragment length polymorphism of nuclear and mitochondrial DNA: Applications in fisheries science, B.K. Padhi, and R.K. Mandal, *Persp. Cytol. Genet.* (Eds. G.K. Manna, and S.C. Roy) **8**, 185-195, 1995.
8. Myoinositol phosphates as 'implicated' in metabolic and signal Transduction pathways in plants, Susweta Biswas and B.B. Biswas, *J. Indian Chem. Soc.*, **71**, 495-499, 1994.
9. Receptor for myoinositol trisphosphate from the microsomal fraction of *Vigna radiata*, Susweta Biswas, Basudev Dalal, Mita Sen and Birendra B. Biswas, *Biochem. J.*, **306**, 631-836, 1995.
10. Magnesium induced structural changes in tubulin, A Bhattacharyya, B. Bhattacharyya and S. Roy, *J. Biol. Chemistry*, **269**, 28655-28661, 1994.
11. Local unfolding and stepwise loss of the functional properties of tubulin, D. Sackett, B. Bhattacharyya & J. Wolff, *Biochemistry*, **33**, 12868-12878, 1994.
12. Fluorescence spectroscopic studies of proteins. In: *Subcellular Biochemistry* S. Roy & B. Bhattacharyya **24**, 101-114 (Plenum Press).
13. A 61 kb ring chromosome shows ARS-dependent increase in its mitotic stability in *mcm2* mutant of yeast. A. Roy, N. Roy, M. Maitra and P. Sinha, *Current Genetics*, **26**, 403-409, 1994.
14. The *mcm2-1* mutation of yeast causes DNA damage with a *RAD9* requirement for repair, A. Roy and P. Sinha, *Current Genetics*, **27**, 95-101, 1995.
15. Old Detection of β -thalassemia chain reaction. D. GhoshDastidar, R.N. Dutta, P. Gupta and J.M. Old *Indian J. Med. Res.* **100**, 111-114, 1994.
16. Molecular cloning of putative *mos* protein serine/threonine kinase from *Entamoeba histolytica*, A. Lohia and J. Samuelsons *Biochem. Biophys. Acta*, **1222**, 122-124, 1994.
17. Molecular cloning of ras and rap gens from *Entamoeba histolytica* P. S. Sen, A. Lohia, J. Samuelson, *Mol. Biochem. Parasitol.* **64**, 111-120, 1994.

Ph. D. Awarded

Name	University/subject	Year	Title	Supervisor
Suparna Sengupta			Interaction of colchicine and its fluorescent analogues with tubulin.	Prof. B. Bhattacharyya
Santanu Dasgupta			Studies on 2S storage protein and its gene in Brassica species.	Prof. R.K. Mandal

Participation in Conferences/Symposium/ Training programme/Award and Honour received.

Prof. R.K. Mondal delivered a talk in the golden Jubilee Symposium on Biotechnology of oils and oilseeds at IICT, Hyderabad in June, 1994. delivered a talk on scientific work of Dr. Gopal Chandra Bhattacharya at the inaugural meeting of G.C. Bhattacharya Centenary Celebration, Calcutta in August 1994; attended International symposium on Molecular Biology of Development and Aging at Bhubaneswar in Sept. 1994. Presented talk and chaired a session in symposium on Crossroads of Biochemistry, Molecular Biology and Biophysics at BHU in Feb. 1995. Delivered a lecture and chaired a session at the National seminar on the Role of Biotechnology in Improving Agriculture held at Rajasthan Agricultural University Jaipur in March, 1995. Gave a talk on "Biotechnological approaches for improvement of seed protein quality at ICGB, New Delhi in March, 1995 and Humboldt Club Seminar on Biotechnology held in Calcutta in March 1995.

Prof. S. Biswas delivered an invited lecture in XVIth IUBMB Satellite Symposium on Cellular calcium homeostasis in Calcutta in September, 1994. **Rinku Ghosh** delivered a lecture organised by Plant Physiology Forum in Kakdwip, 24-Parganas in November, 1994. **Prof. N.C. Mandal** delivered a talk under the auspices of the Society of Biological Chemists (India), Calcutta Branch in April, 1994. Served as a member of the Scientific Advisory Committee for National Institute of Cholera and Enteric Diseases. Delivered an invited talk 16th IUBMB Congress Meeting held at New Delhi in September, 1994. Delivered an invited talk in the Asian Conference on Transcription (a Satellite Meeting of the Post-IUBMB Congress) held at Bangalore in September, 1994.

Nominated by INSA as a member of the National Committee for International Union of Biochemistry and Molecular Biology (IUBMB); has been nominated by INSA as a member of the National Committee for International Union of Biochemistry and Molecular Biology (IUBMB) for 1994-97.

Prof. B. Bhattacharyya acted as Convenor of a Satellite Symposium on "Protein Structure, Function and Engineering" at Calcutta, 1994-95; acted as convenor of a Symposium of "Protein-Protein Interaction in the Formation and Function of Biological Polymers" in IUBMB Congress at New Delhi, 1994-95;

Prof. S. Biswas and Dr. P. Sinha attended the XVIth IUBMB meeting held in New Delhi in 1994 and presented posters; attended the XVIth

IUBMB satellite meeting on GRBS held at BARC, Bombay, 1994 and delivered a talk.

Dr. P. Gupta Organized training courses conducted under the manpower Development Programme of Department of Biotechnology, Government of India; practical course on "Techniques in Production of Transgenic animals" in Aug-September, 1994; practical Course for In-service Scientists/Technicians on "Recombinant DNA techniques" 1994-95; participated in International union of Biochemistry and Molecular Biology (IUBMB) meeting held in New Delhi Sept. 1994; Indo-British Seminar and workshop on "Thalassaemia control" held at Wadia Hospital, Bombay in Sept. 24, 1994; International Conference on "Cell Signalling and Ovoimplantation" held at All India Institute of Medical Sciences, New Delhi (Nov. 21-24, 1994) and won Best poster presentation award. 3rd International Conference on "DNA Fingerprinting" held Krishna Oberoi, Hyderabad (Dec. 13-16, 1994).

XVIII All India Cell Biology Conference held at National Botanic Research Institute, Lucknow in February, 1995.

Delivered Invited talk on organized by Central zoo Authority, Ministry of Environment & Forests held at Vigyan Bhavan, New Delhi in October 1994; invited talk in the XX Annual Conference of Indian Society for Human Genetics held at Osmania University, Hyderabad in Dec. 1994; Invited talk in the Symposium on Chromosomal and Molecular Basis of Genetic analysis, held at Banaras Hindu University, Varanasi in Jan. 1995; Invited talk on "Recent Advances in Molecular Cytogenetics" to the participants of DBT sponsored Technician training course on Animal Tissue and Cell culture methods for study of Mammalian Cyrtogenetics (including human) held at Vivekananda Institute of Medical Sciences, Calcutta in Feb. 1995.

Dr. A. Lohia delivered an invited talk at UNESCO Symposium "Nutrition, Lipids, Health and Disease" Penang, Malaysia, and also at IUBMB Satellite Symposium "Genetic rearrangements in Biological Systems" BARC, Trombay, September, 1994; Presented poster at IUBMB New Delhi, September, 1994; invited talk at All India Cell Biology Symposium, Lucknow, in February 1995. Had a visiting student M.K. Krelsinger, from Harvard Medical School, Boston USA for 3 months who worked on the PCR diagnostic assay for pathogenic strains of *E. histolytica*.

Dr. P. Parrack visited Dr. S. Adhya's lab. at NCI for 7 weeks in 1994 NIH (USA) on a special invitation from Dr. Adhya, to discuss and carry out preliminary work on a collaborative project. attended the symposium on "Protein structure, Function and Engineering" at Bose Institute, Calcutta, in Sept. 1994; participated and presented

poster in the "Asian Conference on Transcription - III" held at the Indian Inst. of Science, Bangalore, in Sept. 1994.

Dr. R. Chattopadhyaya all members of his participated in the Satellite Symposium on Protein Structure and Function in September, 1994 of IUBMB, in the Park Hotel, Calcutta.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dr. M. Sen, S.S. Gangopadhyay, Dr. S. Sengupta, R. Bhattacharyya, Dr. G.S. Sa, S. Bhattacharyya, S. Dasgupta, M.K. Maiti, S.K. Ghosh, B.K. Padhi, A. Indra, Nilanjan Ray, Rinku Ghosh, Suranjan Ghosh, Sudit S. Mukhopadhyay, Gituly Ganguly, Surekha Mandal, VMH Namboodri, Saurabh Pal, Atasi Podder, Runa Sur, Purba Mal, Samarpan Majunder, S. Roychoudhury, M. K. Maiti, B. Chaudhuri, N. K. Jana, S. Sau, S. K. Ghosh, N. De, L. Adhikary, S. Roy, G. Chakraborty, B. Roy, S. Ghosh, N. Sarkar, P. Basu, P. Kundu, M. Maitra, H. Dutta, M. Basu, P. Mandal, S. Chakraborty, S. Banerjee, S. Bhattacharyya, K. Ghosh, P. Sen, C. Chattopadhyay, J. Mukherjee, Dr. P. Venkatiah, Dr. B.K. Padhi, Dr. Bhudeb Bhattacharyya, Dr. Pradip Kr. Mahapatra, Dr. Sumita Sinha, Dr. Bhaswati Goswami, Dr. Brajadulal Chatterjee, Dr. Chaiti Gauguly.

OTHER SUPPORTING STAFF MEMBERS

B.K. Banerjee, S. Saha, S.C. Debray, D.C. Das, S.K. Das, A.K. Banerjee, N.C. Dutta, S. Das, S. Chakraborty, A.K. Poddar, D. Ray, B. Bez, A. Molla, S.S. Maity, B. Ghorui, D.C. Mandal, R.B. Das.

Grants-in-aid Scheme

Investigator/Co-investigator	Title	Financed by
Prof. Susweta Biswas	Myoinositol tris and tetrakis-phosphate generated by Phytase action on myoinositol hexakis phosphate and its involvement in signal transduction process in plant cell	C.S.I.R.
Dr. Anuradha Lohia	Organisation of the <i>Estamoeba histolytica</i> genome	C.S.I.R.
Prof. B. Bhattacharyya	Studies on the identification and characterisation of functional domains of Tubulin.	C.S.I.R.
Prof. N.C. Mandal	Studies on the promoters and operators of Mycobacteriophage L1 and construction of mycobacterial expression vectors	C.S.I.R.
Prof. R. Chattopadhyaya	Crystallographic studies of lipase from <i>A. niger</i>	C.S.I.R.
Prof. N.C. Mandal	Studies on the Lethal interaction of the Bacteriophage lambda replication gene P with its host <i>E. coli</i> .	C.S.I.R.
Dr. R. Chattopadhyaya	Purification and crystallisation of locally available proteins	DST

Biophysics

Faculty : Prof. A.K. Banerjee (Chairman), Dr. S. Roy

INSTITUTIONAL PROJECT III

A.1. Structural basis of catalytic mechanism and interaction at active site Calotropin DII and β -lactam- β -lactamase.

Asok Banerjee, Indrani Dey, Sreya Ghosh, Sampa Pain, A. Seal, Bishnu Mukhopadhyay, Asim Bera

The crystallographic structure of Calotropin DII, a novel cysteine protease has been revealed by molecular replacement method using papain as phasing model. The refinement is in progress with an objective to visualise its substrate specificity, and compare it with papain and other cysteine proteases.

The Crystallographic structure of another β -lactam analog has been solved for making inhibitor complex (with the macromolecule) and elucidation of its mode of interaction at active site. The mode of interaction of a series of β -lactams to β -lactamase have been studied by molecular modelling and docking procedure.

All the results are encouraging with prospect of a successful package for receptor based drug design of the antithiol-agents/blockers/thiol-protease inhibitor in this field.

A.2. Visualization of the role of water molecules in the protein-nucleic acid interaction at atomic resolution.

Asok Banerjee, Sreya Ghosh, B.P. Mukhopadhyay, Sampa Pain, Indrani Dey

Success has been achieved to cocrystallize & solve the structure of complex of L-serine with two Inosine 5' - monophosphate in highly hydrated form ($12H_2O$). This potential model, first of its kind reported, throw some interesting findings which are still to be characterised in macromolecular complexes. Water mediated specific & nonspecific interactions of the partners are found to play a key role in recognition. Several other cocomplexes have been done and data collection and structure solution is underway.

A.3. Structural & modelling studies of a peptidoglycan - a chemoreceptive constituent of Mycobacterium cell wall.

Asok Banerjee, Sreya Ghosh, Indrani Dey, Sampa Pain and Bishnu P. Mukhopadhyay

Peptidoglycan has been studied computationally and eliminates many possible hypothetical models. Kinetic and binding affinity studies of the different chemical agents/ligands with model peptidoglycan system has clarified their mode of interaction at molecular level.

A.4. Quantitative structure activity relation study of several series of specific drugs & analogs by graph theoretical pattern recognition approach.

Asok Banerjee, C. Roychoudhury, P. Bag

Interesting development has been made in the lactam series of compounds. On the role of anthracene nucleus as anticancer agents, some interesting findings have been found.

A.5. Structural and Molecular Basis of Co-operative Interaction in lambda-repressor:

Siddhartha Roy, Sumita Bandyopadhyay, Anusree Bhattacharyya, Sunanda Dev in collaboration with **Prof. N.C. Mandal**, (Biochemistry Dept. B.I.)

Structural and molecular basis of co-operative interaction in DNA binding proteins are one of the most studied areas. Co-operative binding of λ -repressor and its structural and molecular origin were studied for last several years. It has been observed that the protein-protein interface of the repressor dimers bound to adjacent promoters are distinctly different from the free dimer-dimer interface in solution. It also suggests that the C-terminal tail region, which is involved in dimer-dimer association in the solution, may not be involved in the co-operative interaction. This is the first known example of context dependent variation of protein-protein interaction.

A.6. Structure-function relationships of glutamyl and glutamyl-tRNA synthetases of *E. coli*.

Siddhartha Roy, Anusree Bhattacharyya, Amit Mandal, Rajat Dasgupta, Asim Bothra and Subhra Bhattacharyya

Based on X-ray structure of glutamyl-tRNA synthetase from *E. coli* a structure of glutamyl-tRNA synthetase from *E. coli* by homology modeling has been developed. This will now be further refined. The structural basis of loss of activity of proteins in dilute solution using glutamyl-tRNA synthetase as a model system has also been investigated. Results indicate that loss of domain-domain pairing in multi-domain proteins may be the controlling event in the solid surface catalyzed activity loss.

A.7. Spectroscopic studies of gal repressor-ligand interaction.

Siddhartha Roy and Sumana Chatterjee in collaboration with **Sankar Adhya**, NIH, USA.

Structural and molecular basis of several mutants of gal repressor were investigated. One of this mutants, is resistant to induction by galactose and carries a tyrosine to phenylalanine mutation. A fluorescence assay of binding of galactose and other inducers to gal repressor was developed. Binding studies to this mutant indicate that the mutation causes weakening of galactose binding but is not deficient in subsequent conformational changes that leads to transcriptional activation.

A.8. Distance measurement between ligand binding sites of tubulin using fluorescence energy transfer:

Siddhartha Roy and Anusree Bhattacharyya in collaboration with **B. Bhattacharyya** (Biochemistry Dept., B.I.)

DCVJ is an important hydrophobic probe that binds to a single site in tubulin, probably near the inter-prot filament binding sites. Fluorescence energy transfer was used to obtain distances between DCVJ site and several ligands such as ANS, ruthenium red and colchicine. A self consistent distance estimate is obtained which leads to the conclusion that DCVJ binding site and hence one of the inter-prot filament binding sites is located on the C-terminal domain of the α subunit.

PUBLICATIONS

1. An artificial intelligence approach to computer aided anticancer drug design using molecular topology C. Roychoudhury, S. Saha, and Asok Banerjee. Proceedings of the XVI International Cancer Congress Papers, Vol. I, pp. 2991-2996, 1994.

2. Crystal structure of Acid-catalysed dimerisation of the intermediate from Benzo(b) Thiophene-2-Isopropanol, Asok Banerjee, G. Biswas, S. Pain, B. B. Maji, K.L. Ghatak, S.N. Ganguly & Y. Iitaka. *Journal of Chemical Research(s)*, pp. 60-61, 1995.

3. Crystal and molecular structure of D1 (2-Methylbenzotriazole) Sulfate ($C_7H_9N_3SO_4$), A.C. Gomes, G. Biswas, B.P. Mukhopadhyay, Y. Iitaka, and Asok Banerjee. *Journal of Chemical Crystallography*, **24**, 383-385, 1994.

4. Crystal structure of Acid-Catalysed dimerisation of the Intermediate Benzo[b] Thiophene-2-Isopropanol Asok Banerjee, G. Biswas, S. Pain, B. B. Maji, K.L. Ghatak, S. N. Ganguly & Y. Iitaka. *Journal of Chemical Research (M)*, pp. 0553-0565, 1995.

5. The crystal and molecular structure of an epoxide, $C_{30}H_{50}O$ Indrani Dey, B.P. Mukhopadhyay and Asok Banerjee. *Journal of Chemical Crystallography*, **24**, 387-389, 1994.

6. Magnesium induced structural changes in tubulin. Anusree Bhattacharyya, B. Bhattacharyya, and Siddhartha Roy, *J. Biol. Chem.* **269**, 28655-28661, 1994.

7. Role of C-terminal tail region in the self-assembly of lambda repressor. Sumita Bandyopadhyay, Utpal Banik, N.C. Mandal, B. Bhattacharyya, and Siddhartha Roy, *Biochemistry* **34**, 5090-5097, 1995.

8. Characterization of an urea induced molten globule state of glutamyl-tRNA synthetase. Biplab Das, Tista Bhattacharyya, and Siddhartha Roy, *Biochemistry* **34**, 5242-5247, 1995.

Participation in Conferences/Symposia/ Training/Programme/Award and Honours received.

Prof. A. Banerjee invited & delivered at INSA chapter University of Madras, Nov. 1994, invited & delivered a talk at Central Forensic Laboratory, Calcutta, 1995; invited and attended IUBMB meeting & Internat Cancer Congress meeting at New Delhi, in September, 1994 and presented papers.

RESEARCH SCIENTIST/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS /JUNIOR RESEARCH FELLOWS

Dr. B.P. Mukhopadhyay, Dr. S. Bhattacharyya, Dr. A. Seal, A. Bhattacharyya, S. Ghosh, A.K. Bothra, S. Bandopadhyay, I. Dey, S. Deb, A. K. Pal, S. Chatterjee, A. K. Mondal, R. Banerjee, B.K. Das, J. Chakravarty, S. Pain.

OTHER SUPPORTING STAFF MEMBERS

A. Bhattacharyya, B. Goswami, B. Munshi.

Grants-in-Aid Schemes

Investigator/Co-investigator	Title	Financed By
Prof. A. Banerjee	Studies on model nucleotide-peptide/peptide ligand complex at atomic level by x-ray Crystallography	C.S.I.R.
Prof. A. Banerjee	Studies on fundamentals of chemotherapeutic drugs at molecular level	I.C.M.R.
Dr. S. Ray	A study of structural and molecular basis of Co-operative binding to operator sites of repressor	C.S.I.R.
Dr. S. Ray	Nuclear magnetic studies of structure and dynamics of bent DNA	D.S.T.
Dr. S. Ray	Fluorescence spectroscopic studies of amino acyl t-RNA synthetases belonging to two different classes	C.S.I.R.

Animal Physiology

Faculty : Prof. A.K. Ray (in-charge), Dr. R. Ghosh, Dr. G.S. Sa (from 19.1.95)

INSTITUTIONAL PROJECT IV.

A. Environmental Physiology and Hormonal Regulation

A.1. Toxic stress of carbofuran technical in fish, *Labeo rohita* (Ham).

Rama Ghosh, Mousumi Sen, A.K. Dasmahapatra

To assess the toxicity of carbofuran technical (CF) on *Labeo rohita*, median tolerance limit (TLm) value was measured.

The data indicated the TLm value (50% mortality) of carbofuran technical for *Labeo rohita* to be 1.8 mg/l (ppm).

A.2. Effect of carbofuran technical on 17-beta-estradiol content in serum and ovary of singi fish, *Heteropneustes fossilis* (Bloch) during prespawning and spawning phases of reproductive cycle.

Rama Ghosh, Sudipta Chatterjee

Whether or not this carbamate pesticide affects 17-beta-estradiol levels in the serum and ovarian cytosol of the Singhi fish at prespawning and spawning phases was studied. It was observed that fish at prespawning phase contained more hormone (17-beta-estradiol) than spawning phase. CF reduced this hormone level in both the phases. During prespawning phase, CF at 0.5 mg/l and 1.0 mg/l doses reduced estrogen level in serum up to 50% ($P < 0.01$). Further reduction (about 70%) was found in fish treated with 2.0 mg/l dose of CF. During spawning phase about 60% reduction in serum estrogen level was observed by CF in 0.5 mg/l. More than 60% reduction was found in 1.0 mg or 2.0 mg/l dose.

17-beta-estradiol in ovarian cytosol varied significantly ($P < 0.01$) between prespawning and spawning fish. Like serum, carbofuran (0.5-2.0 mg/l) treatment reduced (2.5 fold) the hormone level ($P < 0.01$) in the ovary in comparison to that of control fish in both the phases of the reproductive cycle.

A.3. Bioaccumulation of carbofuran and 3-hydroxy carbofuran contents in liver, muscle and ovary of singi fish, *Heteropneustes fossilis* (Bloch)

exposed with sublethal doses of the pesticide.

Rama Ghosh, Sudipta Chatterjee, Udayan Banerjee Environmental Science Section

It was observed that 3-OH carbofuran a metabolic product of carbofuran, accumulated in the liver, muscle and ovary was always at the higher level than carbofuran, the parent compound added to the medium during the experiments. The metabolic product (3-OH carbofuran) was also remained at high level in water (environment). The accumulation was dependent upon the dose of the pesticide used in the experiments. But in control fish the pesticide residues were not detected.

A.4. Primary culture of catfish hepatocytes in serum-free media and their response to estrogen :

Rama Ghosh, A.K. Dasmahapatra, P.K. Mondan (Department of Biochemistry).

Addition of 17-beta-estradiol to the cultured hepatocytes after 24 hours of plating induced vitellogenin synthesis within 48 hours. The stimulation of vitellogenin synthesis by estradiol and its inhibition by cycloheximide were also observed.

A.5. Interaction of 1-ethynylpyrene and hepatic CYP1A1 from rainbow trout, *Oncorhynchus mykiss*.

A.K. Dasmahapatra and P. C. Lee

1-ethynylpyrene (EP) inhibits microsomal 7-ethoxyresorurin-O-deethylase (EROD) activities from the liver of both rainbow trout and rat. Trout hepatocytes treated with EP had increased microsomal EROD activity and a concomitant increase in CYP1A1 protein as measured by Western blot analysis. EP at 10^{-9} - 10^{-6} M did not interfere with beta-naphthoflavone (BNF) induction of CYP1A1 in trout hepatocytes. In contrast, treatment with alpha-naphthoflavone (ANF), another inhibitor of CYP1A1, resulted in a significant inhibition of the basal (at 10^{-6} M ANF) and BNF induced (at 10^{-6} M and higher concentrations of ANF) level of EROD activity. ANF also did not significantly induce CYP1A1 protein but led to attenuation of the induction of CYP1A1 proteins

Annual Report

by BNF in trout hepatocytes cultures. Thus, in trout hepatocytes, EP acts differently from ANF in the modulation of CYP1A1.

A.6. Induction of triploidy by cold shock in catfish (*Heteropneustes fossilis* Bloch)

Studies on characteristic feature, growth and reproduction

A. K. Ray, Basant K. Tiwary

Two and half fold increase in weight in triploid fish than their diploid counterpart has been household laboratory conditions ($25 \pm 1^\circ\text{C}$). Also an earlier method for detection of triploidy in Singhi fish (*H. fossilis*) has been developed. Ratio between body depth (BD) and standard length (SL) proved to be a significant indicator of triploidy. Ratio was restricted between 0.19 to 0.32 in triploids and 0.16 to 0.18 in diploids. Histological studies on ovary and testes reveal the presence of immature oocytes and small seminiferous tubules in triploids, respectively.

A.7. Role of estrogen in the ovarian development in freshwater prawn *Macrobrachium rosenbergii*:

A rapid estrogenic response in hepatocyte culture of freshwater prawn, *Macrobrachium rosenbergii* :

A. K. Ray, Debjani Ghosh

In our attempt to understand the role of estradiol-17-beta in the reproductive processes of freshwater prawn the vitellogenin (egg-yolk precursor protein) synthetic action of the hormone in hepatopancreas *in vivo* was . Subsequently, a hepatocyte culture system from prawn viable for 7-10 days has been developed. This has become a nice model to study the biological functions of different crustacean hormones, as yet unknown, on the vitellogenin synthetic capacity of the hepatocytes.

A.8. Thyroid hormone regulation of mammalian brain function :

A. K. Ray, P.K. Sarkar, Nilkanta Chakraborty

Role of thyroid hormone (T_3) on adult brain function has been studied. Specific thyroid hormone binding sites (receptors) at the synaptosomal membranes of neurones obtained from cerebral cortex of adult rats has been demonstrated. Thyroid hormone-specific binding site interaction inhibits the synaptosomal membrane $\text{Na}^+ - \text{K}^+ - \text{ATPase}$ activity. Further experiments indicate mediation of second messenger system (s) in the expression of the physiologic function of thyroid hormone. It is thought that the thyroid hormone

is actively related to the membrane-linked, energy-dependent processes in the neuronal signal generation and transfer.

A.9. Phenylhydrazine-hydrochloride (PHH) - thyroid hormone interaction in rat :

A. K. Ray, Mitali Pramanik

In order to understand the interaction of phenylhydrazine hydrochloride (PHH) with the red cell and involvement of thyroid hormone for counteraction of the PHH-induced oxidative stress, experiments have been designed to explore the nature of red cell membrane stability during this condition. Purified red cell membrane (Ghost) were prepared and subjected to PHH insult to observe the membrane stability. It appears that the red cell membrane has a very high $\text{Ca}^{2+} - \text{ATPase}$ activity and a moderate level of activity of $\text{Na}^+ - \text{K}^+ - \text{ATPase}$. It indicates that the oxidative stress has its strong impact on the ion transport (Na^+/K^+) system in the red cell by disorganizing the membrane stability.

B. Control of growth and development of silkworm and silk production :

B.1. Development of a short-term hepatocyte culture system from *Bombyx mori* L :

A. K. Ray, Ananda Mukhopadhyay

Hepatocytes from the 5th instar larval or pupal stage of *Bombyx mori*, were made into culture in a medium of 1PL-41 at pH 6.5, at $25 \pm 2^\circ\text{C}$. The cells attached to a coated attachment factor after 24 hr. This attachment factor was prepared from silkworm skin. The hepatocytes appeared like spherical cells with several small globules attached outside the cell membrane. The activity of lactate dehydrogenase and malic enzyme activity of the fat body cells were monitored both in suspension and in attached cells for various periods. *In vitro* cells viability was established up to a period of 96 hrs.

Such fat body cell culture model can be used to understand (1) metabolic functions of different insect and vertebrate hormones, hormone-hormone interactions, (2) generation of ligand-mediated cell signalling in isolated insect cells, (3) susceptibility of the insect cells to different insecticides/environmental pollutants, (4) metabolic alterations during infected conditions in *Bombyx mori*.

B.2. Anabolic role of estradiol-17-beta on posterior silk gland of *Bombyx mori* L. :

A. K. Ray, Bela Keshan

Previously it has been demonstrated that

estradiol-17-beta (E_2) has a stimulatory action on the vitellogenin (egg-yolk precursor protein) synthesis in the fat body and help in ovarian maturation. To observe the beneficial effect of this vertebrate hormone on the commercial features of the silkgland, it has been found that stimulation of the metabolic activity, such as activation of the mitochondrial trehalase and glutamate-pyruvate transaminase activity in the posterior silkgland after treatment with different doses of estrogen. This part of the silkgland is responsible for fibroin production.

B.3. Biochemical changes in the cold-shocked tasar silkworm eggs :

A. K. Ray, Niranjana Kumar, A.B. Chaudhury (in collaboration with Central Tasar Research and Training Institute, Ranchi)

It is a custom to preserve the eggs of silkworms in cold condition to delay the hatching of the larvae. In tasar silkworms, sometimes unusual hatching is observed in the cold-shocked eggs. In order to understand the reasons for such unusual hatching of larvae from the cold-shocked eggs several metabolic parameters in these conditions have been studied.

It has been observed that the cytosolic and mitochondrial malic enzyme activity attains their peak on the day of hatching of the larvae, in normal condition.

Preservation of the tasar eggs at 5° for 10 days diminished these enzyme activity to an undetectable level. After withdrawal of the eggs from the cold environment such blockade in the malic enzyme activity persisted for another ten days. Although the malic enzyme showed complete blockade, hatching of the larvae occurred in contrast to that found in normal unshocked eggs.

Since malic enzyme is involved in cellular oxidation and in the lipogenic process, it appears that lipogenesis is not much involved in the onset of hatching.

PUBLICATIONS

1. Synaptosomal T_3 content in cerebral cortex of adult rat in different thyroidal states: Pradip K. Sarkar and Arun K. Ray, *Neuropsychopharmacology*, **II**, 151-155, 1994.

2. Interaction of 1-ethynlpyrene and hepatic CYP1A1 from rainbow trout : P.C. Lee and A.K. Dasmahapatra, *Chem. Biol. Int.* **93**, 1-10, 1994.

Participation in Conferences/Symposia/ Training Programme/Awards and Honours received.

Prof. A.K. Ray delivered a lecture and acted as a Chairman of Session in the XIII National Symposium on Reproductive Biology and Comparative Endocrinology at Osmania University, Hyderabad in January 1995, delivered a lecture and acted as a Chairman of a Session in the UGC-sponsored seminar on "Modern Trends in Zoological Research" held in North Bengal University, Siliguri in March, 1995, Visited on invitation and delivered a lecture in Central Tasar Research and Training Institute at Ranchi, in February, 1995.

Dr. Rama Ghosh and **Dr. A.K. Das Mahapatra** participated in "National Symposium on Biodiversity" organized by the Zoological Society of Calcutta, acted as a Lecturer-cum-Instructor in a Workshop organized by RSIC, Bose Institute, on Recent Trends in Residue Analysis, during February 14-18, 1995.

Dr. R. Ghosh, Dr. A.K. Das Mahapatra, Dr. Ehsan Ahmed Khan, Mousumi Sen, Sudipta Chatterjee, Basant K. Tiwary and Bela Keshan participated in 82nd Indian Science Congress at Jadavpur, during January 3-8, 1995. **Dr. Ananda Mukhopadhyay, Dr. Ehsan Ahmed Khan, Basant K. Tiwary, Mitali Pramanik and Bela Keshan** participated in the XIII National Symposium on Reproduction Biology and Comparative Endocrinology held at Hyderabad in January 27-28.

Ph. D. Awarded

Name	University/Subject	Year	Title	Supervisor
Sri Pradip K. Sarkar	Calcutta/Biochemistry	1995	Thyroid hormone action in synaptosome of adult rat brain	Prof. A.K. Ray
Santanu Das	Calcutta/Zoology	1995	Studies on the role of estrogen in reproduction in silkworm, <i>Bombyx mori</i> L. (race Nistari)	Prof. A.K. Ray

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dr. Debjani Ghosh, Dr. Basant K. Tiwary, Bela Keshan, Dr. Ehsan Ahmed Khan, Dr. R. Kirubakaran, Dr. Ananda Mukhopadhyay, Sudipta Chatterjee Nilkanta Chakraborty

OTHER SUPPORTING STAFF MEMBERS

Dr. A.K. Dasmahapatra, I. Ray, S.K. Ghosh, A.K. Santra, N.C. Jana.

Plant Molecular & Cellular Genetics

Faculty : Prof. S.K.Sen (In charge), Dr. A. Pal, Dr. S.Das, Dr. S.R.Sikdar

INSTITUTIONAL PROJECT I.

A.1. Generation of insect resistant transgenic crop plants.

S. Das, S.K. Sen, Ashis Nandi, Dipankar Ghosh, Dipankar Das, A.S. Rishi, Krishna Roy, A. Mandal, Sushma Mishra, Ramkrishnan NA, Soma Pal, A. Basu, D. Basu, P. Nayak,

Entomocidal endotoxin coding genes viz., *cryIA(b)*, *CryIA(c)*, *cryIIIA* of *Bacillus thuringiensis* (*Bt*) and trypsin inhibitor genes from the seeds of cowpea and soybean were desired to be transferred to plants in order to generate insect resistant crop plants. The genes were isolated from their natural background and suitable chimeric geneconstructs were developed to ensure sufficiently high expression in the target plants. In case of *Bt*, choice of promoters, use of UTR sequences at the 5' and 3' ends, codon usage of the gene have been the areas of technical concern. Finally, after introduction of many modifications, highly expressive transgenic cultivars of *indica* rice have been developed. Encouraging progress has also been attained in cotton, Brassica, chickpea, Capsicum. Already developed rice transgenics are being tested against insects in the field. The third generation seeds of the transgenics are destined for field test through the help of agencies like International Rice Research Institute, Manila and the Directorate of Rice research, Government of India.

A.2. Development of transgenic crop plants with altered plant developmental pattern.

S. Das, S.K. Sen, N.S. Bajerjee, C. Ganguly, Malay Ghosh, T. Saha, D. Basu, S. Mishra, P. Nayak.

Attempts to generate transgenic crop plants with altered plant developmental pattern have yielded some useful results which are indicated as:

1. Homozygous transgenic mustard lines of B-85 strain with *ro14* gene in their fifth generation have flowered uniformly and stably or 20 days earlier in the field than the control lines. They also showed longer flowering duration and better

tolerance to drought condition than the control line. (2) In rice, a genotype which lacks tillering capacity but can mature in 60-65 days, under the influence of *ro1C* gene in the field in their third generation showed improved tillering capacity than the control line without adversely affecting and other desirable characters. (3) In Jute, it appears that the growth influenced by *ro1C* gene may ultimately influence the quality of the bast fibre formation amongst the transgenics.

A.3. Introgression of genetic traits from wild crucifers to cultivars of Indian mustard through protoplast fusion.

S.K. Sen, S.R. Sikdar, S. Pal, & F. Begum.

Successful recovery of somatic hybrids between *Brassica juncea* and *Diplotaxis harra*; *B. juncea* and *Trachystoma aphanoneurum* have been achieved and their backcross progenies (BC₁) in the field have shown transfer of some of the desirable characters of the wild plant species introgressed into the cultivar. Selections from backcross progenies of somatic hybrid between *B. juncea* and *Eruca sativa* (*Erussica*) have generated homozygous novel plant types with bold seed, erect plant habit, appressed fruiting character and high yielding capacity under water stress conditions. Field trials are underway.

A.4. Genetic engineering to improve the quality and quantity of mustard oil and seed meal.

S. Das, S.K. Sen, Krishnakali Niyogi, Ashis Bhattacharyya, Manas Pathak, Sarmila Chattopadhyaya & **D. Ghosh**, (Chemistry Dept., Bose Institute)

P.K. Saha, Amitava Roy, **T. Ghosh, K.K. Mukherjee** (Botany Dept., Bose Institute) Mrinal K. Maiti, Niranjana Das, **S. Ghosh** (Biochemistry Dept., Bose Institute) S. Pal, **S.R. Sikdar**, D. Basu, P. Nayak.

Improvement of the quality and quantity of the mustard oil and seed meal is receiving our active consideration. Introduction of the bacterial ACP

Annual Report

(acyl carrier protein) gene product in the developing seed of mustard is one of the strategies to improve the quality of oil production. The candidate gene from *Azospirillum brasiliense* has been isolated and character and details of the promoter and UTR elements of the ACP gene of *Brassica campestris* have deciphered. A chimeric gene has been constructed and attempts for generation of transgenic mustard plants are underway.

In another programme, genetic engineering of fatty acid chain elongation mechanism in developing seeds of mustard is destined to be interrupted through introduction of alien genes like either palmitoyl-ACP-thioesterase or stearoyl-ACP-thioesterase. The gene products from heterologous plant systems have been characterised and the nucleotide sequences of both the genes are being worked out. The genes would be made to express under the control of the regulatory elements of oleoyl-ACP-thioesterase gene of mustard.

Attempts to improve the protein quality of the mustard seed meal are being made through introduction of alien genes coding for proteins rich in essential amino acids under the control of 2S protein gene regulatory elements of the mustard. Additionally, low glucosinolate containing genetic attribute of a wild strain of *B. juncea* is being transferred to B-85, an elite cultivar of *B. juncea*.

A.5. Nuclear male sterility :

S.K. Sen, S.R. Sikdar, S. Das, P. Roy Chowdhury, Soma Paul, S. Roy Choudhuri, A. Mandal, D. Basu, & P. Nayak

Insight into the molecular mechanism that governs cytoplasmic male sterility in V20A and IR62829A lines of rice has been looked upon. It could be revealed that the *cms* lines are characterised by the rearrangement of the *atp6* mitochondrial gene organisation.

Creation of cytoplasmic male sterile lines in mustard has been attempted through transfer of cytoplasm of known *cms* lines like Polima, Jan and Ogu to a cultivar, B-85 through asymmetric protoplast fusion. Inactivation of the nucleus of the *cms* donor line and cytoplasm of the recipient, before protoplast fusion could result fully male sterile plants without affecting the ovule fertility. Inactivation of the nucleus of the donor system alone prior to protoplast fusion could generate partial sterility and extensive mitochondrial recombination.

In another programme, nuclear male sterile lines are being generated through the use of another-specific promoter coding for antimetabolites. In mustard, attempts for developing such transgenics to judge for selective expression are being carried out. Cotton and tomato also figure as target crop plants.

A.6. Production of variable diosgenin embryoclones of *Costus speciosus* (Koen.) **Amita Pal**

This is in continuation of earlier work. The diosgenin yield remained consistent upto the fourth vegetative generations. Spectral data of isolated diosgenin samples from the embryoclones confirmed purity. The results indicate that the genetic changes remained stable.

A.7. Selection of YMV resistant plant *Vigna mungo* cv. T9.

Amita Pal, Aparajita Mitra

One Yellow Mosaic Virus resistant plant was selected from a field where almost all the plants were viral infected. The seeds of this plant were subjected to field trials at the Gamma Field of BARC, Trombay, where there was severe infection of YMV. The yield data of YMV resistant and YMV susceptible plants were compared. The investigations on genomic difference between these two varieties are underway.

PUBLICATIONS

1. Somatic embryogenesis from callus cultures of *Solanum sarrachoides* Sendt. S. Banerjee, P.S. Ahuja & A. Pal. *J Plant Physiol* **143** : 750-752, 1994
2. Reporter gene transfer in tissues of *Vigna radiata* by cocultivation method and through microprojectile bombardment. A. Pal, C.R. Bhatia & B.B. Biswas. *Proc Plant In Vitro Technology* (Ed: NA Shammann) University Pertanian Malaysia, pp. 131-139, 1994
3. Callus cultures from zygotic embryos of *Costus speciosus* and their morphogenetic response. A. Roy & A. Pal *J Plant Biochem. & Biotech.* **4** : 29-32, 1995
4. Monitoring functional property of the transgene through rapid amplification of cDNA ends in *indica* rice transformants. D. Basu, S. Das, P. Nayak & S.K. Sen *Current Science* **68** : 1140-1144, 1995

Participation in Conferences/Symposia/ Training Programme/Awards and Honours received.

Dr. A. Pal delivered an invited talk in the National symposium on Tissue culture of Medicinal Plants organised by Centre for Advanced Study, Dept. of Botany, Calcutta University, Calcutta, held in Feb., 1995; participated in an Int. Conf. on "Current Progress in Medicinal & Aromatic Plant Research" held at Calcutta in Dec. 1994. She was one of the members of Scientific Committee.

Aparajita Mitra was awarded the second best poster award, a silver medal in the National Symposium on "perspectives of Modern Biology", held at Calcutta in Dec. 1994. She has also been nomi-

Bose Institute

nated as a Fellow of the Indian Association of Biological Sciences in recognition of her contribution in Tree Tissue Culture.

Prof. S.K. Sen, Dr. S. Das, Dr. D. Basu & Dr. P. Nayak had attended the Rockefeller Foundation's 7th Annual Meeting of Int. Rice Biotechnology held in May 1994 at Bali, Indonesia. Prof. Sen delivered an invited lecture on *indica* rice transformation and insect resistant transgenic plant production.

Prof. S.K. Sen delivered an invited lecture in a Symposium on "Molecules to Chromosomes" organised in Banaras Hindu University : delivered two invited lectures in the Institute of Life Sciences, Bhubaneswar; delivered an invited lecture at Max Mueller Bhavan, Calcutta in Symposium on Biotechnology.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dipankar Ghosh, M. Chandra, S. Roy Chowdhury, Dr. D. Basu, Dr. T. Saha, N.S. Banerjee, S. Majumder, K. Roy, Dr. A. Basu, S. Mishra, A. Mondal, D. Das, A. S. Rishi, F. Begum, P. Roy Chowdhury, A. Mitra, D. Bandyopadhyay, S. Paul, A.K. Nandi, Ramakrishnan, N. A. M. Ghosh, Dr. A. Lahiri Majumder, Dr. N. Jasani Gupta, Dr. P. Nayak.

OTHER SUPPORTING STAFF MEMBERS

P. Mukherjee, B.K. Mondal, M. Singh, P. Basu Roy, B.P. Pradhan, G. C. Dey, A.K. Dey, S. Basak.

Grants-in-Aid Schemes

Investigator/Co-investigator	Title	Financed By
Prof. S.K. Sen	Plant Improvement using modern biotechnology	U.N. D.P.
Prof. S.K. Sen/Prof. R.K. Mandal	Centre for Plant Molecular Biology	D.B.T.
Prof. S.K. Sen	Development of transgenic cotton plants resistant against bollworm attack and yield loss.	D.B.T.
Prof. S.K. Sen	Production of transgenic <i>indica</i> rice plants with useful gene.	The Rockefeller foundation
Prof. S.K. Sen	Generation of genetically engineered tea plant	Tata Tea Ltd.

Immunotechnology Section

Faculty : Prof. P. K. Ray

INSTITUTIONAL PROJECT V

A.1. Development of immunodiagnostics for biotoxins in food and feed

P.K. Ray, S. Raisuddin and A. Subramoniam.

There are many biotoxins (naturally occurring toxins) present in our food causing various types of illnesses including malignancies. Many of the biotoxins induce immunosuppression. Considering need to develop simple and quick methodologies for detection of biotoxins immunoassay method for aflatoxin detection has been developed.

A.2. Molecular modelling of anticancer and immunomodulatory agents

P.K. Ray, and S. Raisuddin.

To determine the entire structure of protein A molecule, extensive studies on the homology of protein A with other functionally active proteins using computerized databank were undertaken. It was found that protein A has some sequence homology with DNA binding proteins, epidermal growth factor, transactivating transcriptional regulatory protein, NADPH cytochrome P-450 reductase, DNA polymerase accessory protein, cell division controlling protein, transforming protein, regulatory protein etc.

A.3. Synthesis and functional studies on small peptides having immunological activities

P.K. Ray, and P.K. Datta.

Synthesis of octapeptides of protein A has been undertaken using peptide synthesizer. An octapeptide (NH₂-Glu-Asn-Ala-Phe-Tyr-Glu-Leu-COOH) has been purified using HPLC. Immunoblotting studies have revealed that it has binding ability

with IgG. This octapeptide has the ability to displace protein A from the protein A-IgG complex. The molecular structure of the octapeptide has been determined by the help of computer and it has been found by quanta calculation that one hydrogen bond is formed between the octapeptide, Asn-130 and Fc-fragment, Asn-434.

PUBLICATIONS

1. Acrylamide induced immunosuppression in rats and its modulation by 6-MFA, an interferon inducer, S.I.A. Zaidi, S. Raisuddin, K.P. Singh, A. Jaferi, R. Hussain, M.M. Hussain, S.A. Mall, P.K. Seth and P. K. Ray, *Immunopharmacol. and Immunotoxicol.* **16** (2), 247, 1994.

2. Modulation of antisheep erythrocyte primary antibody response of Protein A in normal mice, S.I.A. Zaidi, S. Raisuddin, A. Jaferi, K.P. Singh and P.K. Ray, *Immunopharmacol. and Immunotoxicol.* **16** (1) 85, 1994.

Participation in Conferences/Symposium/ Training programme/Awards and Honour received

Dr. P. K. Datta participated in symposium of Bioinformatics : The current Scenario in Calcutta in January, 1994 and presented a talk. also presented an abstract in Society of Biological Chemists Meet in Haldia in 1994. participated in XVI IUBMB India, Satellite Symposium on Protein Structure, Function and Engineering in Calcutta in September, 1994, also participated in XVI International Congress of Biochemistry and Molecular Biology in New Delhi, in September, 1994.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS/JUNIOR RESEARCH FELLOWS

Dr. P.K. Datta, P.K. Sarkar, Dr. M. Srivastava, V. Subhalakshmi

OTHER SUPPORTING STAFF MEMBER

U.K. Ghosh.

Environmental Sciences Section

Faculty : Prof. P. K. Ray

INSTITUTIONAL PROJECT IV

A. Studies on the Environmental Impact Assessment and Environmental Management Plan of 2nd Oil Jetty of Haldia Dock Complex :

P. K. Ray, U. Banerjee and D.P. Modak.

A.1. Studies on the Disaster Management Plan of 2nd Oil Jetty

P. K. Ray, D.P. Modak and U. Banerjee.

Impact of the activities of oil jetty of the Man and Environment were investigated in details in a 10 Kms radius around the Jetty. It was found that in the course of handling crude oil & other POL products a significant amount is discharged into the estuary which not only adversely effects the aquatic environment but also contaminates the ground water resources. Also the untreated ballast water from the tanker causes adverse impacts on the environment. The detailed investigations were then used in the value functional curves of **Battle Environmental Evaluation Systems**, where in a scale of 1000 the total impact on the environment was rated to be - 122 without Environmental Management Plan. Therefore a detailed Environmental Management Plan including oil spil contaminant and Ballast water treatment plant was prepared. With the proper implimentation of which the environmental impacts would improve from - 122 to + 21.

A.2. Studies on the Pollution Impact of Sediment Dredging in Hooghly River and its Estuarine Region on the aquatic flora and fauna

P. K. Ray, U. Banerjee and D.P. Modak.

The following investigations were carried out :
Water Quality ; Suspended Sediment Quality ;
Sediment Quality ; Ecological Monitoring ; Bio-
logical Monitoring and Ecotoxicological Studies.

RESEARCH SCIENTISTS/RESEARCH ASSOCIATES/POST DOCTORAL FELLOWS/ SENIOR RESEARCH FELLOWS /JUNIOR RESEARCH FELLOWS

Dr. U. Banerjee, Dr. D.P. Modak, Dr. B.K. Mohanty

OTHER SUPPORTING STAFF MEMBERS

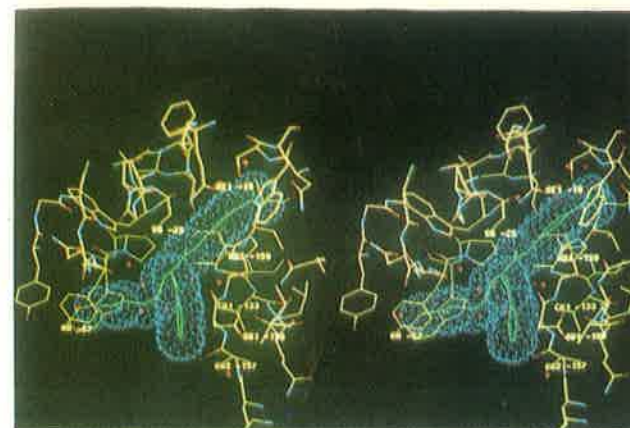
A. Adak, A. Dalal, S. Roy, J. Das, D. Nayak.

The data indicate the deterioration of both biotic and abiotic environment during dredging and dumping operation. The sediment and water is contaminated with highly toxic chemicals like, pesticides, polynuclear aromatic hydrocarbons and heavy metals. The sediment toxicity studies showed an inhibition of catalase, peroxidase and urease activities. The ecological investigations show a depletion of plankton population and benthic fauna. The bioaccumulation and biomobility studies show a potential risk of the toxic chemicals entering the human food chain.

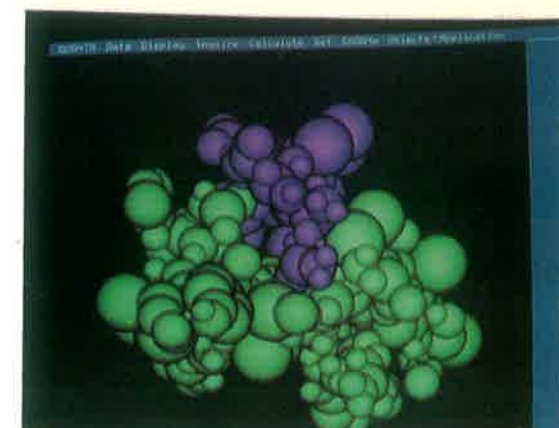
A.3. Studies on microbial degradation of effluents resulting out of organophosphorous (DP) manufacturing plant.

P. K. Ray, U. Banerjee, D.P. Modak and B.K. Mohanty

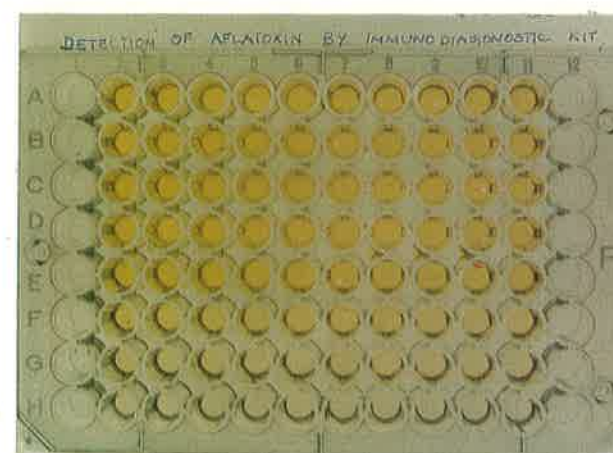
The effluent characteristics of organo phosphorous pesticides manufacturing unit has been investigated in details. The effluent treatment is actually done in the following steps : (1) Chemical treatment - acid hydrolysis followed by lime treatment then separation of calcium sulphates & phosphates by settling. (2) Anerobic degradation in 4 oxidation ponds and (3) Finally activated sludge treatment process. After detailed investigations the activated sludge treatment process was found to be the one to be actually not working at all. A laboratory scale activated sludge treatment process was developed at a scale of 10 lts per day using predominantly mixed cultures of *Pseudomonas* sp. *Arthrobacter* sp. and *Flavobacter* sp. The study showed 85% reduction of organic load in effluent bringing down the initial BOD of >600 to <30 mg/L. The process was then upscaled to 40 KL per day in several steps and constructed at the site for 80% O₂ saturation and active biological process.



Calotropin DII and BAPA Complex



Computer Model : Binding between Octapeptide and Fc fragment of IgG



ELISA of AFLATOXIN, the kit developed Immunotechnology section



Transgenic tomato plant



Generation of a stable line of mustard originated from genetic introgression between *Brassica juncea* and *Eruca sativa*



Transgenic mustard cv. B-85 (elite cultivar) with *ro1A* plant developmental gene

Mrs. I. Biswas (**Librarian**) upto 28.2.95.

Mrs. I. Biswas (**Librarian**) upto 28.2.95.

Publication :

Library news No. 1, 2, June, September, 1994

Circulation :

In both Campuses 6941 readers [3644 (CB) + 3297 (MB)] used the library for reference work. 33 permission cards were issued to outside readers.

Under Inter-Library loan system, 8 volumes were issued to other institutions ; 3 books were taken on loan. Photocopying of journals under the inter-library loan system were supplied to INSDOC.

Current Content Services :

About 160 users searched the current content through computer in the main campus library from 20.06.94 to 31.03.95.

Photocopying Services :

1,15,303 copies of photocopying (xerox) services in C.B. and 44,104 copies in M.B. were given to faculty and staff of the institute.

Budget :

26.50 lakhs for 1994-95.

OTHER SUPPORTING STAFF MEMBERS

R. Bhattacharyee, R. Mitra, P. Das, K. Hait, S.K. Paul, P.K. Sarkar, Dr. B. Chowdhury, G. Mukherjee, G. Biswas, A.K. Koay, S. Bhuiyan, M. Joge Sharma, A.K. Nandi, D. Das.

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Workshop

Mr. A. Mukherjee (Superintendent)

The Bose Institute Workshop has mechanical, electrical, refrigeration, carpentry, glass, blowing and drafting units. The workshop received about 2,000 requisitions during the year from various departments and sections.

An important job was the design and fabrication of several instruments and gadgets. Some of these were — two Crescographs, a microwave apparatus, radioactive shield, rotoroid stands with movable legs, apparatus made using plexiglass, and carpentry jobs.

Scientific instruments were repaired and maintained by the Workshop personnel.

Major electrical works included drawing several new lines at the Centenary building and the Main Campus. Main switches were maintained. Some steps were taken to reduce the voltage

fluctuation at the Main Campus. The refrigeration section maintained ten cold rooms and repaired A/C machines upon request.

Glass apparatus as required by scientists were made by the Workshop. The drafting section helped students and scientists in preparing their theses and manuscripts. Arrangements for projection and microphone system during seminars were managed by Workshop personnel. The Workshop Store stocked items frequently needed, purchased according to Institute rules. Stocks were verified by an internal physical verification team.

A new Ambassador Car and two TATA buses (model 407) were purchased and two old vans were disposed. Cars/buses are maintained and allotted by the Workshop Superintendent.

OTHER SUPPORTING STAFF MEMBERS

H. P. Dey, Pranab Banerjee, B.P. Dutta, Swapan Jagsharma, S.N. Das, Raj Kumar Das, Mrinal Chandra Roy, Sk. Abdul Rezzak, Samar Dutta, Dipak Dutta, Sisir Ghosal, Ashutosh Sarkar, Sisir Sarkar, Sithil Mukherjee, Tarapada Das, Anil Sengupta, Pitambar Patra, Dipen Sen, Tarapada Sarkar, Bankim Dutta, Subhas Chakraborty, Jogendra Nath Das, Elia Hossain, Basanta Shit, Tapan Mondal, Bholanath Saren, Abdul Molla, Walter D. Rozario, Panchanan Santra, Nirdhan Chandra Das, Lochan Shee, Ashit Banerjee, Md. Raffick, Md. Farruck, Sourendra Chakraborty, Brahmdeo Prasad, Sairun Begum, Murari Mohan Shee, Kishori Mohan Saha, Kalachand Sen, Gopal Chandra Das, Panchugopal Karak

Regional Sophisticated Instrumentation Centre

Dr. A. Chatterjee (Scientist In-charge)

The RSIC continued to provide analytical instrumentation services to users in the region. An overall resume provide by the Centre during the year 1994-95 is given in the table.

The Mass Spectrometer, CW NMR were in operation with sporadic faults. Servicing work associated with these instruments were affected at times owing to non-availability of spare parts. The instruments like EPR Spectrometer, Atomic Absorption Spectrophotometer, Transmission Electron Microscope, GCMS Spectrometer, GC, HPLC and Spectrofluorimeter provided routine services to the users satisfactorily without any major fault.

The Scanning Electron Microscope after its recovery from major breakdown during 1993-94, started providing satisfactory services for magnifications upto 20,000 to the users in this financial year.

The new single crystal X-ray Diffraction unit has already landed in Calcutta and it is in the process of clearing and subsequent arrangements for commissioning. This will definitely raise hopes of better performance from the X-ray diffraction unit of the Centre in the very near future.

The Ultracentrifuge has been shifted to the Botany Department of the Institute. The system is expected to run shortly.

A five day Workshop on Recent Trends in Pesticide & Residue analysis was conducted satisfactorily by RSIC from 14th-18th February, 1995, and received excellent response from the users not only from the Eastern region but also from other regions of the country.

A six months training programme on Refrigeration & Air-conditioning was undertaken by RSIC personnel from May, 1994 to November, 1994.

Participation in Conferences/Symposium/ Training programme/Award and Honour received.

Dr. S. Chaudhuri delivered an invited talk at the Indian Association for the Cultivation of Science in June, 1994 and participated in the Satellite Symposium on "Protein Structure, Function and Engineering" in September, 1994.

Dr. A. Chatterjee provided technical consultancy to Calcutta Port Trust for Differential Global Positioning System and Vessel Traffic Management System.

Mr. J. Chattopadhyay participated the Fifth National Workshop on Mass Spectrometry at RSIC, Chandigarh in April, 1994.

RESUME OF ACTIVITIES 1ST APRIL '94 TO 31ST MARCH '95

Outside User			Bose Institute User	
Instruments	No. of Samples	Revenue Earned	No. of Samples	Revenue (Unpaid)
AAS	437	Rs. 30950.00	1257	Rs. 55275.00
EPR	80	5350.00	26	1300.00
CCMS	11	1320.00	58	6960.00
Time of Use (In Hrs.)			Time of Use (In Hrs.)	
TEM	239	49965.00	106	21570.00
GLC	79	10325.00	121	7650.00
FLS	51	2190.00	71	2840.00
SEM	77	14590.00	71	16754.00
		Rs. 114690.00		Rs. 112349.00

Grand Total = 2,27,039.00

OTHER SUPPORTING STAFF MEMBERS

Dr. Dilip Kumar Mukherjee, Dr. Siddartha Chaudhuri, Arabinda Biswas, Tapan Dutta, J. Chattopadhyay, Chitra Ganguly, Arup Kr. Sen, Samir Kr. Mukherjee, Pradip Kumar Karmakar, Subhas Chandra Maikap, Pathik Ranjan Ray, Alakananda Sarkar, Tanim Modak Dhar, Manisha Banerjee, Debebrata Polley, Sankar Santra, Sanjoy Santra, Saraswati Sen, Shyam Sundar Kundu, Gobinda Das, Amit Kumar Mahinder.

J.C. Bose Unit and Museum

Mr. D. Sen (In-Charge)

In the last year's report it was mentioned that in collaboration with Workshop this Unit took the responsibility of duplicating four sets of J.C. Bose's Portable Compound Lever Crescograph Instrument. Two sets have already been duplicated. Trial of those two instruments are going on in the Museum.

Dibakar Sen, In-charge, J.C. Bose Unit and Museum collected some materials on J.C. Bose from Rarikhal, Vikrampur, from the 'Vicinity of the ancestral house of Acharya J.C. Bose during his visit to Bangladesh in December 1994.

During the celebration of 65th birth anniversary of Prof. A.K. Barua, a one-day exhibition was arranged on his work in befitting manner in the Museum on 11th November 1994.

An exhibition on health was organised in the J.C. Bose Museum in collaboration with the British Council Division : British High Commission on the 28th February 1995 as a part of the programme of National Science day.

During the Seminar on "Aspects of Atmospheric Chemistry" an exhibition of books on Environment, under the auspices of British Council Division, British High Commission was organised in the Ground floor of the J.C. Bose Museum on March 1 and 2, 1995.

On 30th November, 1994, special demonstration was arranged to mark the Anniversary Day of the Bose Institute.

During the year under review a good number of visitors both from abroad and within the country visited the Museum.

Besides, the J.C. Bose Unit and Museum furnished information Xerox copies of papers and photographs of Acharya J.C. Bose and the Bose Institute to various organisations, eminent persons on request.

Participation in Conferences/Symposium/ Training programme/Award and Honour received.

D. Sen delivered a lecture at Rabindra Bhaban Museum, Santiniketan on the 25th November 1994.

Sri Sen was invited by the J.C. Bose Foundation, Bangladesh, to be present in the inaugural ceremony of J.C. Bose Memorial Museum. Infact, he delivered the inaugural address in this occasion at the ancestral house of Acharya J.C. Bose at Rarikhal, Vikrampur, Bangladesh on 25th December 1994, and he also delivered several lectures in Bangladesh.

OTHER SUPPORTING STAFF MEMBER

N. Das

BILL

NJAY

KSHINDARI RO

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Distributed Information Centre

Dr. S. Mukherjee (In-Charge)

DIC has been established at the Bose Institute as part of a national biotechnology information network. Like the other DIC's at various institutions around the country, this particular centre, stores, manipulates and retrieves bibliographic, sequence and structural databases for its users.

While primarily serving, scientist in Calcutta, the DIC at Bose Institute has also served users from Baroda, Benares, Bhubaneswar, Gwalior, Jorhat, Nagpur, Sambalpur etc.

Workshops have been an important activity of the DIC. During the past year, six different workshops were organized :

(i) "Dialog-Online Search" (2 days) (ii) "Neural Networks in Biology" (3 days) (iii) two lectures by Dr. Clare Sansom, Leeds University (iv) "Internet databases and CD-ROM databses" (1 day) (v) "Online databases and CD-ROM" (2 demonstrations) (vi) "Sequence Analysis" (7 days).

DIC ran two courses primarily for doctoral students of the institute — 'Introduction to PC: Its Applications and 'Introduction to Fortran Language'. Students are required to pass a few courses as part of their doctoral training.

Each faculty has his/her own account for receiving e-mail. Another central facility is the molecular modelling platform.

The research community of Bose Institute are provided orientation, training, and consultancy services on a daily, walk-in basis. Non-academic staff are also trained to develop basic computer literacy. Senior administration staff were offered a course on office automation, electronic file sys-

tem, word processing, and database management.

Several software programs were developed at DIC and are still in use by scientists and technical staff, e.g. ANOVA, Line & Tester Analysis, monitor of system logs, database management/development programme.

Two new sorts of software were also developed during 1994-1995. One is retrieval of bibliographic information for indexing ; another is a menu-driven utility program to read and extract information from EMBL entries, using some standard keywords.

The DIC currently maintains six PC's, five printers of various kinds, two CD-ROM's in PC's, one Indy workstation, one scanner and one micro VAX Computer-II, whose terminal server now supports more VAX ports. It can now be accessed from various locations of the Centenary Building of Bose Institute. The Cartridge Tape Drive and 16 MB RAM were installed in the new Indy machine.

DIC has now been recognized as a National Centre for Molecular Modelling in Eastern India.

In collaboration with Bose Institute scientists, DIC personnel have been involved in at least six research and developmental projects.

In the last year under consideration, three kinds of new services were introduced and sustained :

- a 'Current Awareness Service'
- a 'Journal Preview Service' for unsubscribed periodicals
- an e-mail listing of new arrivals in other area libraries.

OTHER SUPPORTING STAFF MEMBERS

Dr. N.S. Rao, Dr. C. Mukherjee, Dr. T. Ghosh, V.S. Sundarajan, T. Bhattacharya, S. Majumder, S. Gupta, T. Mondal, D. Mondal.

Publication

Mr. A.K. Das Gupta (Superintendent)

Keeping track of the long history of Bose Institute publications including the books authored by Jagadis Chandra Bose and D.M. Bose and the Transactions of the Bose Research Institute, a separate Publication Section was started in 1980 to deal with increasing volume of publication matters of the Bose Institute at the initiative of the then Director Prof. S.C. Bhattacharyya. Since then the Publication Section has been doing all the publication matters of the Bose Institute, i.e. Transactions of the Bose Research Institute (four issues in a year); Annual Report (both English and Hindi versions); Director's Report, Memorial Lectures, Folders, Posters and leaflets of Symposium and Training programmes regularly.

On the 78th Foundation Day (30th November, 1994) Publication Section published a rare book entitled "PATRABALI" containing letters of J.C. Bose to Rabindranath Tagore with anotation and was released by Dr. S.Z. Qasim, Member Planning Commission, Govt. of India.

With the special initiative of Prof. P.K. Ray, the present Director, a 486AT DX2 PC has been installed in the Publication Section to meet the increasing load of the institute publications in a systematic manner.

Publication section is also providing photocopying facility to the faculty and other staff members of our institute.

OTHER SUPPORTING STAFF MEMBER

C.K. Sasmal

Administration

Prof. P.K. Ray (**Director**),
Mr. A.J. Dutta (**Registrar**), Mr. T.K. Ghorui (**Dy. Registrar**), Mr. B. Chakraborty (**Accounts Officer**)

OTHER SUPPORTING STAFF MEMBERS

Centenary Campus

P.K. Basu, R.K. Kundu, R.N. Bhattacharyya, Maya Dutta, S.P. Sit, P.K. Barman, S. Pal, A. Bera, S.R. Dechoudhury, A.K. Sengupta, P. Das, T. Mukherjee, E. Pal, Tapan Chakraborty, N.R. Ghatak, S. Kar, Subir Sen, A. Chakraborty, A. K. Ghosh, R.R. Pandey, S.K. Ghosh, Dhrubajyoti Sen, Sujit Kr. Ghosh, B.K. Mandal, M.C. Das, Rita Nath, Ranjit Kr. Ghosh, S. Chakraborty, Ruby Das, B. Marrick, B. Marrick, Sudam Jana, A. Jana, Sukumar Das, S. Chatterjee, R.C. Sarkar, Dipak Dutta, R. Ghosh, K. Sur, Dulal Turi, S. Devi, C. Ranigwa, T.K. Banerjee, K. Turi, R. Das, A. Hela, S. Turi, K. Basar, Kamala Turi, N. Yadav, K. Ansari, Amaratya Sen, Debasish Mandal, Mahabir Prasad, Sukumar Mandal, Sudhanshu Guchait, P.K. Mullick, Rita Ganguly.

Main Campus

Samar Chakraborty, Kajal Chowdhury, Ankur Dutta, Madhusudan Mitra, Sankar Nath Sinha, Swapan Singha, Rina Roy, Sanat Kr. Dey, Mahendra Nath Shee, Santosh Patra, Ramani Kanta Jana, Tarun Chakraborty, Kashinath Paul.

Acharya Jagadis Chandra Bose Memorial Lecture

The 56th Acharya Jagadis Chandra Bose Memorial Lecture was delivered by **Dr.S.Z.Qasim**, member Planning Commission, Govt. of India on "**Some Achievements of Indian Science in the Post-independence Period.**"

Lectures

Dr. Amit Mukherjee, University of Kansas Medical Centr. Kansas City U.S.A. "The role of Fts Z in Bacterial Cell Division."

Dr. Sujoy Das Gupta, Department of Microbiology, Bose Institute Calcutta, "New Approaches Towards the Control of Tuberculosis".

Dr. Swapan Saha, Department of Physics, Bose Insitute, Calcutta "Nucleon-Nucleon Interactiion via Transfer Reaction".

Dr. Ronald W. Hart, National Centre for Toxicological Research Public Health Services, Arkanas U.S.A. "The Modulatory Effects of Directory Restriction".

Dr. Maitrayi Das Gupta, Department of Biochemistry, Calcutta University, "Ca²⁺ binding Protein Kinases". "Novel Targets for Calcium Signal in Plants".

Dr. (Mrs.) Nilima Sarkar, Boston Biomedical Research Centre, Boston, U.S.A. "Polyadenylated mRNA : From *E. Coli* to Elephant".

Prof. Amiya K. Hazra, University of Michigan, Ann Arbor, Michigan, "Role of Peroxisomes in Membrane Biogenesis".

Prof. Phillippee Devaux, Institute de Biologic Physico Chimie, Paris, France, "Protein Involved in Transmembrane Lipid Asymmetry".

Prof. Subhas Basu, University of Notre Dame, Notre Dame, U.S.A. "Molecular Biology of Glycosyltransferases".

Prof. Ananda Mohan Chakrabarty : University of Iillinois, Chicago, U.S.A. "Nucleoside Diphosphate Kinase From *Pseudomans aerugenosa* : a Prokaryotic Model to Study Eukaryotic Cell Differntiation, Including Cancer Metastasis".

Dr. Diana Anderson, British Industrial & Biological Research Association, Carlshalton, Surrey, England, "Male Mediated F Teratogenic Abnormalities".

Prof. Sankar Mitra, University of Texas, Galveston, U.S.A., "Regulation of Alkylation Damage Repair in Mammalian Genoms".

Dr. Salil Kumar Das, Mehary Medical College, Nashville, Tennesy, U.S.A. "Choline Phosphotransferase : An Integral Membrane Protein".

Dr. Tapas Das, Cleaveland Clinic Foundation, Ohio, U.S.A. "Regulation of Transcription and Replication in the Life Cycle of VSV".

Dr. Chandrakant P. Giri, Centre of Food Safety and Applied Nutrition, Food and Drug Adminstration, U.S.A. "A. c-DNA Subtraction Library Approach to Indentify Novel Candidate Human Tumer Suppressor Genes. The Isolation of 1.4 - 1.7 k6 c-DNAs Representing TGF - 1 Inducible Differentiation Genes".

Dr. Tapan Mishra, University of Illinois, Chicago, U.S.A. "Modulation of Mercury Resistance in Bacteria".

Dr. Krishna C. Agrawal, Tulane University Medical Centre, New Orleans, U.S.A. "Mechanism of Zidovudine (anti-AIDS-drug) Induced Anaemia : Reversal with a combination of Erythro poietin and Interleukin - 3".

Dr. Dilip Nag, State University of New York, Albany, New York, U.S.A. "Genetic Re-combination and Meiosis in Yeast".

Dr. Debabrata Raychoudhuri, Tufts University School of Medicine, Boston, U.S.A. "Is FtsZ the primordial cytoskeletal Protein, Essential for Bacterial Cell Division?"

Dr. Ranjan Sen, Brandeis University, Waltham, U.S.A., "Factors Regulating Immunoglobulin Gene Transcription".

Dr. (Mrs.) Jyoti Sen, DANA Farber Cancer Institute, Boston, U.S.A. "Molecular Events During T Cell Development".

Prof. Amiya K. Banerjee, Cleveland Clinic Foundation, Ohio, U.S.A. "Gene Expression of Negative Strand RNA-viruses - Role of Cellular Protein Kinase".

Dr. Ranjit Das Gupta, University of Wisconsin, Madison, U.S.A. "An RNA Insect Virus with Potential for Use in Biotechnology".

Dr. B. Pramanik, Schering Plough Research Institute, New Jersey, U.S.A. "The Application of Electrospray Spectrometry in Probing Protein Ligand and Protein-Protein Noncovalent Interaction".

Dr. Rajabrata Sarkar, University of Michigan, Ann Arbor and University of California, Los Angeles, U.S.A. "Effect of Nitric-Oxide on Cell Proliferation and Cellcycle Key Enzymes".

Dr. Elizabeth Faruswarth and **Aaron M. Ellison**, Clapp Laboratory Mass, U.S.A., Harvard University, Boston, U.S.A. "Animal Plant Interactions, Community Structure and Ecosystem Dynamics in Neotropical Mangrove Forest".

We condole the untimely death of Smt. Mira Basu of the Administration on December 2, 1994 and of Shri Tarapada Sarkar of Workshop on February 27, 1995.

Acknowledgement

The Council takes the opportunity to express, its grateful thanks to the Department of Science and Technology, Government of India, for providing generous funds in the form of Grants-in-aid, and for the support of research projects, and also to other external agencies such as the Government of West Bengal, Department of Atomic Energy, Council of Scientific and Industrial Research, Indian Council of Agricultural Research, Indian Council of Medical Research, etc., for their support in various forms. The Council also records its thanks to the British Council, Federal Republic of Germany, United States of America, the Rockefeller Foundation, the ECU and others for their support in several forms, such as research grants, gift of equipments, books, travel grants, collaborative project, etc. The Council further records its thanks to the Governing Body, Bose Institute, and to the members of the various Selection Committees for their help and interest.

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5. Principal Accountant General (A. & E), West Bengal,
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The Sun-God dispelling darkness ;
A bronze-plaque in the Lecture Hall of the Bose Institute



Lady with the Lamp



Library



Distributed Information Centre

