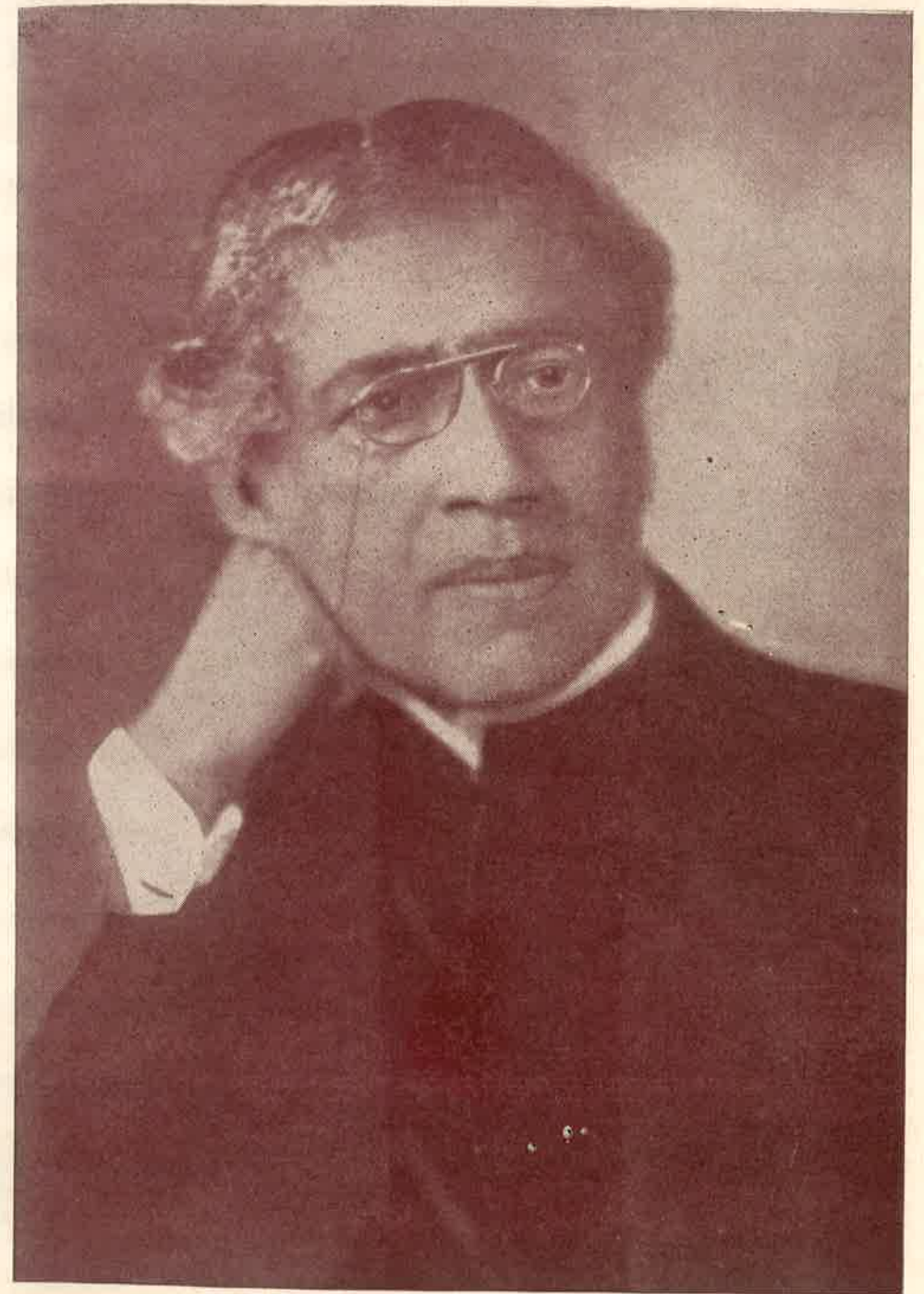


75TH
ANNIVERSARY
BOSE
INSTITUTE
ANNUAL
REPORT
1992-93





Acharya J. C. Bose
The Founder

Bose Institute

ANNUAL REPORT

1992-93

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FOREWORD

I take much pleasure to release the Annual Report of the Bose Institute for the financial year 1992-93. During this year, one of the landmark events in the history of the Bose Institute *i.e.* the Platinum Jubilee, of this prestigious Institution was celebrated. A year-long programme was undertaken, a number of invited lecturers from various parts of the country and from outside India gave invited talks on topics of contemporary interests. The institute organized a total number of nine symposia during the month of November, December and March. Fifty Scientists from various parts of the country enthusiastically delivered lectures in their own disciplines, discussing the recent developments in their respective field. There was jubilation, joy and happiness all around and the Institute had seen an unprecedented cooperation and collaboration amongst the staff, both Academic and Non-academic, to make it a great success. The Institute had proven once again its own strength and that good scientific work are being carried out by our Scientists was brought to light. The exhibition, cultural programme, and the even mass dinner-everything was widely participated by all section of our staff including those who came from outside. Everyone could get a fresh breath in the new atmosphere. In one word, the entire effort was a great experience. I would like to personally express my sincere thanks and gratitude to all whose active participation, help and enthusiastic cooperation and collaboration made this programme a matter to be remembered for many years to come.

The Institute's RSIC, DIC, CPMB, Workshop, Library and PDF Programmes had been given a boost and a new orientation. Some of the vacant positions were filled up to induct new highly skilled manpower. Outstanding cases of promotion of scientists and non-academic staff were taken up and successfully completed. Designation of large number of staff which were kept pending for several years were duly processed after a series of discussions with the members of staff of various organizations. Sophisticated equipment brought in the Institute for the PDF programme were installed and have been brought to the level of functioning after a great deal of endeavours from all concerned. The Institute had initiated a Course Programme for the PD fellows, for the first time.

The Institute have been receiving inadequate amount of funds from DST and had overspent to an extent that the negative balance had gone upto Rs. 4.00-13.00 lakhs in preceeding years. During the year under report, through proper planning and management, the previous deficiency was not only covered but following the

principle of zero-based budgeting, the Institute could bring it to an even condition. A generous grant obtained from DST to look into some of the additional outstanding areas of our functioning was of tremendous help to the Institute, so much so that we have taken up a project for installation of EPABX system and modernize our administrative set up by incorporation of Computers, Electronic Type Writers and Copying Machine etc. The Seminar Rooms of both the campuses have been renovated and the building of the Main Campus got a face-lift as much as it was possible within the limited means of fundiug. The Canteens of both the Campuses are being renovated. The students hostel has now full occupancy.

The participation of members of our Institute in large number of exhibitions and workshops in various parts of West Bengal was a great success. The Institute arranged an exhibition entitled 'J.B.S. Haldane and Indian Science' in collaboration with B.I.T.M. at Bose Institute from 23rd to 30th September, 1992, and also organized a successful Science Day Celebration on February 28, 1993 wherein a large number of students from various schools of West Bengal participated in Lecture Competition, Quiz Contest and Essay Writing. The Institute also celebrated World Environment Day on 5th June 1993 by organizing a one day symposium. Platinum Jubilee Celebration Medals were given to the retired employees and to others. The Council have so kindly recommended for giving a wrist watch to the present members and scholars of the Institute.

During a part of the year, Dr. (Mrs.) P. Chakrabarti served as acting director (upto May 31, 1992). From June 1, 1992 Prof. P. K. Ray, former director of the CSIR National Laboratory at Lucknow, Industrial Toxicology Research Centre, took over the charge as Director, Bose Institute.

The Institute has published 132 papers in reputed scientific journals and produced 9 Ph. Ds. Dr. Dipankar Home received the prestigious Homi Bhaba Award, Prof. B. Bhattacharya and Prof. N. C. Mondal received the Fellowship of Indian Academy of Sciences, Bangalore. Prof. P. K. Ray received the Fellowship of The National Academy of Sciences, Allahabad. Prof. Ray also received Dr. N. L. Ramanathan Memorial Oration medal and Prof. A. K. Chatterjee Memorial Gold Medal.

Wishing you all a very happy, productive and fruitful year ahead of us.

Prof. P. K. Ray
Director

PLATINUM JUBILEE CELEBRATION

The Platinum Jubilee of the Bose Institute (1917-1992) was celebrated with due solemnity and enthusiasm starting from November, 1991 and extending upto March 1993. The Bose Institute Council and the members of staff and students of Bose Institute organised, with support and help of eminent scientific colleagues from many parts of India, a series of scientific programmes to commemorate this event. The main object of celebrating the Platinum Jubilee was to highlight the pioneering role of Bose Institute in promoting science and technology in India and to encourage young and future generation scientists by the recognition this Institute commands all over the world as a premier seat of higher learning-an Institution that made India and Indians feel proud of. A National Organizing Committee was constituted to provide guidance to the overall programme through their valued advice to the Local Organizing Committee :

National Organizing Committee

Chairman	: Dr. A. P. Mitra, FRS
Co-Chairman	: Prof. A. K. Sharma, Calcutta University
Members	: Prof. B. K. Bachawat, Delhi Univ.-South Campus Dr. R. Chidambaram (BARC) Prof. U. R. Ghatak (IACS) Prof. R. S. Kapil (RRL-Jammu) Prof. C. K. Majumder (SNBNCBS) Prof. G. Mehta (Dept. of Chem., Univ. of Hyderabad) Prof. P. K. Maitra (TIFR) Dr. Nityanand (CDRI) Dr. P. Rama Rao (DST) Prof. S. Ramaseshan (Raman Res. Inst.) Prof. P. K. Ray (Bose Inst.)—Convener

Further, a Scientific Organizing Committee was formed to render advise in formulating the scientific programmes Consisting of following members :

Scientific Organizing Committee

Chairman	: Dr. D. Balasubranian (CCMB)
Members	: Prof. P. Balaram (IISC) Prof. Asis Datta (JNU) Prof. G. Mehta (IISC) Prof. D. Mukherjee (IACS) Prof. N. Mukund (IISC) Prof. T. Ramakrishnan (IISC) Prof. S. Ranganathan (IIT-Kanpur) Prof. S. K. Sen (Bose Institute) Dr. Bikash Sinha (VECC) Prof. P. K. Ray (Bose Institute)-Convenor

Local Organizing Committee

Chairman	: Prof. P. K. Ray
General Secretary	: Prof. S. Chanda
Joint Secretaries	: Dr. S. Raha, and Dr. T. B. Samanta
Treasurer	: Sri T. K. Ghorui
Members	: Prof. A. Banerjee Prof. R. K. Mondal Prof. B. Bhattacharya Smt. R. Mitra Smt. I. Biswas Sri A. Mukherjee Dr. I. Bose Dr. D. Mukherjee Prof. P. Chakraborti Dr. S. Mukherjee Dr. P. K. Chakraborty Sri S. Mukherjee Dr. A. Chatterjee Dr. A. K. Roy Sri A. J. Datta Dr. S. Roy

Sri Haripada Dey	Prof. S. C. Roy
Prof. M. H. Engineer	Sri D. Sen
Prof. A. C. Ghose	Dr. P. C. Sen
Dr. A. Ghosh	Prof. S. K. Sen
Prof. B. Ghosh	Sri T. Sengupta
Dr. R. Ghosh	Dr. S. R. Sikdar
Sri N. K. Malakar	

A week long symposium entitled "Life and Non-life : Unity and Diversity" was organized from November 23 to 28, 1992. All the areas of research pursued at the Bose Institute were covered under this broad head. A Plenary Session was held to mark the inauguration of the symposium where Prof. Satya Sadhan Chakraborty, Minister for Higher Education, Govt. of West Bengal and Dr. A. P. Mitra, F.R.S. among others took part. Five one-day minisymposia were held under the broad heading "Life and Non-Life : Unity and Diversity" They were :

1. Unity of Physical principles : Simplicity to Complexity (24.11.92).
2. Structure, function and dynamics of biomolecules (25.11.92).
3. Protein folding, conformation and design (26.11.92).
4. Man, Microbes and environment (27.11.92).
5. Biotechnology-extending the horizon from lab. to land (28.11.92).

Leading experts from India and abroad took part in these sessions where they reviewed the recent developments in the relevant areas. In addition to the invited talks there were contributions related to the subject of each minisymposium in the form of posters. Simultaneously, an exhibition depicting the history of Bose Institute and its role in the growth and development of modern science in India was held. All departments and sections of the Bose Institute demonstrated their significant contributions made through decades of painstaking work displaying charts, posters and exhibits. On 29 November 1992 a Panel Discussion took place to sum up the deliberations made from 24 to 28 November.

On 30 November 1992, birth anniversary of Acharya J. C. Bose and 76th Foundation Day of the Bose Institute, 54th Acharya Jagadis Chandra Bose Memorial Lecture was delivered by Prof. H. Sarat Chandra, Head of the Dept. of Microbiology, and Cell Biology, Indian Institute of Science, Bangalore, where renowned scientists and intellectuals took part to commemorate 75 years of sustained service of the Bose Institute to the nation. Prof. B. D. Nag Chowdhury presided over the meeting.

A one-day seminar entitled "From J. C. Bose to Bohr's complementarity : new Light on Light" was organized by the Bose Institute in collaboration with S. N. Bose National Centre for Basic Sciences, Calcutta on December 15, 1992 where eminent scientists from India and abroad participated.

A three-day symposium was organized from March 1 to 3, 1993 under the heading "Boses' Symposium" to discuss the scientific contributions of the Founder Director Acharya J. C. Bose and his successor, Dr. D. M. Bose who was the Director of Bose Institute for more than three decades. They made some fundamental contributions whose importance and implications are now being understood more and more. Boses' Symposium was held to compare and contrast their contributions vis-a-vis the modern research to place their discoveries and inventions in a proper global perspective. Following topics, were discussed under the heading "Boses' Symposium" :

1. Millimeter Waves (1.3.93)
2. Elementary Particle Physics (2.3.93)
3. Biophysics (3.3.93)

A number of eminent scientists took part in this symposium.

A meeting of the Scientific Organizing Committee with the scientific staff members of Bose Institute was held on 4th and 5th March 1993. A dedicated discussion during these two days was held on the present and future research directions of Bose Institute in the light of international trends in the rapidly evolving areas of scientific research. The deliberations, taking into account the recent developments in various areas of physical and life sciences, and the areas of scientific strength within the Bose Institute, yielded concrete and constructive recommendations. The whole exercise under the aegis of Scientific Organizing Committee assumed great significance not only for the Bose Institute but also for overall science policy of India.

As a part of the yearlong programme of Platinum Jubilee Celebration, the Bose Institute conducted a series of Lectures under the heading "Platinum Jubilee Lecture Series" in the latter part of 1992 and first part of 1993. Several eminent scientists from India and abroad delivered lectures under the auspices of this series. Publication of the proceedings of the Platinum Jubilee Symposia is being processed.

1. The front view of the Bose Institute (93/1, Acharya Prafulla Chandra Road) Main Campus.
2. Volunteers working in the reception counter during the inauguration of the Platinum Jubilee Celebration.
3. Volunteers working in the registration counter during the Platinum Jubilee Celebration.
4. Inauguration of the Plenary Session of the Symposium on "Life and Non-Life: Unity and Diversity" in the auditorium of Bose Institute (Main Campus) held on 23rd Nov., 1992. From left to right are Prof. B.B. Biswas, Prof. S.C. Bhattacharyya, Prof. S.K. Mukherjee (all are former Directors, Bose Institute), Dr. A.P. Mitra who presided over the function and Prof. Satya Sadhan Chakraborty, Minister of Higher Education Govt. of West Bengal, as Chief Guest and Prof. P.K. Ray on the dias delivering his address.
5. Dr. A.P. Mitra giving away the merit certificate to a successful competitor in the Essay Writing competition on National Science Day, 28th February, 1993.
6. Prof. R. N. Chakraborty, President of Valedictory Session, receiving memento from Prof. P. K. Ray, Director, Bose Institute.
- 7-8. Two foreign delegates delivering lectures during the Platinum Jubilee Symposium.





9. Prof. B. K. Bachhawat, delivering his lecture on the occasion of Platinum Jubilee Celebration.

10. Prof. P. K. Ray, Director, Bose Institute delivering address on the occasion of the inauguration of Platinum Jubilee celebration.

11. Dr. A. P. Mitra, Prof. P. K. Ray, Prof. M. H. Engineer, Prof. S. C. Roy and Prof. (Mrs.) Asima Chatterjee in one of exhibition stalls.

12. Prof. B. B. Biswas, former Director, Bose Institute visiting an exhibition stall.

13-15. Cultural function held in connection with Platinum Jubilee Celebration by Mamata Sankar Ballet Troupe and Institute staff and scholars.

Acharya Jagadis Chandra Bose Memorial Lecture

The 54th Acharya Jagadis Chandra Bose Memorial Lecture was delivered by Prof. H. Sharat Chandra, Chairman and Head, Department of Microbiology & Cell Biology, Indian Institute of Science, Bangalore on "Genomic imprinting and its evolution".

Lectures

<i>Name of the Speakers</i>	<i>Title of the Lectures</i>
1. Dr. Stephen Bernath Institute of Molecular Biology Kurfursten Anlage 5 Heidelberg 6900 Germany.	Molecular Biology and the Origin of Life.
2. Dr. Dilip Nag Department of Biology University of N. Carolina Chapel Hill USA.	Post-meiotic Segregation in Yeast : a hairpin connection.
3. Dr. Uttam Surana Institute of Molecular Pathology Vienna Austria.	Genetic control of the mitotic phase in Yeast cell cycle and its relevance to other eukaryotes
4. Dr. Subrata Pal Saha Inst. of Nuclear Physics Belgachia Campus Calcutta-700 037.	Protooncogenes in early mammalian development.
5. Dr. Debabrata Chakraborty Albert Einstein College of Medicine New York USA.	Molecular cloning and characterization of eukaryotic translation initiation factor-5 : A member of GTPase super-family.
6. Dr. Joachim Holtake Boehringer Mannheim Germany.	Non-radioactive DNA labelling method.

7. Dr. Balaram Ghosh
Johns Hopkins University
School of Medicine
Baltimore, Maryland
USA.
Cell-cell communications in Immunological Recognition.
8. Dr. Sankar Mitra
Centre for Molecular Sciences
University of Texas
Medical School at Galveston
USA.
DNA Repair : A Recipe for Survival.
9. Dr. Utpal Banerjee
Department of Biology
UCLA, Los Angeles
USA.
The role of tyrosine kinase and ras related pathways in neuronal development in *Drosophila*.
10. Dr. Chaitali Mukhopadhyay
Department of Chemistry
and Biochemistry
University of Maryland,
Baltimore
USA.
Dynamics of Macromolecules—A Computer simulation Approach.
11. Dr. Babul Borah
Procter and Gamble
Pharmaceuticals
Norwich, N. Y.
U.S.A.
An application of magnetic resonance imaging and spectroscopy to the development of pharmaceuticals.

Obituary

The Bose Institute was deeply grieved at the passing away of the following former workers of the Bose Institute. Condolence resolutions, duly adopted in general meeting of the staff, were sent to members of the bereaved families :

1. Smt. Dipta Bhattacharyya, SRF—31.8.92.
2. Prof. T. C. Bhadra, Ex. Prof. of Physics—13.9.92.
3. Shri Pijush Sen, Ex. Sr. Field Asst.—28.1.93.
4. Shri Swadesh Ranjan Ghosh, Ex. Workshop Superintendent—23.3.93.

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.

Members of the Council

1. Shri Sanjoy Sen
2. Prof. S Bose
3. Shri Debabrata Bose
4. Prof. R. N. Chakraborty
5. Prof. D Banerjea
6. Prof. B. B. Baliga
7. Prof. B. K. Bachhawat (upto 18.7.92)
8. Prof. S. N. Chatterjee (from 18.7.92)
9. Secretary, Department of Science and Technology, Government of India, or his nominee.
10. Director General, C. S. I. R. or his nominee
11. Joint Secretary and Financial Adviser, Department of Science and Technology or his nominee
12. Representative of the Lok Sabha
13. Principal Accountant General (A & E), West Bengal.
14. Secretary, Higher Education (Nominee of the Govt. of West Bengal)
15. Municipal commissioner, Representative of the Calcutta Municipal Corporation.
16. Director, Bose Institute—ex-officio
17. Deputy Director, Bose Institute—ex-officio
18. Dr. K. K. Kannan
19. Prof. D. Balasubramanian

Nominees of the
Governing Body

Two Scientists from
outside West Bengal

Registrar, Bose Institute—Secretary

- Invitees :
1. Representative of the Academic Council
 2. Representative of Bose Institute Employees Association.

Members of the Governing Body

1. Shri Sanjay Sen
2. Prof. Sunando Bose
3. Shri Debabrata Bose—Secretary
4. Prof. S. D. Chatterjee
5. Prof. R. N. Chakraborty
6. Dr. (Mrs) Debi Chakraborty
7. Prof. D. Banerjee
8. Prof. B. B. Baliga
9. Prof. S. N. Chatterjee
10. Prof. B. K. Bachhawat (up to 18.7.92)
11. Shri Som Nath Sanyal (from 27.8.92.)
12. Director, Bose Institute.

Members of the Finance Committee

1. Shri Sanjoy Sen (Representative of the Council)
—Chairman
2. Shri Debabrata Bose (Representative of the Governing Body)
3. Director, Bose Institute—ex-officio
4. Joint Secretary and Financial Adviser to the Department of Science and Technology, Govt. of India, or his nominee.
5. Principal Accountant General (A & E), West Bengal.
6. Registrar, Bose Institute—Secretary

Members of the Centre Management Committee RSIC, Bose Institute, Calcutta

1. Director, Bose Institute—Chairman
2. Scientist In-Charge, RSIC—Member Secretary
3. Representative of DST—Member
4. Prof. C. L. Khetrapal, SIF, IISc, Bangalore—Member
5. Prof. E. S. Rajagopal, I & SU, IISc, Bangalore—Member
6. Prof. U. R. Ghatak, Director, IACS, Calcutta—Member
7. Prof. J. Das, Dy. Director, IICB, Calcutta—Member
8. Dr. S. K. Chakraborty, IJIRA, Calcutta—Member
9. Prof. (Mrs) P. Chakrabarti, Bose Institute—Member
10. Prof. R. K. Mandal, Bose Institute—Member

Co-opted members

11. Prof. B. B. Baliga
12. Dr. S. N. Chatterjee, INSA Sr. Scientist, SINP, Calcutta
13. Dr. B. K. Sarkar, Director, C. G. & C. R. I., Calcutta
14. Dr. S. R. Das, Chairman—cum-Managing Director,
National Instruments Ltd., Calcutta

Members of Research Staff and Scholars

- Director** : Prof. P. K. Ray, Ph. D., D. Sc., FIBiol. (Lond.),
FNASc.—From 1.6.1992.
- Director (Acting)** : Prof. P. Chakrabarti, M. Sc., Ph. D.—upto 31.5.92.

Department of Physics

- Chairman** : Prof. M. H. Engineer, M. Tech., Ph. D.
- Professor** : Dr. S. C. Roy, M. Sc., Ph. D.
- Readers** : Dr. A. K. Chatterjee, M. Sc., Ph. D.
Dr. S. N. Changdar, M. Sc., Ph. D.
Dr. S. Raha, M. Sc., Ph. D.
- Lecturers** : Dr. I. Bose, M. Sc., Ph. D.
Dr. D. Home, M. Sc., Ph. D.
Dr. (Mrs) B. Roy, M. Sc., Ph. D.
Dr. B. K. Chatterjee, M. Sc., Ph. D.
- Research Scholars** : Mrs. Aparna Das, M. Sc.,
Mrs. Santa Bandyopadhyay, M. Sc.
Shri Sitangshu Bikas Santra, M. Sc.
Shai Timir Baran Biswas, M. Sc.
Shri Nirmal Kumar Halder, M. Sc.
Shri Sandip Dutta, M. Sc.
Shri Abhijit Bhattacharyya, M. Sc.

Department of Chemistry

Chairman	Prof. N. K. Sinha, M. Sc., Ph. D. (from 1st January '93)
Professor	Dr. P. Chakrabarti, M. Sc., Ph. D. (Chairperson upto 31st December, 1992)
Readers	Dr. Amitabha Ghosh, M. Sc., Ph. D. Dr. P. Bhattacharyya, M. Sc., Ph. D. Dr. Dolly Ghosh, M. Sc., Ph. D.
Lecturers	Dr. Parimal C. Sen, M. Sc., Ph. D. Dr. Manas Chakrabarty, M. Sc., Ph. D. Dr. K. P. Das, M. Sc., Ph. D. Dr. A. K. Sarkar, M. Sc., Ph. D. (upto Jan '93) Dr. Joyoti Basu, M. Sc., Ph. D. Dr. Manikuntala Kundu, M. Sc., Ph. D. (Assigned from Microbiology Dept.)
Research Scholars	Shri Subhansu Ray, M. Sc. Shri Seabrata Mahapatra, M. Sc. Shri Tapan K. Chaudhuri, M. Sc. Sm Archana Batabyal, M. Sc. (from 1st March, 1993) Sm Anuradha Bhaduri, M. Sc. Shri Amiya K. Maiti, M. Sc. Shri Ashis Bhattacharyya, M. Sc. Shri Tapan Mukherjee, M. Sc. Sm Mallika Ray, M. Sc. Shri Dipankar Bhattacharyya, M. Sc.

Department of Botany

Chairperson	: Prof. (Mrs) Bharati Ghosh, M. Sc., Ph. D.
Professors	: Dr. S. Chanda, M. Sc., Dr. rer. nat. (Gottingen) Dr. A. N. Lahiri Majumder, Ph. D., D. Sc.

Department of Botany (Contd.)

Readers	: Dr. B. Majumder, M. Sc., Ph. D. Dr. S. Gupta, M. Sc., Ph. D. Dr. S. N. Ganguly, Ph. D., D. Sc. Dr. B. B. Mukherjee, M. Sc., Ph. D. Dr. K. K. Mukherjee, M. Sc., Ph. D. Dr. (Mrs.) S. Sen-Mandi, M. Sc., Ph. D. (Cantab)
Lecturers	: Dr. P. K. Saha, M. Sc., Ph. D. Dr. D. N. Sengupta, M. Sc., Ph. D. Dr. (Mrs.) S. Bhattacharyya, M. Sc., Ph. D. Dr. (Mrs.) S. Gupta-Bhattacharyya, M. Sc., Ph. D.
Research Scholars	: Shri Saubhik Das, M. Sc. Shri Sudhi Ranjan Gupta, M. Sc. Shri Aniruddha Roychowdhuri, M. Sc. Shri Somen Nandi, M. Sc. Shri Manas Kr. Chattopadhyay, M. Sc. Ms. Jayasree Banerjee, M. Sc. Shri S. B. Tripathe, M. Sc. (20.5.92—2.8.92) Shri Nirmal Mandal, M. Sc. (from 2.12.92) Ms. Sangita Basu, M. Sc. (from 2.12.92) Ms. Sanghamitra Bhattacharya, M. Sc. (from 15.12.92) Ms. Pampa Chakrabarty, M. Sc. (from 2.1.93)

Department of Microbiology

Chairman	: Prof. A. C. Ghose, M. Sc., Ph. D.
Professors	: Dr. A. K. Mishra, M. Sc., Ph. D. Dr. S. L. Chakrabarty, M. Sc., Ph. D.
Readers	: Dr. (Mrs.) A. L. Chandra, M. Sc., Ph. D. Dr. (Mrs.) A. Das, M. Sc., Ph. D. (upto 30.4.92) Dr. Timir B. Samanta, M. Sc., Ph. D.

Department of Microbiology (Contd.)

	Dr. (Mrs.) Kalyani Sen, M. Sc., Ph. D.
	Dr. (Mrs.) Geeta Nanda, M. Sc., Ph. D.
	Dr. P. K. Chakrabarty, M. Sc., Ph. D.
Sr. Lecturer	: Dr. (Mrs.) Roma Chakravarty, M. A., Ph. D.
Lecturers	: Dr. Pradosh Ray, M. Sc., Ph. D.
	Dr. Manikuntala Kundu, M. Sc., Ph. D.
	(Assigned to Dept. of Chemistry)
Pool Officer	: Dr. (Mrs.) Anjana Banerjee, M. Sc., Ph. D.)
Research Scholars	: Shri Ramkrishna Sadhukhan, M. Sc.
	(upto 21.11.92)
	Smt. Mousumi Ghosh, M. Sc.
	Smt. Nupur Roy, M. Sc.
	Shri Ranadhir Chakraborty, M. Sc.
	Smt. Sumana Majumder, M. Sc.
	Shri Subhajit Das Gupta, M. Sc.
	Shri Subha Manna, M. Sc. (from 10.5.92)
	Shri Tapan Kumar Dutta, M. Sc.
	(from 11.7.92 to 31.12.92)
	Smt. Kajori Ghosh, M. Sc. (from 1.7.92)
	Shri Subrata Das, M. Sc.
	Shri Ranjan Nandy (upto 31.12.92)

Department of Biochemistry

Chairman	: Prof. B. Bhattacharyya, M. Sc., Ph. D.
Professors	: Dr. R. K. Mandal, M. Sc. Ph. D.
	Dr. N. C. Mandal, M. Sc., Ph. D.
Readers	: Dr. (Mrs.) Susweta Biswas, M. Sc., Ph. D.
	Dr. (Mrs.) Pratima Sinha, M. Sc., Ph. D.

BOSE INSTITUTE*Department of Biochemistry (Contd.)*

Lecturers	: Dr. Prabhakar Gupta, M. Sc., Ph. D.
	Dr. (Mrs.) Anuradha Lohia, M. Sc., Ph. D.
C.S.I.R. Emeritus Scientist.	: Prof. Sudhamoy Ghosh, M. Sc., Ph. D.
Research Scholars	: Md. Golam Faruk, M. Sc.
	Shri Sudip Chatterjee, M. Sc.
	Shri Santanu Dasgupta, M. Sc.
	Shri Basudeb Dalal, M. Sc. (upto 31.8.92)
	Shri Arup Indra, M. Sc.
	Sm. Purba Mal, M. Sc.
	Shri Nilanjan Ray, M. Sc.
	Sm. Rinku Ghosh, M. Sc. (From 1.9.92)
	Sm. Madhumita Basu, M. Sc. (From 1.9.92)
	Shri Samarpan Majumder, M. Sc. (From 1.9.92)
	Sm. Suranjana Guha, M. Sc. (From 21.11.92)
	Smt. Purba Mal, M. Sc.

Department of Biophysics

Chairman	: Prof. Asok Banerjee, M. Sc., Ph. D., (Cal, M. Ny. A. Sc. (USA)
Sr. Lecturer	: Dr. Siddhartha Ray, Ph. D.
Scholar	: Mrs. Sreya Ghosh, M. Sc.

Animal Physiology Section

Reader and In-Charge	: Dr. A. K. Ray, M. Sc., Ph. D.
Lecturer	: Dr. Rama Ghosh, M. Sc., Ph. D.
Pool Officers	: Dr. P. B. Patra, M. Sc., Ph. D. (upto 31.5.92)
	: Dr. Anuradha Chaudhury, M. Sc., Ph. D.
	(from 1.6.92 to 12.10.92)

Animal Physiology Section (Contd.)

- Research Scholars : Smt. Debjani Ghosh, M. Sc, (upto 7.5.92)
 Shri Shantanu Das, M. Sc.
 Smt. Sudipta Chatterjee, M. Sc.
 Smt. Mitali Pramanik, M. Sc. (upto 14.8.92)

Plant Molecular & Cellular Genetics Section

- Professor-in-Charge : Prof. S. K. Sen, Ph. D., D. Sc., FNA
 Sr. Lecturer : Dr. Amita Pal, Ph. D.
 Lecturers : Dr. (Mrs.) S. Das, M. Sc., Ph. D.
 Dr. S. R. Sikdar, M. Sc., Ph. D.
 Research Scholars : Miss S. Sengupta, M. Sc.
 Mrs. M. Chandra, M. Sc.
 Miss S. Roy Chowdhury, M. Sc.

Regional Sophisticated Instrumentation Centre

- Scientist In-Charge : Dr. A. Chatterjee, M. Sc., Ph. D.
 Technical Officers : Dr. Dilip Mukherjee, M. Sc., Ph. D.
 Dr. S. Chaudhuri, M. Sc., Ph. D.
 Mr. A. Biswas, M. Sc.
 Mr. T. Datta, B. E, (E & T. C. E.)

Administration

- Registrar : Shri A. J. Datta, B. Sc., L. L. B.
 Dy. Registrar : Shri T. K. Ghorui, M. Com., I. C. W. A. (Inter)
 Workshop Superintendent : Shri Alok Mukherjee, B. E. (Mech).
 Librarian : Mrs. Ila Biswas, M. Lib. (Sc.)

Technical Report

16. A foreign delegate delivering lecture during the Platinum Jubilee Celebration Symposium.
17. A section of the audience during the inauguration of Platinum Jubilee Symposium.
18. Prof. S. C. Bhattacharyya, former Director, Bose Institute, Prof. P. K. Ray, Director, Bose Institute and Prof. S. Chanda, General Secretary, Local Organising Committee, Platinum Jubilee Celebration going through the exhibition.
19. A part of stall of the British Council, Calcutta in the exhibition.
20. Prof. A. N. Bhaduri, Director, Indian Institute of Chemical Biology, Calcutta and Prof. P. K. Ray, Director, Bose Institute visiting an exhibition stall.
21. Prof. H. Sarat Chandra, Chairman & Head, Department of Microbiology & Cell Biology, Indian Institute of Science, Bangalore, lights the first out of 75 lamps to commemorate the Platinum Jubilee Celebration of the Bose Institute in front of the statue of Acharya J. C. Bose. On his left are Prof. P. K. Ray, Chairman and Prof. S. Chanda, General Secretary, Platinum Jubilee Celebration Committee, on 30th November, 1992.
22. The Samadhi Mandir of Acharya Jagadis Chandra Bose.





23. Superheated drop detector designed and made in the Bose Institute Workshop.
24. Nano second single photon counting spectrofluorometer.
25. Shimadzu GCMs-QP1000.
26. Library, Main Campus.
27. Contour clamped homogeneous electric field (CHEF) apparatus for separating chromosome sized DNA molecules. DNA sequencing apparatus in the background.
28. A scholar of Biophysics Department in Computer Graphics.
29. Generation of cytoplasmic male steriles in *Brassica juncea* through transfer of cytoplasm by protoplasm manipulation technique.
30. Differential viscometer developed in the Department of Physics is being used to study viscosity changes in polymers on gamma irradiation.
31. The Microscopy Room, working on microprocessor controlled photomicrographic equipment.
32. Microprocessor controlled wind monitoring station and High Volume Sampler being used for air quality monitoring.
33. Reaction of dye producing Lichen with alkali.
34. The Earth Station of NICNET at DIC, serving the backbone of Satellite Communication for Networking.
35. Philips PSEM-500 Scanning Electron Microscope.

A. PHYSICS

Institutional Project No. VI: Problems in Condensed Matter, Intermediate Energy Physics and Related Interdisciplinary Areas.

A. *Physical Acoustics, Microwave and Solid State Physics*

- (i) *Development of a hanging wire velocitimeter* : B. K. Chatterjee and B. Roy.

Calibration of hanging wire velocitimeter reported earlier (Bose Institute Ann. Rep. 1990-91) has been completed. A numerical code for generating drag force on the hanging wire produced by the flowing liquid has been developed. Comparison and fitting of the experimental results with the numerically computed deflections due to drag force is underway.

- (ii) *Study of High T_c Ceramic Samples* : S. P. Basu, R. N. Chakraborty (Department of Applied Physics, Calcutta University) and A. K. Chatterjee.

Samples of $\text{YBa}_2\text{Cu}_3\text{O}_7$ ceramic compounds have been prepared. We have used a set-up with four terminals for measurement of resistance and A. C. susceptibility. From both the measurements, the transition temperature T_c has been found to be 85K.

- (iii) *Tangential instabilities at the interfaces of flowing liquid layers* : B. Roy and M. H. Engineer.

One of the characteristic features of the shear generated interface deformation pulses in the acoustically driven liquid layers is that the crest of the pulse always points from the less to the high viscous liquid or considering the bulk flow velocities of the liquid layers the crest of the deformation always points from the slower to the faster moving liquid layer. Two sets of interface deformation pulses have been observed in the interfaces of three liquid layers, keeping the oil layer in between the two water layers of slightly different densities. Work is being continued to characterize the interface deformation pulses in the three comoving liquid layers in a rectangular tank.

B. Nuclear Physics

- (i) *Measurement of Compton profile of glassy material Ag_2O and R.F.A. Model Calculations*: Santa Bandyopadhyay and A. K. Chatterjee.

The Compton profiles of Cu_2O and Ag_2O which are isoelectronic and isostructural systems have been compared. The difference in the measured results is attributed to a difference in the bonding nature as the core orthogonalization contribution is supposed to be small.

The Renormalized Free Atom model calculation of Compton profile has been performed for two oxides of copper, viz., CuO and Cu_2O .

- (ii) *Compton profile calculation by using theoretical LCAO model*: A. Chatterjee (I.A.C.S.) and A. K. Chatterjee.

The Compton profile of CuO has been calculated by an appropriate extension of the method of Aikala et al (Phil.Mag. 33, 603-11, 1976) based upon linear combination of atomic orbitals. In the calculation the nearest-neighbour order number upto 21 has been considered.

C. Applied Radioactivity and Liquid Dynamics: Aparna Das and S. N. Changdar.

- (i) A sliding cell technique based on radio-tracer method was used to measure diffusion coefficients in H_3PO_4 solution in H_2O and D_2O keeping temperature constant. Observations show, that

- (1) D decreases with increasing concentration.
- (2) D in H_2O is greater than D in D_2O medium.
- (3) There is hydration effect at 0.84 moles/litre.

The change of D with increase in C can be explained by considering the electrostatic interactions among the ions within the solution. The difference of D of an ion at constant temperature at same concentration may be explained by considering both the mass effect and structure effect of the solvent used. The dip at 0.84 moles/litre in $(D-\sqrt{C})$ curve possibly shows the effect of hydration at that particular concentration.

- (ii) The same method is used to measure the diffusion coefficient of ternary systems, eg, $\text{H}_3\text{PO}_4\text{—CaHPO}_4\text{—H}_2\text{O}$, $\text{H}_3\text{PO}_4\text{—Na}_2\text{HPO}_4\text{—H}_2\text{O}$ to observe the effect of coupled flow due to the introduction of the new species (CaHPO_4 , Na_2HPO_4) in aqueous solution of H_3PO_4 . This is due to the fact that diffusive motion of the ion is affected by the forces exerted on the diffusing ion by the new atoms introduced, which are also in motion.

D. Radiation Physics and Condensed Matter (Experiment)

- (i) *Effect of suspended particles on the viscosity of fluids*: Nirmal Halder and B. K. Chatterjee.

The variation of viscosity of polydimethyl siloxane with concentration of polydisperse powders is being investigated using a sensitive differential viscometer [Santra et.al.J. Phys. E. 21,896 (1988)]. For this purpose a preliminary calibration of viscometer and a systematic study of errors has been undertaken. An improvement of the viscometer has also been made by attaching a solid brass cylinder at the terminal end of the suspended wire. The study is aimed in understanding a model proposed by us [Santra et.al. Phys. Rev. A 43, 4296 (1991)] on how the viscosity of viscous liquids change in the presence of concentrated suspensions.

- (ii) *Parameterization of Rayleigh scattering cross sections*: K. Chakraborty, B. K. Chatterjee and S. C. Roy.

Precise values of differential Rayleigh scattering cross sections available for 10 elements from aluminium to Lawrencium, for 7 photon energies from 59.5 keV to 1.332 MeV for 55 angles from 0° to 180° are being fitted for all atomic numbers and angles in the energy range provided. Several programs have been developed and several others are under way, all of which are to be executed in tandem, to obtain the coefficients of the multidimensional fitting.

- (iii) *Modification of the Rayleigh scattering cross section code for its execution on a PC/AT*: Soma Mukhopadhyay (Guest Worker) and S. C. Roy.

The Rayleigh scattering cross section code developed at the University of Pittsburgh [Kissel et. al. Phys. Rev. A. 22, 1970 (1980)], consisting of a number of programs is for the first time being edited to be executed on a PC/AT-80386 with DOS operating system.

- (iv) *Measurement of elastic scattering cross sections*: S. Dutta, B. K. Chatterjee and S. C. Roy.

Elastic scattering cross sections of gamma rays using sphere of revolution geometry for scatterers have been measured using Hp-Ge detector for lead target. Effective centre and efficiency of the detector have also been measured (which has very often been neglected in many measurements). The measured values obtained did not meet our expected precision. Further measurements are planned.

- (v) *Study of nucleation in superheated liquid drops*: S. Dutta, B. Roy and S. C. Roy.

Theoretical calculations have been completed for ascertaining the feasibility of nucleating vapour phase transformation in superheated drop of Freon 12 affected by γ -rays. Investigation is being pursued in exploring a suitable gel-liquid system which is very sensitive to γ -rays for ejecting sufficient number of electrons with suitable energy for nucleation in superheated drops of Freon 12.

E. Theoretical Physics

1. High Energy Physics, Astrophysics and Cosmology

- (i) *Diagnostics of Quark-Gluon Plasma*: Jan-e Alam (VECC, Calcutta), Bikash Sinha (VECC and SINP, Calcutta), Dinesh K. Srivastava (VECC, Calcutta) Somenath Chakrabarty (Kalyani University) and Sibaji Raha.

Various aspects of electroweak probes of quark-gluon plasma (QGP), expected to be formed transiently in ultrarelativistic nuclear collisions, have been investigated. It has been shown that with increasing energy, the importance of the massive resonances in the hadronic sector tends to decrease, when a realistic 3-dimensional evolution is properly taken into account. It has been established that (γ/π^0) continues to be a clean signal for QGP even at the highest energies.

- (ii) *Nonlinear processes in multiparticle production*: Timir Baran Biswas, Debapriyo Syam (Krishnagar Government College) and Sibaji Raha.

Phenomenological analyses of rapidity distribution of multiplicities in hadronic collisions have been performed and compared with prototype nonlinear maps like the logistic map and the circle map. Intermittency structures have been investigated through the computation of normalized factorial moments for the logistic map and comparison with the counterparts for multiplicity distribution at various energies.

- (iii) *Finite temperature field theory of strongly interacting matter*: Abhijit Bhattacharya and Sibaji Raha.

Real time Green's function formulation of strongly interacting matter has been studied and compared with the results of Thermofield Dynamics.

- (iv) *Survivability of Strange Quark Nuggets*: Jan-e Alam (VECC, Calcutta), Pijushpani Bhattacharjee (IIA, Bangalore), Bikash Sinha (VECC and SINP, Calcutta) and Sibaji Raha.

A microscopic, QCD-motivated colour flux tube model has been constructed to estimate the rate of neutron evaporation from primordial strange quark nuggets formed in the cosmic first order phase transition during the microsecond era after the big bang. A conservative baryon number limit of $10^{4.5}$ has been obtained above which the strange nuggets would be stable on a cosmic time scale and thus be a viable candidate for dark matter within known physics.

2. Foundations of Quantum Mechanics

- (i) *Wave-Particle Duality*: D. Home, P. Ghose & G. S. Agarwal.

The experiment with single photon states of light using a two-prism arrangement proposed in collaboration with P. Ghose (S. N. Bose National Centre for Basic Sciences, Calcutta) and G. S. Agarwal (University of Hyderabad) was performed at Central Research Laboratory, Hamamatsu Photonics, Japan by Y. Mizobuchi and Y. Ohtake corroborating the theoretical prediction, showing for the first time a classical wave and particle like properties in the same experiment. The conceptual significance of this experiment in relationship to Bohr's complementarity principle and wave-particle duality was elaborated in papers and invited talks at two major international conferences in Japan and Italy.

- (ii) *Quantum Zeno Effect*: D. Home and M. A. B. Whitaker.

A new unified treatment of all types of quantum Zeno processes was developed in collaboration with M. A. B. Whitaker (Queen's University of Belfast, Northern Ireland).

- (iii) *Wigner Distribution Function in EPR*: D. Home, G. S. Agarwal and W. Schleich.

A new application of Wigner Distribution Function was made in the Einstein-Podolsky-Rosen problem for spin systems in collaboration with G. S. Agarwal (University of Hyderabad) and W. Schleich (University of Ulm, Germany).

- (iv) *Macroscopic Quantum Coherence*: D. Home, E. Squires, L. Hardy and M. A. B. Whitaker.

A critical investigation of the on-going SQUID experiments at IBM, USA, on macroscopic quantum coherence, with E. J. Squires (University of Durham, England), L. Hardy (University of Durham, England) M. A. B. Whitaker (University of Belfast) revealed that contrary to what was claimed by the proposers of the experiment, even if the quantum mechanical predictions are verified they would not repudiate the hypothesis of "realism" at the macroscopic level. This provides a new twist to the implications of macro-quantum coherence.

3. Condensed Matter and Statistical Physics

Lattice statistical models : I. Bose and S. B. Santra.

The dynamics of the Forest Fire model under rotational constraint has been studied on the square and triangular lattices and scaling relations at the critical fire propagation probability determined. A scaling theory of the external perimeter or hull of critical percolation clusters in spiral percolation on the square and triangular lattices has been formulated.

Condensed Matter Physics :

(i) *Strongly correlated system :* I. Bose and S. Gayen.

A general class of antiferromagnetic spin models in two dimensions has been constructed for which the ground states can be determined exactly. Some exact results have been derived for the motion of a pair of holes in the t-J model and the relevance of the results for high temperature superconductivity investigated.

(ii) *One dimensional systems and the Geometric Phase :* M. H. Engineer.

The interaction of many electrons and phonons has been studied in the weak coupling limit. It is shown that for quadratic fermion dispersion the curvature of the Hilbert space leads to profound modification of the ground and excited states. Within the Born-Oppenheimer approximation the modifications change the topology of the slow, phonon configuration space, which leads to the novel effects. The case of linear dispersion near the Fermi points has also been studied. Preliminary applications were made to the case of conducting polyacetylene. The current-voltage response of quasi one-dimensional systems was also studied.

B. CHEMISTRY

Institutional Project No. I: Improvement of plant productivity nitrogen fixation and photosynthesis using modern biotechnology and plant breeding.

A. (i) *Studies on isolation, purification and distribution of FAS enzymes in oil seeds :* Asis Bhattacharyya, Manas Pathak and Dolly Ghosh.

(a) *Isolation and purification of Medium Chain Acyl-ACP-Thioesterases (MCT) from different plant sources.*

For the improvement of oil quality in oil seeds of *Brassica* by intervention of MCT, in addition to oleoyl-ACP-thioesterase from coconut endosperm as reported earlier, we have isolated and partially purified few more saturated and unsaturated MCT from di-cot seeds like chura, mango etc.

(b) *Distribution of Acyl-Carrier Protein (ACP) in the different stages of maturing oil seeds of Brassica campestris var (c. v. Agrani).*

The seeds collected at different days after flowering from Madhyamgram field have been assayed enzymatically for the level of ACP during seed maturation. Maximum level of ACP is detected at about 20 days after flowering.

(ii) *Determination of fatty acid composition and oil content of wild oil seeds—family Cucurbitaceae:* Anirudha Aich and Dolly Ghosh in collaboration with K. K. Mukherjee (Department of Botany).

For the quest of non-conventional source of oil seeds survey of wild gene pool of some unexploited cucurbitaceous plants namely (1) *Cucumis triconus*, (2) *Mukia scabratta*, (3) *Trichosanthes cucumeria*, (4) *Bryopsis lacinisa*, (5) *Trichosanthes planata* have been made. Their oil content are of the range 25-35% and some of them contain 5-8% conjugated diene fatty acids. Of the seeds analysed, the fatty acid profile of (1) and (2) are interesting because of the absence of conjugated fatty acid and presence of in (1) mainly linoleic acid > 60% and in (2) mainly palmitic acid > 55% in their oil.

Institutional Project No. II : Chemical and Biological Studies on Marine Organisms.

- A. (i) *Chemical investigation of an Armina sp. : Synthesis of halogenated Constituents* : P. Bhattacharyya, B. B. Ghosh, K. Basu, D. Ghosal, S. Ray, A. K. Maiti and A. K. Barua.

Earlier the presence of some halogenated compounds in the extract of a marine *Armina* species was detected. It was now been possible to synthesize one of these compounds. To achieve this, a simple method of iodination of aromatic compounds recently developed in this laboratory has been used. Iodination of methyl-4-hydroxyphenyl acetate yielded methyl-4-hydroxy-3-iodophenyl acetate and methyl-4-hydroxy-3, 5-diiodophenyl acetate. The former has been found to be identical with one of the constituents isolated from *Armina* species.

Progress has been made towards the synthesis of other iodinated constituents of *Armina* species.

- (ii) *Seasonal variation of bioactive lipid components in marine organisms* : D. Banerjee, C. Banerjee, T. K. Patra, D. Pal and Amitabha Ghosh in collaboration with Dr. S. Misra and Prof. A. Chaudhury, Dept. of Marine science, University of Calcutta.

Some benthic animals, vertebrates and invertebrates have been studied for seasonal variation of the bioactive fatty acids viz. Arachidonic acid, EPA and DHA. EPA and other omega-3 (ω -3) fatty acids in the diet reduce cholesterol and triglyceride concentration of blood plasma. Arachidonic acid and DHA have also some pharmacological effects. Variations in sterols, phospholipids and other lipids also have been studied. Some novel types of phospholipids have been isolated.

- (iii) *Development of scale up technology for bioactive fatty acids* : C. Banerjee, D. Banerjee, T. K. Patra, D. Pal and Amitabha Ghosh in collaboration with Dr. S. Misra and Prof. A. Chaudhury, Dept. of Marine Science, Calcutta University.

For the development of scale up technology of EPA, mixed methyl esters of fatty acids were obtained in bulk, by transesterification of marine lipids. The mixed methyl esters, which were rich in EPA (ca 10%) were then purified by silica gel column chromatography. The purified methyl esters were then subjected to urea fractionation in two ways, viz. normal and counter current distribution techniques. The later technique was found to be suitable for developing scale up technology.

- (iv) *Development of scale up technology of lectin from T. tetescopium* : T. K. Patra, D. Pal, D. Banerjee, C. Banerjee and Amitabha Ghosh in collaboration with Dr. S. Misra and Prof. A. Chaudhury, Dept. of Marine Science, Calcutta University.

The lectin from the haemolymph of *T. tetescopium* was found to bind with hog pancreatic mucin. It was purified 900 folds by affinity column chromatography on Sepharose-bound mucin, as revealed by agglutination of rabbit blood erythrocytes.

- (v) *Investigations on the fatty acids of some marine organisms of sundarban mangrove estuary* : D. Pal, T. K. Patra, C. Banerjee, D. Banerjee, Amitabha Ghosh in collaboration with Dr. S. Misra and Prof. A. Chaudhury, Dept. of Marine Science, Calcutta University.

Some abundantly available marine organisms of Sundarbans mangrove estuary were studied for lipids and fatty acids. The organisms include Prawn (*P. monodon*), sea anemone (*Paracondylactis sq*) mud skipper (*Boleophthalmus boddaerti*), and Ray fish (*Dasyatis sq*).

Freshly collected animals were sacrificed and extracted for total lipids, which was transesterified and analysed for fatty acids using gas liquid chromatography. The lipids were found to be rich in EPA content.

Institutional Project No. III : Studies on structure, function and dynamics of biomolecules.**A. Physical, Chemical and Structural Studies on Proteins**

- (i) *Studies on protein folding* : Tapan K. Chaudhury and N. K. Sinha.

In the previous annual report it has been stated that two domains of trypsin-subtilisin inhibitor isolated from turtle egg-white refold independently. The Arrhenius activation energies of folding of its trypsin domain and subtilisin domain have been calculated as 15.9 kcal/mole and 21.6 kcal/mole respectively. During the folding process a number of intermediates has been detected in the size-exclusion chromatography. The loosely folded molecules with an apparent Stokes radius of 23 Å have been eluted early, followed by more compact structures and finally by most compact structure of native inhibitor (19 Å).

- (ii) *Studies on low molecular weight trypsin inhibitors*: S. Saha, Umes Ch. Halder and N. K. Sinha.

In order to establish the sequence to reactivity relationship of serine protease inhibitors, two more low molecular weight trypsin inhibitors have been isolated and purified from the seeds of *Momordica charantia* and *Luffa acutangula*. The MC-2 inhibitor from *M. charantia* is highly basic and its isoelectric point higher than pH 11. It contains a single polypeptide chain of 27 amino acid residues and a reactive site arginine.

The LA-2 inhibitor from *L. acutangula* is acidic in nature and its isoelectric point is at pH 4.55. It is stable over the pH range of 2-11 at room temperature and inhibits trypsin by forming enzyme-inhibitor complex at a molar ratio of unity. Its molecular weight is 3,500 and arginine residue is present at its reactive site.

- (iii) *Sites of interaction of proteins at solid/liquid interface*: Anuradha Bhaduri and K. P. Das.

It was shown in last year's report that acetylation of the $-NH_2$ groups (both α and C) of protein caused a dramatic change in the adsorption of protein on alumina. Further studies showed that the pattern of adsorption of proteins on silica is quite different from that in alumina. Affinity of proteins for silica is higher compared to that for alumina. Both β -lg and acetylated β -lg showed positive adsorption on silica in the pH range 2-6. Negative adsorption was obtained for acetylated β -lg at pH 7.5 and above.

In order to understand the nature of interaction of proteins with alumina and silica, attempt was made to desorb proteins from the alumina and silica by Tween-20 and SDS. It was found that SDS (8mM) and Tween-20 (0.02%) was unable to desorb any appreciable amount of protein from alumina at pH 5.0. In case of silica, SDS (8mM) could desorb substantial amount of protein while Tween-20 could not.

Further work on negative adsorption of proteins at solid/liquid interface is going on with other proteins, i.e. ovalbumin, lysozyme, etc.

- (iv) *Effect of acetylation of proteins on its changes in solution conformation*: Anuradha Bhaduri and K. P. Das.

Attempts are being made to study the change in solution conformation (if any) due to acetylation of α - and ϵ - NH_2 groups of β -lg, ovalbumin etc. Changes in surface hydrophobicity, ANS binding, tryptophan quenching are being studied fluorimetrically.

- (v) *Interaction of low molecular weight proteins at solid/liquid and liquid/liquid interface*: K. P. Das in collaboration with N. K. Sinha.

Experiments are being carried out to test reversibility of the surface interaction of a 4 KD basic protein, isolated from marine turtle eggwhite. Preliminary results indicate that the protein under certain conditions can be made to interact reversibly with silica surface. Conditions where reversibility is not met are being examined critically.

- B. *Studies on heterocyclic and organosulphur compounds*: A. K. Maiti and P. Bhattacharyya.

(i) Simple method for C-isoprenylation of hydroxy carbazoles has been developed.

(ii) Montmorillonite clay has been successfully employed for dithioketalisation of various carbonyl compounds.

- C. (i) *Synthetic studies on heterocycles*: Archana Batabyal and Manas Chakrabarty.

In this last year of the targeted multi-pronged synthetic approaches towards indolocarbazoles (IC), the various approaches have almost been brought to completion. The results indicate that (i) the P(III)-chloride-catalysed Fischer-type indolisation is fruitful for carbazole from cyclohexanones, but fails for the formation of ICs from cyclohexane diones, (ii) the photo- and Pd (II)-acetate-catalysed cyclisation of *N, N'*-diphenyl phenylenediamines is feasible for the *meta*-derivative; for the *para*-diamine, only the *N, N'*-dimethyl derivative succeeds, whereas *o*-phenylenediamine yields, not IC, but dimethyl-1-anilinocarbazole, (iii) the 2-haloindole to 2, 2'-biindolyl (BI) to IC route is successful, but a low yielding one; despite using a no. of PTCs, BI could be obtained from 2-haloindole in only 30% yield; even the use of 2-iodoindole, prepared from 2-chloroindole by Finkelstein reaction, proved abortive.

- (ii) *Heck-type reaction with Z, E-dienylmethylamines and aryl halides*: A. K. Sarkar in collaboration with S. Banerjee, Dept. of Pure Chemistry, Calcutta University.

Earlier, we have demonstrated an elegant methodology for accessing stereocontrolled Z, E-penta-2, 4-dienylamines. Now we are engaged in the palladium-catalysed coupling of these dienylamines with aryl halides. Presumably, Heck-type reaction would give the E, E-dienyl-methylamines, although preliminary studies

indicated that some of the unexpected double aryl coupled products were formed. The investigation of the mechanism of this reaction is in progress. The synthetic utilities of these dienylmethyamines will be explored.

- (iii) *Synthesis of pyran and pyrone derivatives by intramolecular Diels-Alder reactions*: A. K. Sarkar in collaboration with S. Lahiri of the Dept. of Pure Chemistry, Calcutta University.

Several suitably substituted aromatic aldehydes and ketones are treated under Luche reaction conditions for better understanding of the mechanism of this reaction. These homoallylic alcohols are converted into suitable substrates which will be subjected to Diels-Alder reaction for the synthesis of pyrananopyrones. Intramolecular Diels-Alder reaction is in progress.

D. Chemistry of plant Products

- (i) *Chemical investigation of *Murraya koenigii**: A. K. Maiti and P. Bhattacharyya.

A minor carbazole alkaloid, isolated from the alcoholic extract of the stem bark of *Murraya koenigii* has been characterised as 2-methoxy carbazole-3-carboxylate from physical and chemical evidences.

- (ii) *Chemistry of terrestrial plant products*: Amar C. Nath and Manas Chakrabarty.

Two plants were mainly investigated—the orchid, *Coelogyne ochraceae*, and *Polyalthia longifolia* belonging to the family Annonaceae. The orchid has finally produced four phytochemicals, viz. two 9, 10-dihydrophenanthrenes (coelogenin and coelogenin), a trioxxygenated bibenzyl (batatasin III) and a 9, 10-dihydrophenanthraquinone (ochrone B), all of which have been identified by detailed spectroscopic analyses and derivatisations.

The continued search for insecticides from *P. l.* has culminated in the isolation of a few more diterpene acids from its seeds. Their structure elucidation is in progress. However, one metabolite, isolated earlier from the bark of *P. l.* has been identified as 2-oxokolavenic acid, reported for the first time from any *Polyalthia* species.

E. Studies on prostaglandins

- (i) *Studies on prostaglandin (PG) synthetase-Demonstration of cyclooxygenase as the target site of Ca^{2+}* : Eli Mukherjee, Mallika Roy and Dolly Ghosh.

It has been reported by us that Ca^{2+} plays a regulatory role in PG-biosynthesis with respect to the *in vitro* conversion of arachidonic acid to PGE_2 by the multienzyme complex, cyclo-oxygenase-peroxidase-isomerase (MES). To monitor the actual site of Ca^{2+} action of MES, the effect of Ca^{2+} on the individual enzymic steps, cyclo-oxygenase, peroxidase and isomerase activity have been carried out separately. Ca^{2+} exerts an exactly similar hysteretic effect (i. e. induces a time dependent alteration of enzyme kinetics) on the cyclo-oxygenase as in the case of PGE_2 synthetase. The effect of Ca^{2+} on the rate of cyclo-oxygenase activity is also very similar to that of PGE_2 synthetase activity. On the contrary Ca^{2+} has no effect at all on peroxidase activity. These findings and our previous findings lead us to the conclusion that Ca^{2+} regulates PG-biosynthesis by exerting its effect on cyclo-oxygenase active site.

F. Studies on Biomembranes

- (i) *Structure and function of the erythrocyte membrane*: Amit K. Das, Raja Bhattacharyya, P. T. Srinivasan, Manikuntala Kundu, Parul Chakrabarti and Joyoti Basu.

In addition to our previous studies on the palmitylation of a 55kDa peptide, we have now shown that protein 4.2 is palmitylated in human erythrocytes. Protein 4.2 is a major cytoskeletal protein of human erythrocytes. It has already been demonstrated that 4.2 is myristylated at the N-terminal glycine. We have now shown that protein 4.2 is also palmitylated. Labeling of erythrocytes with [3H] palmitic acid, followed by extraction of peripheral proteins from ghosts with alkali, shows association of [3H] palmitic acid with a 70kDa protein which has been identified as protein 4.2 using polyclonal antibodies in western blots. The associated [3H] fatty acid is sensitive to cleavage with hydroxylamine, suggesting an ester/thioester linkage. The influence of palmitylation on the association of 4.2 with other erythrocyte membrane proteins is under investigation.

Continuing studies on defects of the erythrocyte membrane in chronic myelogenous leukemia (CML) have shown that CML erythrocyte proteins are more susceptible to breakdown under conditions of oxidative stress induced by t-butylhydroperoxide or xanthine/xanthine oxidase. This has been studied by measuring the release of free alanine in erythrocytes (which have no de novo alanine synthesis machinery).

- (ii) *Peroxidation in human uterine tumours*: Subhansu Ray and Parul Chakrabarti.

Peroxidation index in tumour microsomes has been found to be lower than that in their normal counterpart. This may be due to the higher level of α -tocopherol and DTNB-reactive thiol concentration in tumour microsomes, because

alpha-tocopherol can partly trap peroxy radical produced in the membrane and the thiol dependent enzymes like glutathione reductase can donate the reducing equivalent to the tocopheroxy radical for regenerating alpha-tocopherol. In summary the lower peroxidation index in tumour microsomes is associated with higher antioxidant potential.

- (iii) *Regulation of membrane structure and function in fish during seasonal fluctuation of environmental temperature* : Ramaballav Roy and Dolly Ghosh.

Our recent studies on brain membranes of *Clarias batrachus* during seasonal variation of temperature revealed the following observations. In the synaptosomal membrane though the degree of augmentation in the ratio of PC/PE is much less but there is about a 60% increase in the level of SM and also there is an increase in Chol/PL ratio as compared with winter adapted fishes versus summer adapted ones. However, variations of temperature has no effect on PI content of synaptosomal membrane.

G. Structure, function and interaction of proteins

- (i) *The involvement of Mg^{2+} -independent Ca^{2+} -ATPase in Ca^{2+} -uptake in goat spermatozoa membranes* : Rita Sikdar, S. Chandra, G. Adhikary and P. C. Sen (Supervisor) in collaboration with U. Ganguly, NICED, Calcutta.

Microsomal membrane vesicles isolated from goat spermatozoa contain Ca^{2+} -ATPase, and exhibit Ca^{2+} -transport activities that do not require exogenous Mg^{2+} . The enzyme activity is inhibited by calcium-channel inhibitors e.g. verapamil and diltiazem, like the well known Ca^{2+} , Mg^{2+} -ATPase. The uptake of calcium is ATP (energy) dependent and the accumulated Ca^{2+} can be completely released by the Ca^{2+} -ionophore A23187, suggesting that a significant fraction of the vesicles are oriented inside out.

- (ii) *Regulation of protein kinase C by a heat stable enterotoxin in rat enterocytes* : Parimal C. Sen in collaboration with U. Ganguly, NICED, Calcutta.

A protein kinase C isolated from rat intestinal epithelial cells is found to be stimulated five fold by *E. coli* heat stable enterotoxin (STa) in dose and time dependent manner. The pretreatment of the cells with STa resulted in the phosphorylation of specific membrane proteins with MW 37KDa, 100KDa and 140KDa. However, STa had no direct effect on the enzyme activity. The results suggest the involvement of PKC in STa induced signal transduction in rat enterocytes.

- (iii) *Drug-protein and drug-lipid interactions in the regulation of transport enzymes* : Gautam Adhikary, Sucheta Chandra, Dipankar Bhattacharyya and Parimal C. Sen (Supervisor).

Two amphiphilic drugs-chloroquine and chlorpromazine have been found to inhibit various transport enzyme activities in time and concentration dependent manner both *in vitro* and *in vivo* as well as in reconstituted system. The *in vivo* studies revealed that the drug effects are reversible suggesting that the pharmacological use of those drugs could be made without significant side effects. The conformational change of the enzymes is found to take place after drugs treatment as evident from tryptophan fluorescence data.

- (iv) *Regulation of monovalent ion dependent ATPase by inhibitor protein isolated from rat brain cytosol* : Sucheta Chandra, Dipankar Bhattacharyya, Gautam Adhikary and Parimal C. Sen (Supervisor).

An inhibitor protein partially purified from rat brain cytosol is found to inhibit Na^+ , K^+ -ATPase and H^+ , K^+ -ATPase activities without any effect on Ca^{2+} , Mg^{2+} -ATPase and Ca^{2+} -ATPase activities. The biochemical role of this inhibitor protein in regulating Na^+ , K^+ -ATPase has been studied.

Institutional Project No. IV : Studies on ecology environmental pollution and related problem.

- (i) *Studies on neuro immunology* : D. Ghosal, A. K. Barua in collaboration with G. Adhikary and P. C. Sen.

We have reported earlier that brain microsomal ATPase of healthy control and malnourished rodents responded differentially to immunization. The control healthy animals showed *Suppression* in ATPase activity upon immunization followed by a *burst of activity* at 96 hrs i.e. at the peak of immune response. Malnourished immunoincompetent animals only showed ATPase stimulation. Injection of a bone marrow derived cytokine in the malnourished animals improved the immunocompetence and ATPase activity profile was found to be like that of the control healthy animals. It has now been observed that the left lobe of the cerebral cortex responded preferentially to immunization and cytokine treatment over Right cerebral cortex and cerebellum/brain stem sections. The receptor for the immunogen/cytokine is believed to be at or near the ATPase enzyme in the microsomal membrane of rat brain. No significant changes of the suppressor protein controlling ATPase activity was observed.

(ii) *Immunoprophylaxis of chicken field study at Birati, 24 Pgs. (N) :*

The rodent bone marrow cytokine was earlier reported as non-specific specific i.e. it shares some structural and functional homology among different species. As the cytokine showed immunomodulatory effect in immunosuppressed rodents, rabbits, g. pigs, goat and human it is employed to improve immunosuppression of poultry suffering from mycotoxicosis/New Castle Disease/Cocci/E. coli infections. Reports to-date showed that more than 40% untreated control birds died due to the above mentioned diseases while the cytokine treated birds showed mortality less than 8%. This cytokine is now being purchased by the farmers of Birati from Bose Institute. A new immunoprophylactic approach to the treatment of poultry is envisaged.

Institutional Project No. V : Studies on microbes and parasites for Industrial and Medical applications.(ii) *Penicillin-interactive proteins of Mycobacterium smegmatis SN2 :* Rathin Chattopadhyay, Tapan Mukherjee, Dhiman Basu, Mukul Ghosh, Manikuntala Kundu, Joyoti Basu and Parul Chakrabarti.

Further studies on the purified transpeptidase of *M. smegmatis* SN2 have shown that the protein is sensitive to ampicillin, SCH34343 and cefoxitin. The sensitivity towards cefoxitin is significant in view to its efficacy in the mouse foot pad model of leprosy. The tentative N-terminal sequence of the protein has been determined to be :

X-Asp-Ile-Leu-Asn-Pro-Asn-Pro-Asp-Gly-Asn-Glu-X-Ile-Glu-Val-Asp. Transpeptidation using the substrate Ac₂-L-lys-D-ala-D-ala and the acceptor gly-gly occurs with a K_m of 4mM.

The intracellular beta-lactamase purified from *M. smegmatis* is being characterized in detail with respect to its substrate and inhibitor profile. Clavulanic acid and sulbactam, suicide substrates of beta-lactamase were both found to inhibit the enzyme with K_i values of 0.27μM and 3.40μM respectively.

(ii) *Lectin from Mycobacterium smegmatis SN2 :* Saurav Sarkar, Swapnanjan Goswami, Manikuntala Kundu, Joyoti Basu and Parul Chakrabarti.

Further studies in relation to the role of lectin in *Mycobacteria*-macrophage

interaction showed that the binding of *M. avium*, *M. tuberculosis* and *M. smegmatis* with mouse peritoneal macrophages could be inhibited by mannan and anti-*M. smegmatis* lectin antibodies. Components crossreactive with the *M. smegmatis* lectin were found on the cell surface of *M. leprae*, *M. tuberculosis* and *M. avium*, strengthening the likelihood of lectin-macrophage interaction being involved in the primary step leading to colonization of macrophages by these pathogens.

(iii) *Penicillin-binding proteins (PBPs) of Shigella dysenteriae type I :* Sebabrata Mahapatra, Anindya Sundar Ghosh, Alok Kanti Kar, Joyoti Basu, Parul Chakrabarti and Manikuntala Kundu.

Drug resistance is posing increasing threats to the chemotherapy of shigellosis. It has been undertaken to study the interaction of the penicillin-binding proteins of *Shigella dysenteriae* type I with beta-lactam antibiotics. Competition studies with non-radioactive beta-lactam antibiotics and [¹⁴C] benzylpenicillin showed that SCH34343 (a penem) and cefoxitin were the most effective antibiotics. Although the MIC of ceftriaxone was also very low, the ID₅₀ value of inhibition of ¹⁴C-penG binding by ceftriaxone, was several orders higher than that of SCH34343 or cefoxitin.

The PBPs of ampicillin-resistant *S. dysenteriae* type I have been solubilized with Triton X-100, and one of the PBPs has been subsequently purified by chromatography on Q-Sepharose Fast Flow. This PBP has a M_r of 38,000. No DD-carboxypeptidase activity could be found associated with this protein.

C. BOTANY

Institutional Project No 1. Improvement of Plant Productivity, nitrogen fixation and photosynthesis using modern biotechnology and plant breeding.

A. (i) *Molecular responses of stress in rice and Brassica*: Bharati Ghosh, Dibyendu Sen Gupta, Tirtha Jyoti Bhaduri, Malabika Roy, Sankar Das, Manas Chatterjee, Sudhi Ranjan Gupta, Subarna Ghosh.

Using the oligo nucleotide probe made according to cDNA, oat arginine decarboxylase was amplified and subcloned. It was next sequenced to match the correct product. Southern and northern blot hybridization from salt sensitive (IR-29) and tolerant (Pokkali) rice genotypes are being made using oligo probes.

Last year we reported the purification of ADC enzyme from the *B. campestris*. The native structure of purified ADC was very unstable, the Mr. was approx. 239 kDa, pH optima 8.0, tempr. optima 37°C. Monovalent and divalent cations significantly inhibit the enzyme; MGBG, canavanine, pyridine-HCl, hydroxylamine inhibit ADC upto 70%. Plant growth regulators stimulate ADC activity; DTT and pyridoxal phosphate help in restoration of enzyme at 2 mM and 3 mM conc. respectively. ADC antibody has been raised. The titre of polyamine oxidase (PAO) is high in salt tolerant *Brassica*. This is the first report of PAO in *Brassica*.

A 198 bp PCR was obtained from Pokkali genomic DNA according to the sequence of *SalT* cDNA from Taichung Native-1; the product has been subcloned into TA cloning vector PCR II (Invitrogen) and sequenced. Southern experiment shows one hybridized fragment of 1.4 kb. Northern hybridization is going on to see the expression of mRNA for *salT*.

In addition to free polyamines, thermal stress causes an accumulation of more conjugated di and tri amines in tolerant rice calli, rather than in sensitive rice. Using suicide inhibitors of PA biosynthesis, besides ADC, degradative enzymes (DAO, PAO) also play an important role in adaptive process.

Spermine and spermidine can be used as a substitute of IAA in producing profuse rhizogenesis. Polyamine has a role in somatic embryogenesis.

(iii) *Regulation of ribulose 1,5-bisphosphate carboxylase in stress and senescence*: Bharati Ghosh, Anindita Bose (CSIR), Anindita Bhattacharya (ICAR).

The synthesis of Rubisco was more susceptible to thermal stress in the sensitive rice cultivars than in tolerant ones. In sensitive ones, RLSU synthesis is inhibited much more strongly than RSSU. RubisCO was purified from tolerant and sensitive rice cultivars. Under thermal stress, protease activity using RubisCO as substrate showed no significant change. But in reproductive sink induced senescence, RubisCO degradation is much more pronounced. The content of total soluble protein, chlorophyll fluorescence and RubisCO protein decreased gradually in the process of senescence.

B. (i) *Mutation breeding programme for rice improvement*: B. Majumder.

One pure and sterile mutant S.417 was isolated for its clustered nature of grains which was monogenically recessive; after crossing with Satika cv, five pure hybrid lines with better grain yields were isolated.

After gamma irradiation of various doses, the rice varieties showed a gradual increase in the frequency of the induced chlorophyll deficiency though there is exception in CHDG cv.

The IR8 cultivars of low frequency of chlorophyll mutants after crossing with cvs like SR. 26B, and Mota having no chlorophyll mutant, the frequency of chlorophyll deficient plants are increased in the hybrids. It proves that there is mutated site in the chlorophyll locus of rice cv. IR8.

(ii) *Salt tolerant hybrids in rice*: B. Majumder.

After transferring of salt tolerant character from rice Dhulobji cv to IR8, in F_2 population, selections were isolated and maintained. Yield trial indicates that the hybrid lines are superior to their parents.

Patnai rice with morphological characters like apiculus. grain size, collected from Sunderban was grown in Madhyamgram. Jata Patnai and Beaked Patnai were found to be significantly higher in grain yield than the others.

C. (i) *Soluble and chloroplastic myo-inositol synthase from plant source: Regulatory aspects*: Aniruddha Roychowdhury, Sriparna Bagchi and A. N. Lahiri Majumder.

In continuation of last year's work, chloroplastic and soluble myo-inositol synthase (IS) from *Euglena gracilis* were purified to homogeneity (166-fold and 299 fold respectively); the Mr. was approx. 2,81,800 daltons and approx. 1,81,800 daltons respectively. About 4 fold increase in the specific activity of the chloro-

plastidial IS was noted under the influence of light during chloroplast transition. In addition, in *Oryza*, under saltstress; the chloroplastidial IS activity decreased appreciably in susceptible varieties, with 10-15 fold increase of the same in tolerant varieties. The salt enhanced chloroplastic IS activities quantitatively were near equal to those detected in the halotolerant species like *Suaeda nudiflora*, *S. maritima*, *Heliotropium curassavicum* and *Porteresia coarctata*.

- (ii) *Molecular responses of crop plants to salt stress*: Asok Biswas, Sanghita Bhattacharya, Sriparna Bagchi, Aniruddha Roychoudhury and A. N. Labiri Majumder-in collaboration with Prof. S. P. Sen and Bikash Sarkar, Kalyani Univ., Dr. A. R. Bal, CSSRI, Canning.

Photosynthetic efficiency in relation to salt stress in Rice has been monitored in sensitive and tolerant rice varieties both under laboratory conditions as well as under sand culture and field conditions. Results so far obtained suggests that net photosynthesis, as measured by infrared gas analysis, drops in comparison to the control plants along with visible decline in overall growth. Variability in chloroplast, Hill activity, chlorophyll content etc. have also been noted.

To delineate such salt stress effect on photosynthesis, studies of cytosolic and chloroplastic fructose 1, 6-bisphosphatase (s) suggests noticeable reduction of chloroplastic Fru P₂ ase activity in seedlings grown under various degrees of salinity. Both the enzymes are presently being purified for detailed study.

- D. (ii) *Growth regulators from Gautamala Grass*: (*Tripsacum Laxum*): Jayashree Banerjee and S. N. Ganguly.

From the petroleum ether extract, n-triacontanol was isolated and characterised. From the methanolic extract indole-3-acetic acid and gibberellin A₈, A₉, A₇ were isolated and characterized.

- (ii) *A new anti coagulating compound from Tea* (*Camellia sinensis*): Jayashree Banerjee and S. N. Ganguly.

From the methanolic extract of the defatted tender leaf of *C. sinensis*, a new angular furocoumarin, C₁₆H₈O₅, m.p. 212° was isolated and on the basis of the physical data and chemical degradation, its structure was established.

- (iii) *A new triterpene from the leaves of Sonneratia apetala*: S. N. Ganguly.

From the petroleum ether of *S. apetala*, a new triterpene, C₃₂H₅₀O₈, m.p. 268° was isolated. On the basis of physical data its structure was established.

- E. (i) *Cytogenetical and chemical investigations of naturally occurring diploid and hexaploid Chenopodium album*: B. Bera and K. K. Mukherjee.

Seeds of two diploid cytotypes and one hexaploid cytotype, of *Chenopodium album* are morphologically indistinguishable. Seed proteins including albumin and globulin examined by PAGE also showed distinctive protein banding patterns for seeds of the same and different ploidy level suggesting homology and genetic diversity.

- (ii) *Investigations on the wild gene pool of Ipomoea spp.*: S. Das and K. K. Mukherjee.

Survey of wild gene pool of *Ipomoea* spp. from Gangetic plains resulted in isolation of nine wild species in addition to three cultivated species namely, *I. quamoclit*, *I. nil* and *I. batatas*. Phenetic tree among species of *Ipomoea* was constructed through Hierarchical Cluster Analysis using different phenotypic characters.

- (iii) *Cytogenetical investigations of Beta spp.*: S. Bhattacharya and K. K. Mukherjee.

Genetic diversity of the recombinant genotypes originating from crosses between *Beta palonga* and *B. vulgaris* was evaluated with Discriminant Function Index. The present study indicates wide genotypic diversity which can be used to exploit heterosis in *Beta*.

- F. (i) *Studies of two physiological seed types of Bauhinia*: S. Biswas (Guest worker) and P. K. Saha.

Two sp. of *Bauhinia* absorb different amount of water during germination which can be correlated with dormancy and germination.

- (ii) *Morphological studies in some leguminous seeds*: S. Biswas (Guest worker) and P. K. Saha.

The seeds of *Pachyrrhizus angulatus* on SEM studies revealed the difference in micropyle, hilum and strophiole within the same species.

- G. (i) *Improvement of rice and Brassica*: J. S. R. Murthy, Jayanti Sen (CPMB), J. P. Sharma (PDF), Amitava Ray, Nirmal Mondal, Sangita Basu, B. B. Mukherjee, S. Gupta and P. K. Saha.

(a) *Rice* :

Plant regeneration of rice cvs. Basmati, Heera gobindobhug and Ratna was achieved by culturing anthers in N_6 medium. The regenerated plants were multiplied in vitro, acclimatized and transferred to pots. Anthers of F_1 derived from crosses *O. sativa* (Swarnaprava) and each of *O. latifolia*, *O. melapbugenesis*, *O. longistaminata*, *O. eichingeri* were also cultured. None of F_1 pollen responded in culture media as pollen production in hybrids was poor or the anthers were sterile (done in CRRI, Cuttack).

The plantlet regeneration was possible by embryo rescue and embryo culture method for the hybrids made by the cross between *O. sativa* X *O. longistaminata*. Callus was induced in similar ovulus and regeneration was obtained.

Anther culture of flood tolerant cultivar FR/13A and Pankaj showed callusing and subsequent regeneration of albino as well as flood tolerant plants.

(b) *Brassica* :

Some interspecific and intraspecific crosses were made between *B. campestris*, *B. juncea* and *B. napus*. Interspecific crosses were not successful but some rudimentary seeds were obtained between *B. campestris* (B-9) X *B. napus* (Tower). Anthers of *B. Juncea* X *B. campestris* responded in culture and anther derived calli started regeneration.

- (ii) *Micropropagation in Michelia champaca and Calamus rotang L.* : Gourab Gangopadhyay, Amitava Ray, P. K. Saha, B. B. Mukherjee S. Gupta (W. B. Govt. Project).

Substitution of sucrose in medium along with glucose or fructose in presence of BAP and NAA supported establishment of *Michelia*. 2, 4-D along with BAP and GA_3 supported rapid growth of explants with emergence of new leaves. Addition of 0.3% activated charcoal in medium was necessary.

- (iii) *Regeneration of Cuminum sativum* : Ramit Poddar and S. Gupta.

Both hypocotyl and cotyledonary leaf of *Cuminum stivum* responded to callusing best in IAA and coconut milk containing MS media and regenerated shoots flowered in vitro.

- (iv) *Physiological change of tobacco callus under salinity stress* : Gourab Gangopadhyay, Dr. S. P. Mukherjee (Guest worker), Amitava Ray, Ramit Poddar, S. Gupta and B. B. Mukherjee.

Dry weight of callus, increased during first 3 subculture in NaCl containing medium, though RWC and viability declined. Viability of tissues, initially adapted to 171 mM NaCl, increased due to shock treatment in high saline media.

H. Programme for development of sustainable agriculture

- (i) *Simple hydration-dehydration pretreatment of Rice seeds* : Selva Meena Dass and Swati Sen-Mandi.

The above treatments helped to obtain :

(a) A value of 100% germinability from a 85% germinating stock. Ensuring 100% soil emergence of the seedlings (due to the same pretreatment) helps to eliminate wasteful use of seed material.

(b) Better yield (in seed weight per plant). This ensures target crop-yield from lesser number of plants grown per unit area and makes the cultivation practiced less requiring of land-nutrient resources.

- (ii) *Sowing single seed/seedling per hole/hill in wheat/Rice : cultivation* : Smritimala Ganguli, Gitali Das, Selva Meena Dass, Somen Nandi and Swati Sen-Mandi.

Appreciably high effective tillers per unit area have been obtained in these experiments; the number of effective tillers was much higher than tiller number produced per unit area in the conventional multiple seed/seedling sowing practices.

- (iii) *Embryo rescue from non-viable seeds for salvation of germplasm under threat of extinction due to post maturation deterioration* : Smritimala Ganguli and Swati Sen-Mandi.

Plantlets raised from embryos of nongerminating seeds (naturally deteriorated) of wheat establish well in the field, grow normally with considerably high number of effective tillers and produce viable seeds.

- (iv) *Germplasm screening parameters* : Somen Nandi, Gital Das, Smritimala Ganguli and Swati Sen-Mandi.

- (a) Activity of β -amylase has been identified as a parameter of seedling vigour.
- (b) ESR signals of different viability seed stocks show a good correlation with germination ability in cereals (viz. Rice and wheat).

I. (i) *Molecular Basis of cytoplasmic male sterility (CMS)*: S. K. Gupta (PDF) and D. N. Sengupta.

To develop cytoplasmic male sterile lines, 45 genetic stocks including seven species were cultivated in last rabi season and the interspecific and intrageneric crosses were made for the derivation of cytoplasmic male sterility. The F_1 hybrids between *R. sativus* X *B. napus*, *R. sativus* X *B. campestris* and *R. sativus* X *B. juncea* were obtained. Using COX II oligonucleotide as a probe, work is going on to find rearrangement in Mt DNA in hybrids/CMS lines (if any).

(ii) *Purification of plant DNA polymerase*: M. Sanat Kumar and D. N. Sengupta.

The work on the purification of DNA polymerase and its expression of *E. coli* is in progress. We have partially purified DNA polymerase from 72 hr germinated rice seedlings. By southern blot analysis we have found that the human cDNA for DNA polymerase can hybridize and detect homologous gene in rice.

Institutional Project No. IV: Studies on Ecology, Environmental Pollution and related problem.

A. (i) *Chemical nature of common allergenic pollen of Cocos nucifera*: Swati Gupta Bhattacharya and Sunirmal Chanda.

To understand the chemical nature of the pollen grains, total carbohydrate and total soluble protein were estimated to be 11% and 13% respectively; free common amino acids were also present. The skin test showed 34% positive response to *Cocos* pollen antigen while clinically five out of seven patients showed ELISA positive reaction to the same pollen; mean value for *Cocos* specific IgE antibodies was estimated to be 1.35 PRU ml⁻¹ as against 0.35 PRU ml⁻¹ in control (PRU Pharmacia RAST unit ml⁻¹).

(ii) *Comparative Aerobiological study using volumetric trap in urban and suburban areas of greater Calcutta with reference to respiratory allergy*: Swapna Banik and Sunirmal Chanda.

A higher concentration of atmospheric pollen grains were recorded from Madhyamgram with 39 pollen types whereas Calcutta recorded 44 pollen types with

a slightly lower frequency. Highest concentration for Calcutta was represented by Poaceae (17.2%) followed by *Trema orientalis* (14.8%) and *Cocos nucifera* (13.0%).

(iii) *Pollen analysis of honey samples from West Bengal*: Arati Malakar and Sunirmal Chanda.

Honey samples collected from different places of West Bengal mainly (Midnapore, Sundarban) were studied. About 100 pollen types were identified. Honey collected from Nondigram, Midnapore contains *Ricinus communis*, *Murrua paniculata*, *Ceiba pentandra*, *Croton bonplandianum*, *Borassus flabellifer*, *Cocos nucifera*, Poaceae and some unidentified pollen grains. Sunderban honey shows the following predominant pollen types, *Rhizophora*, *Bruguiera*, *Avicennia*, *Sonneratia*, *Ceriops*, *Kandelia*, *Excoecaria*, *Nypa*, *Phoenix paludosa*.

(iv) *Palaeocology and palaeoenvironment of Quaternary*: Sunirmal Chanda, Kashinath Bhattacharya (Bot. Dept., Visva-Bharati, Santiniketan) and D. P. Agarwal (Physical Research Laboratory, Ahmedabad), Satadip Sarkar.

Well preserved pollen grains of *Pinus roxburghii*, *P. wallichiana*, *Abies*, *Ficus*, *Alnus*, *Betula*, *Quercus*, *Carpinus* along with a large number of temperate herbaceous plants and Pteridophytes were recorded proving the presence of last interglacial epoch in Kashmir Valley corresponding with Interglacial of Northern Europe. The source of temperate pollen grains coming from northern hill regions of Tripura were confirmed as an effect of meteorological flow. The C¹⁴ dating have been correlated with other radiocarbon datings, which goes back to ± 2500 years.

(v) *Palaeoclimate and Palaeoenvironment in the Bengal Basin during the last 18000 yrs*:—Sponsor: Dept. of Science and Technology, Govt. of India in collaboration with CSME, Calcutta: Sunirmal Chanda, Arghya Hait, H. K. Das and Shibani Chakraborty.

Five bore holes viz., from Kolaghat, Salt Lake, Diamond Harbour, Haldia and Digha have been made to a depth of 30m to collect undisturbed samples for palynological, palaeontological and sedimentological analysis. Palynological analysis of Salt Lake samples records spores and pollen grains clearly comparable to *Acrostichum*, *Rhizophora*, *Ceriops*, *Excoecaria*, *Avicennia*, *Kandelia*, *Sonneratia*, *Bruguiera*, *Heritiera*, *Acanthus*, *Nypa*, *Phoenix* of mangrove affinity. The sediments recovering the above assemblage are comparable with the sediments radiometrically dated as ± 4000 yrs B. P. and thus indicates the existence of mangrove forest at Salt Lake during ± 4000 yrs B. P. Palaeontological analysis of Digha sediments records rich and diverse foraminifera viz., *Ammonia*, *Asterorotalia trispinosa*, *Elphidium*, *Lagena*, *Nonion*, *Quinqueloculina* and different types of ostracoda. Presence of these microfossils in a sedimentary sequence strongly point towards the existence of marine environment at the time of deposition.

D. MICROBIOLOGY

Institutional Project No. I: Improvement of plant productivity, nitrogen fixation and photosynthesis using modern biotechnology and plant breeding.

A. (i) *Iron transport in Rhizobium sp. (Cicer arietinum)*: Nupur Roy and P. K. Chakrabartty.

In continuation of our previous study, siderophore of the strain *Rhizobium sp. (Cicer arietinum)* BICC 651 was purified. The pure siderophore was active in bioassay and could support iron nutrition of the *Rhizobium* strains BICC 632 and TAL 1012 of *Cicer arietinum*. Crude cell free extract of BICC 651 released ferrous iron from ferrisiderophore and converted ferric substrate to ferrous form. The enzyme ferrireductase is constitutive in nature. Partially purified enzyme had a K_m of 0.3 mM.

Outer membranes of *Rhizobium sp. (Cicer arietinum)* BICC 651 had two unique bands having M. W. of 66 KD and 70 KD during iron-limited growth. These may act as receptor for high-affinity iron siderophore uptake system.

(ii) *Genetic diversity of Indian strains of Rhizobium sp. (Cicer arietinum)*: Anjana Banerjee and P. K. Chakrabartty (Supervisor).

To study genetic diversity, electrophoretic separation of plasmids of *Rhizobium sp. (Cicer arietinum)* of Indian origin was attempted by three different 'in gel' lysis methods. The method of Heron & Pueppke (1984) with some modification was adjudged to be superior. In this method low M. W. plasmid bands (<15 Kb) were clearly discernible.

Institutional Project No. IV: Studies on ecology, environmental pollution and related problem.

A. (i) *Airspora of banana and potato plantations and the effect of commonly used pesticide and fungicide on the phylloplane mycoflora*: Naim Uddin and Roma Chakraverty.

Aeromycological studies were made during individual crop seasons. In case of banana, *Aspergillus* and *Penicillium* were dominant during summer and monsoon, while *Cladosporium*, *Epicoccum* and *Zygosporium* predominated in winter. *Curvularia*, *Cephalosporium*, *Alternaria* and *Fusarium* (the latter two as plant pathogens) were observed occasionally. In case of potato, *Cladosporium* predominated throughout followed by *Alternaria solani* and *Phytophthora*, the latter was observed during the late stages of crop growth. Investigation was also carried out to find out the inhibitory effects of commonly used pesticides and fungicides on fungal growth. The pesticides like Cildon (0.06%) and BHC (0.5%) and fungicides like Bavistin (1.0%) were used. Cildon and BHC were found to be more effective against *Curvularia geniculata* and *Aspergillus ochraceus*. Bavistin was effective against *A. niger*, *Cercospora arachidicola* and *Penicillium sp.* Further studies are in progress.

Institutional Project No. V: Studies on microbes and parasites for Industrial and Medical applications.

A. (i) *Biological enrichment of magnesite ore*: B. K. Mohanty and A. K. Mishra.

Magnesite ore grown *B. licheniformis* cells were pleomorphic with protrusions on the cell surface by which they adhered to the ore surface. Soluble silica was released into the leaching solution leading to heavy corrosion of the ore surface, showing absence of silica veins in magnesite ore. Protoplast fusion technique is being pursued for development of better silica solubilizing strains. A new reactor vessel 5 metric ton completely of stainless steel with various modifications for aeration and temperature regulation system has been installed at Salem and is being standardised.

(ii) *Removal of silica from pure kaolinite through microbial leaching*: A. K. Halder, B. K. Mohanty and A. K. Mishra

It is difficult to remove silica from Kaolinite part of Bauxite. Break down of silica from pure kaolinite was studied and a strain of *Bacillus mucilaginous* FM4 has been developed through UV mutagenesis, which removed 35% silica from kaolinite, and was better than the wild type in Bauxite enrichment.

(iii) *Physiological and enzymatic characterization of sulfur compound negative mutants of SD 502*: S. K. Das and A. K. Mishra.

On the basis of various parameters the isolated mutants defective in thionislfate

and other sulfur compound utilization are being classified. It seems that enzymatic blocks in sulfur compound degradation pathways has occurred which could be due to deficiency in Rhodanese, thiosulfate oxidase, sulfide oxidase, & tetrathionase, which is being established.

- (iv) *Sulfur oxidation coupled to dissimilatory iron reduction in Thiobacillus ferrooxidans*: A. Das, P. Roy and A. K. Mishra.

Cytochromes were localised in both the supernatant and membrane fraction of both aerobic and anaerobic sulfur grown cells. Cytochrome contents in the membrane fraction of anaerobic cells were higher showing significance in relation to ferric iron respiration.

The respiratory chain in sulfur oxidation coupled to Fe^{+3} -reduction involved cytochromes a, c and cytochrome d acting as a terminal oxidase, involvement of quinone being uncertain.

Highly aerated sulfur grown cells showed higher iron and reduced sulfur oxidation capacity than the usual sulfur grown cells.

- B. (i) *Biology of sulfur based lithotrophy in Thiobacillus*: Chirajyoti Deb, Ranadhir Chakrabarty, Pratap Mukherjee, Keya Banerjee, Anupama Saha and Pradosh Roy.

The objective of this work is to elucidate the mechanism of sulfur metabolism in *Thiobacillus*, a gram negative autotrophic/facultatively autotrophic bacterium. The biochemistry of sulfur metabolism in *Thiobacillus* is yet not clear. Here we are attempting to describe an alternative pathway of thiosulfate utilization by *T. ferrooxidans*.

The cell free extract of sulfur grown or thiosulfate grown cells showed thiosulfate reductase activity, and the activity was found to be dependent upon reduced glutathione. Glutathione reductase activity was also present. The system was possibly capable of maintaining (*in vivo*) reduced glutathione level through a NADPH generating system absolutely dependent on the addition of reduced glutathione. The products of thiosulfate reductase were sulfide and sulfite which in fact were used as the oxidisable substrates in the metabolism of thiosulfate. The earlier conception of thiosulfate metabolism through activity of thiosulfate oxidase resulting in the formation of tetrathionate is not conceivable and can not be justified by our observation.

- C. (i) *Oxidative cleavage of $\text{C}_{17}-\text{C}_{20}$ bond in pregnane by a Pseudomonas sp.*: Alok Dhar and Timir B. Samanta.

Transformation of progesterone to Δ' -testosterone and Δ' , 4-androstadien-3, 17-dione (ADD) had been reported (Annual Report 1991-92). The lysis of $\text{C}_{17}-\text{C}_{20}$ bond involved an initial cytochrome P_{450} linked oxidation. This was substantiated by the results of transformation *in vivo* in presence of different agents viz., $\alpha\alpha'$ -bipyridyl, iodoacetamide and 8-hydroxyquinolin which completely inhibited the reaction. It was interesting to note that metyrapone-a potent inhibitor of cytochrome P_{450} had no effect on this transformation. The work on role of these inhibitors on this transformation *in vitro* is underway.

- (ii) *Water activity-an important physiological determinant in biotransformation of steroid by immobilized spores*: Tapan K. Dutta and Timir B. Samanta.

Transformation of progesterone to C_{19} analogs by immobilized spores under reduced water activity was studied. The altered product pattern was observed even when the reaction was tried with the entrapped spores germinated in nutrient medium. The products were separated and characterised by HPLC using authentic steroids as reference. The immobilized spores of the test organism under normal water activity transformed progesterone exclusively to its 11- α -hydroxy derivative. The onset of new catalytic activity under reduced water activity is believed to be possible due to accumulation of compatible solutes and restricted germination of spores. To elucidate the exact role of water as regulatory control in the altered product pattern, the water activity of the biocatalyst dehydrated under different conditions is under close scrutiny.

- (iii) *Characterisation of an extracellular invertase produced by Aspergillus ochraceus TS*: Kajori Ghosh and Timir B. Samanta.

An extracellular β -fructofuranosidase has been characterised from the culture filtrate of *Aspergillus ochraceus* TS. Sucrose acted as the best inducer of the enzyme is in progress.

- D. (i) *Studies on Lichen biomass*: Kalyani Sen.

An indigenous process has been developed to produce lichen biomass from the laboratory cultivable lichen. This biomass can be used as a source of plant growth nutrient (PGN). Laboratory scale experiments were done for root and shoot elongation with *Brassica* sp. seeds. Effect of PGN on root elongation is highly significant as

compared to that of control. The mean values of root elongation in control and treated sets were 7.02 ± 0.19 cm and 12.52 ± 0.26 cm respectively. The statistical analysis of data shows that PGN has significantly influenced the root elongation process ($P < 0.001$). Works on PGN with other types of seeds are in progress.

E. (i) *Protease of a keratinolytic streptomycete to unhair goat skin*: R. P. Mukhopadhyay, Papia Mitra and A. L. Chandra.

Streptomyces sp. A₁₁, a new soil isolate, degraded human hair, chicken feather, silk and wool. When human hair was used as substrate cysteine $12 \mu\text{g/ml}$ culture filtrate was released and the protease showed relatively high specific activity at 4.5 units/ml. The 7.3 pH of the medium after incubation turned more alkaline. Thiosulfate was also detected in the culture filtrate. Hair was ruptured during the growth of the organism.

The streptomycete was grown on wheat bran, kaolin, streptomycin and sterile distilled water were added to the organism-bran mass and made into a paste. The paste was added to the flesh side of goat skin pieces and incubated. Hair of the skins were loosened in 20 h.

(ii) *Taxonomy of a keratinolytic actinomycete*: Sumana Mazumdar and A. L. Chandra.

Taxonomic characters of the keratinase producing actinomycetes AC₉₆ and AC₁₇₅ were studied according to internationally accepted methods. Morphological, culture and physiological characters were determined and whole cells and cell wall contents were analysed.

F. (i) *Studies on xylanolytic enzymes-Thermal stabilization of β -xylosidase and saccharification of agricultural hemicellulose*: Mousumi Ghosh, Amitava Das and Geeta Nanda.

Investigations were carried out for producing catalytically active thermostable β -xylosidase from *A. sydowii* MG 43. Heating of this enzyme at $85^\circ \pm 1^\circ\text{C}$ and pH 5.5 to 6.0 causes irreversible, covalent thermoinactivation involving oxidation of the thiol groups. Exogenous addition of cysteine, dithiothreitol, glutathione (reduced) and mercaptoethanol stabilizes the enzyme. Similar effect is also exhibited by divalent cations like Mg^{2+} , Mn^{2+} , CO^{2+} , Ca^{2+} , Zn^{2+} . Chemical

modification of crude β -xylosidase with cross-linking agents like glutaraldehyde also enhances thermostability.

In another study, saccharification of various unutilized agricultural hemicelluloses like wheat bran, rice husk, jute stalk and grass straw is carried out using crude xylanase from *Aspergillus ochraceus*. Optimization of fermentation process is in progress. Immobilization of the spores of *A. ochraceus* has also been carried out successfully.

(ii) *Studies on thermostable β -amylase production by *Bacillus carotarum* B₆*: Rina Rani Ray, Subhas Jana and Geeta Nanda.

While screening for β -amylase producing organisms from soil, a bacterial strain (B₆) was isolated and identified as *Bacillus carotarum* B₆. The enzyme was thermostable with optimum activity at 60°C . The effect of various 'C' and 'N' sources, salts, vitamins and amino acids on growth and enzyme production was studied. Enzyme yield was increased 2.5 fold by treating wild strain with UV-radiation and MNNG. Saccharification of starchy wastes like wheat bran, rice bran, tamarind seed, potato etc. is now in progress.

(iii) *Studies of β -glucosidase in thermophilic fungi*: Bandana Banik and Geeta Nanda.

Some thermophilic fungi isolated from compost soil were studied for β -glucosidase production. The fungi were screened for their β -glucosidase activity by using PNPG, cellobiose, salicin with 1% concentration. The organism *Aspergillus fumigatus* C₈ and *Aspergillus* sp. 50 were best producer of β -glucosidase enzyme (65 U ml^{-1} and 42 U ml^{-1} respectively).

G. (i) *Studies on amylolytic enzymes of a thermophilic fungus *Myceliophthora thermophila* D-14 (ATCC 48104)*: Ramkrishna Sadhukhan and S. L. Chakrabarty.

The enzyme α -amylase extracted from *M. thermophila* D-14 was purified to homogeneity. Its mol. wt., Km value, thermal and pH stability etc. were determined. Immobilization of the enzyme was done. Calcium alginate beads were found most suitable matrix. Regarding re-usability of the immobilized enzyme, loss of activity was almost negligible after third re-use and was dropped by 40% after sixth re-use.

Enzymatic saccharification of rotten potato was done and the hydrolysate was fermented with free and immobilized *saccharomyces cerevisiae*. Production of ethanol varied from 126 ml to 106 ml/kg of potato and fermentation efficiency (FE) from 88 to 74%.

- (ii) *Studies on L-asparaginase and its antineoplastic activity*: Subha Manna, Amaresh Sinha and S. L. Chakrabarty.

It was reported earlier that the enzyme L-asparaginase of *Pseudomonas stutzeri* MB-405 was purified to homogeneity. Its K_m value was determined. LD_{50} value was increased 54% and 75% in case of Dalton's lymphoma (DL) and Erlich's carcinoma respectively. Chemical modification studies were performed to elucidate the role of Cys-residues in catalytic activity of the enzyme.

In another study, the splenic T lymphocytes from Dalton's lymphoma bearing mice treated with L-asparaginase were isolated and assayed for cytotoxicity with Cr^{51} release. Comparison was made with the standard *E. coli*-L-asparaginase. Percentage of cytotoxicity of *P. stutzeri*-L-asparaginase treatment was higher than that of *E. coli* L-asparaginase.

Efforts are also being made to purify the enzyme L-asparaginase to homogeneity extracted from another strain of *Vibrio proteus*.

- (iii) *Production of lactic acid by Lactobacillus cellobiosus D-39*: Monoranjan Chatterjee, Ramkrishna Sadhukhan and S. L. Chakrabarty, in collaboration with R. K. Mandal (Dept. of Biochemistry).

Direct conversion of easily available starchy wastes to lactic acid through enzymatic activity of *L. cellobiosus* D-39 was attempted. The organism possesses both amylase as well as lactic acid producing capacity. Rotten potato was used as the substrate. The optimal parameters for growth and amylase production were standardized. Starch was mostly used by the organism in 16-24 hours of growth. Experimental parameters for large scale production of lactic acid using waste potato mash are now in progress.

- H. (i) *Cell surface proteins and intestinal adherence properties of V. cholerae and E. coli*: Dilip K. Sengupta, Tapas K. Sengupta, Ranjan K. Nandy and A. C. Ghose.

A new type of pilus protein of subunit molecular weight 20 KD was identified in a clinical isolate of non-01 *V. cholerae*. The protein was antigenically unrelated to the TCP protein of *V. cholerae* 01 strains. The role of this protein in intestinal adherence and subsequent colonisation of non-01 vibrios was established.

In another study, cellular adherence properties of certain enteroaggregative *E. coli* strains were shown to be mediated by pilus-like structures that were maximally

expressed by organisms grown at 37°C but not at 30°C. The antigenically related pilus proteins (18~20 KD) were encoded by 88~112 Kb plasmids.

- (ii) *Immunobiology of leishmaniasis*: Mrinal K. Ghosh, Bhudeb Bhattacharyya, Subhajit Dasgupta, Asish K. Ghosh and A. C. Ghose.

An analysis of immunoglobulin G-subclass specific antibody responses in Kala-azar (KA) and post Kala-azar dermal leishmaniasis (PKADL) patients demonstrated interesting variations not only in the antibody titres but also in the nature of leishmanial antigens recognised by acute and convalescent sera.

Studies on the lymphocyte subpopulations in active KA patients revealed an increase in $CD8^+/CD4^+$ cell ratio which came down to normal levels following successful chemotherapy. Accumulation of T-lymphocytes bearing $CD5^+$ markers was also noted in the granulomatous lesions of PKADL patients although their peripheral blood $CD8^+/CD4^+$ ratios were within the normal range.

A model of visceral leishmaniasis was established in hamsters by intracardial inoculation of *L. donovani* amastigotes. The model is being used to evaluate the immunisation potential of various leishmanial antigen preparations. Interestingly enough, prior immunisation of hamsters with the immunomodulator Protein A induced high level of resistance to subsequent leishmanial challenge.

E. BIOCHEMISTRY

Institutional Project No. I: Improvement of Plant Productivity Nitrogen Fixation and Photosynthesis using Modern Biotechnology and Plant Breeding.

- 1.1. *Plant seed storage proteins and their genes*: R. K. Mandal, Santanu Dasgupta, Jaydip Dasgupta, Sudip Ghosh, Somenath Bhattacharyya, Biswajit Roy and Nrisingha Dey.

As a part of the program of improvement of nutritional quality of seed storage proteins, characterization of 2S seed albumins from rape seed/mustard, *Sterculia* (Janglee Badam) and *Chenopodium album* (Bethua Sak) have been completed. All these proteins have nutritionally balanced aminoacids and their genes may be useful for protein quality improvement. The sequencing of 2S protein genes from three primary *Brassica* species and their amphidiploids have been completed as well as the cloning and sequencing of 1.3 Kb upstream regions of 2S protein genes from *B. juncea* and *B. oleracea*. These promoter sequences revealed the canonical TATA, CAT and some seed specific motifs. Different deletion promoters have been studied for their regulatory role in mRNA transcription in transgenic plants through *Agrobacterium* vectors and in protoplast electroporation studies for transient expression. All the eight gene sequences have been deposited in the EMBL/Gene Bank data library. Computer analysis of the protein and nucleotide sequences of the 2S proteins revealed some conserved features of the protein structure which may be important for seed metabolism and storage. The study also gives us a handle to modify the gene for more methionine content of the protein and its better expression in transgenic plants. Physiological and genetic studies have been initiated to identify some phenotypic and molecular markers that can be associated with quantitative characters for yield in mustard. (Supported by UNDP/FAO, DST, DBT and CSIR).

- 1.2. *Production of transgenic virus-resistant plant through the introduction of viral coat protein gene*: R. K. Mandal and Pallab Kundu.

A protocol has been standardized for regeneration of several *Solanaceae* and *Cruciferae* plant species from cotyledon/leaf disc explants using a single tissue culture medium. A gene construct has been made in *Agrobacterium* Ti plasmid binary vector having a potyvirus (Tobacco vein mottling virus) coat protein gene under duplicated caulimovirus 35S promoter and Kanamycin resistance marker. This has been used to transform tomato plants var. Pusa Ruby. The transformed plants will be tested for cross protection against TVMV and other poty viruses. (Supported by CSIR).

- 1.3. *Studies with acyl carrier protein gene of plant and bacteria*: Sudhamoy Ghosh, Niranjana Das and Mrinal K. Maiti.

A PCR generated clone containing a partial sequence of acyl carrier protein (ACP) was obtained using *A. brasilense* DNA as template and the two degenerate oligonucleotides as primers. The cloned DNA insert was sequenced. The derived amino acid sequence of *A. brasilense* ACP (out of the total 72 amino acid in the protein) matched very well with other bacterial ACP proteins. Complete nucleotide sequencing of the ACP gene is in progress.

Two ACP clones (ACP-F1 and ACP-F2) from *Brassica campestris* genomic library have been sequenced. To know whether the two genes are expressed in the seed, two gene specific probes, (one for ACP-F1 and the other for ACP-F2) were constructed from the 3'-terminal untranslated transcribed sequence and northern blot experiments were performed with poly A mRNA isolated from developing *Brassica* seeds. The experiments showed both the genes are expressed in seeds between 15-25 days after flowering but not in the growing leaves. Both the genes (3.9 Kb and 2.6 Kb size) have been re-cloned in pUC-18 vector.

- 1.4. *Studies with *Azospirillum brasilense* to identify genetic factors responsible for plant growth stimulation*: Sudhamoy Ghosh, Sudip Chattopadhyay, Asim Kr. Mandal and Asitava Basu.

Root colonization by the associative bacterium *A. brasilense* and stimulation of plant growth may depend upon C-source utilization from plant and release of nitrogenous compounds (including siderophores) by the bacterium in the rhizosphere. In this connection three genes from the bacterium have already been cloned. (a) The *carR* gene that regulates global carbohydrate utilization as a positive regulatory factor, (b) the *glt* gene (glutamate synthase structural gene) that controls the utilization of N-source and plays an undefined role in *Ntr* (central nitrogen regulation) function and *sidA* (spirilobactin synthesis gene) that controls siderophore production. The *carR* gene has been completely sequenced and found to have evolutionary relationship with another regulatory protein determined by *betB* (osmoregulation). Partial sequencing of *glt* showed that the derived amino acid sequence (GOGAT α -subunit) is very similar to that of *E. coli*, but its promoter sequence is unique in the sense that it has both Sigma 70 and Sigma 54 recognition sites. The *sidA* gene has only been partially sequenced and further sequencing is now in progress.

- 1.5. *Inositol trisphosphate mediated Ca^{2+} mobilization in mung bean and Entamoeba histolytica*: Susweta Biswas, Basudeb Dalal, Rinku Ghosh and Samarpan Majumder.

Recently we have demonstrated the mobilization of calcium from mung bean and microsomal fraction by inositol trisphosphate and observed the effects of different calcium channel blockers, ionophores and ATPase inhibitors. The nature of calcium release here was 'Quantal' in nature. Verapamil, had no effect of $InsP_3$ induced calcium efflux suggesting that the channels are not apparently voltage dependent. Vanadate, Diltiazem partially and chlorpromazine completely blocked $InsP_3$ mediated calcium mobilization. Heparin, a specific $InsP_3$ receptor blocking agent, half maximally and completely blocked $InsP_3$ mediated Ca^{2+} release at 1.5 μ g/ml and 8.0 μ g/ml concentration respectively.

Calcium mobilization from internal stores of the parasitic protozoan *Entamoeba histolytica* was studied by fluorescence measurements of the calcium indicator quin 2 in saponin permeabilized amoebae. Prior energy dependent calcium sequestration was found to be necessary for subsequent release of calcium by $Ins(1,4,5)P_3$. Both $Ins(1,4,5)P_3$ and $Ins(2,4,5)P_3$ could release calcium equally well from permeabilized *E. histolytica*. $Ins(1,4,5)P_3$ -mediated calcium release occurred from a vesicular store, was sensitive to prior treatment by heparin, was desensitized by prior addition of a lower concentration of $Ins(1,4,5)P_3$ and was cAMP independent. GTP had no effect on this calcium mobilization. The energy dependent calcium sequestration was inhibited by vanadate and the calcium antagonist Diltiazem but not by DCCD. Preliminary binding studies showed specific binding of [3H]- $Ins(1,4,5)P_3$ to crude membrane fractions of *E. histolytica*, which was significantly inhibited by heparin in a dose dependent manner. Our results suggested that $Ins(1,4,5)P_3$ -mediated calcium release from internal stores of *E. histolytica* possibly occurred in an $InsP_3$ receptor dependent manner.

- 1.6. *Expression of Arabidopsis 2S3 (AT2S3) gene in transgenic tobacco, mung bean and yeast*: Mahadeb Pal in collaboration with B. B. Biswas (Calcutta University).

In continuation of our earlier work, the differential expression of *Arabidopsis* 2S3 gene under CaMV 35S promoter has been studied in different organs of *Agrabactrium* transformed tobacco and mung bean plants. The 2S gene is expressed in developing seed and in leaf only, and the 2S3 protein in tobacco and mung bean leaf has been found to be degraded. The basis of instability of products both in transcriptional, translational level is not yet understood.

The *Arabidopsis* 2S3 gene (AT2S3) has also been cloned under the regulation of its (i) own (seed specific) promoter (ii) yeast promoter and (iii) CaMV 35S promoter both in integrating and episomal plasmids to study the 2S3 gene expression in yeast. It has been found that the 2S3 gene (under its own promoter) is expressed at the level of 0.05 to 0.1% of total yeast protein. Results indicated that the signal sequence is recognised by yeast calls as monitored by deleting and adding the signal sequence of the AT2S3 gene. The expression of GUS gene under 2S promoter in yeast increased as the cell approached the stationary phase of growth.

Institutional Project No. III: Studies in Structure, Function, and Dynamics of Biomolecules.

- 3.1. *Gene regulation in E. coli and Mycobacteria*: N. C. Mandal, Santanu Ray Chaudhuri, Nandan K. Jana, Biswendu Chaudhuri, Subrata Sau, Lopa Adhikary, Hirock J. Dutta, and Madhumita Basu.

3.1.1. *Lambda P gene lethality*:

In continuation of the work on the bacteriophage lambda *P* gene lethality, it has been shown by precise and improved method of mapping studies that the *rpl* mutation is around 94% linked with the *dnaA* gene and only very weakly linked with the *gyrB* locus (around 20%). These suggest that the above mutation is possibly located within the *dnaA* gene or in a gene located next to the *dnaA* gene at 83 min position of *E. coli* chromosome. The cloning of the gene bearing the *rpl* mutation using *dnaA* as the cocloning marker is in progress.

3.1.2. *Structure-function of subdomains of repressor*:

Different mutant repressors having mutations within C-terminal domain which have altered the function of the repressor have been cloned in expression vector under *tac* promoter and the repressors are being studied *in vitro* using biophysical techniques. (In collaboration with Dr. B. Bhattacharyya and Dr. Siddhartha Roy).

3.1.3. *Gene regulation of mycobacteria and phage L1*:

Using the L1 mutants having *ts* defects in lytic growth, 5 genes of this phage coding for the products controlling host cell lysis have preliminarily been identified; 4 of these genes are clustered between 68 and 71% coordinates of

the L1 genome. Attempt was also made to identify the specific function of the six genes that control L1 DNA synthesis. Using a promoter cloning vector of *E. coli* and expression of the reporter gene *lacZ*, four different segments of L1 DNA have been cloned which could show promoter activity in *E. coli*. Also using transcription terminator cloning vector, two terminators of L1 have been cloned. These *cis*-acting gene regulatory elements are being characterized.

In an attempt to understand the mechanism of regulation of the *gal* operon in mycobacteria, the *galk* gene with its own promoter from *M. smegmatis* mc²6 has been cloned in *E. coli* and the clones identified by functional complementation. From the studies of differential behaviour in the induction of galactokinase and UDP-gal-4-epimerase and the inability to have both the genes cloned in the same segment of mycobacterial DNA, it has been concluded that these two genes are not linked. In *E. coli*, the induction of mycobacterial galactokinase has been shown to be dependent on both C-AMP and its receptor protein, CRP. Further study of the mechanism of regulation of galactokinase expression at molecular level through isolation of mutants of *M. Smegmatis* is in progress.

3.2. *Tubulin substructure and identification of its functional domains*: B. Bhattacharyya, Suparna Sengupta, Dulal Panda, Nabanita Sarkar, Gopal Chakraborty, Pampi Basu and Suranjana Guha.

Recent reports from this laboratory indicate that carboxy termini of tubulin play an important role in the surface property of tubulin. Concentration-dependent dissociation of dimers of goat brain tubulin S and tubulin was studied by fluorescence anisotropy. Upon dilution, assembly-competent fluorescein 5'-maleimide labeled dimers of tubulin S and tubulin show a progressive decrease in fluorescence anisotropy. A nonlinear least square fit of the data gave a dissociation constant of 7.1×10^{-8} M for tubulin S compared to 7.2×10^{-7} M for tubulin at 25°C in 0.1M PEM buffer, pH 7.0. van't Hoff plots of dimer-monomer dissociation of tubulin S and tubulin also show considerable differences in ΔH and ΔS .

We also observed that 5,5'-Bis[8-(phenylamino)-1-naphthalenesulfonate] (bis-ANS), the fluorescent probe which binds to tubulin, inhibits its assembly into microtubules. The inhibitory potentials of bis-ANS and its three structural analogues ANS, Prodan [6-propionyl-2-(dimethylamino) naphthalene], and NSA (naphthalene-sulfonic acid) have been compared. They can be arranged in the following order according to their polymerization inhibitory potentials: bis-ANS > Prodan > ANS > NSA. Interestingly, the naphthalene nucleus is sufficient to cause inhibition of polymerization. Detailed experiments were carried out to examine the mode of assembly inhibition by aminonaphthalenes at the molecular level, using bis-ANS as a

representative. There was little or no effect of bis-ANS on the assembly of tubulin when polymerization was induced by assembly promoters like taxol, DMSO, on glutamate, or on the assembly of subtilisin-digested protein (tubulin S). On the contrary, bis-ANS acts as an inhibitor in the case of MAPS-(MAP2 and tau) and poly (L-lysine)-induced assembly of tubulin. Our results place bis-ANS as a novel inhibitor, which seems to specifically inhibit C-termini-mediated assembly. Of all assembly inhibitors known so far, none exhibits such selection.

3.3. *DNA Replication in Yeast*: Pratima Sinha, Amit Maiti, Alo Pal, Nilanjan Roy and P. V. Venkatiiah.

We are continuing our studies on yeast DNA replication using (*mcm* for minichromosome maintenance) mutants of *S. cerevisiae*. The role of *mcm2-1* mutant was suggested to be in the synthesis of DNA replication by causing under initiations at yeast replication origins. In another direction we are changing, in a defined manner, sequences in a yeast replication origin *ARS1*. The altered *ARS* is being tested in the mutant *mcm2-1* to determine if there are any changes in the efficiency of this *ARS* function. Such studies would be helpful in localizing the site of action of the MCM2 protein.

Amongst other *mcm* mutants, two (*mcm12* and *mcm17*) are being tested for their roles in chromosome maintenance. These have been shown to affect the maintenance of yeast minichromosomes in a size-dependent manner; smaller minichromosome get lost at a higher frequency than larger midichromosomes. We suggest that these two genes are required in organizing DNA in the nucleus for proper replication and segregation. Further studies are in progress to identify the exact mechanisms by which MCM12 and MCM17 proteins act.

3.4.1. *Cloning and characterization of the milk protein genes of buffalo*: Prabhakar Gupta and Purba Mal.

Poly A⁺ was isolated from total RNA of lactating mammary gland of freshly slaughtered buffalo by oligo-dT-cellulose chromatography. The cDNA synthesised on purified poly A⁺ RNA was dC-tailed using terminal transferase and annealed with dG tailed plasmid PBR 322. *E. coli* RRI cells were transformed and recombinants were identified on Amp plates. Inserts were excised by Pst I, labelled with ³²P-dATP and hybridized with Buffalo genomic DNAs immobilized on nitrocellulose after restriction with various enzymes and fractionation in 0.8% agarose gel. Further characterization of buffalo milk protein genes is in progress.

- 3.4.2. *Identification and purification of a nuclear protein which binds specifically to an interspersed Pst-I repeat family in farm animals*: Dr. Prabhakar Gupta, Sudit Sekhar Mukhopadhyay, Dr. Manik Bhakta, Dr. Sankar Ghosh and Golam Faruk.

A family of interspersed Pst-I repeat has been identified in the genome of goat, cattle, buffalo and sheep. The Pst-I repeat has been sequenced and used for subsequent protein DNA interaction studies. Nuclear proteins isolated from the liver of various farm animal species retarded the mobility of radiolabelled DNA indicating DNA binding. Indication was obtained for evolutionarily conserved nature of this interaction. Search for homology stretches amongst these repeat sequences of various species reveals a conserved binding motif of 43 nucleotides with an unchanged nucleotide CAAGG in all the cases. Purification and characterization of this protein is underway.

- 3.4.3. *Co-culture systems for in vitro embryo production in farm animals*: Prabhakar Gupta, A. K. Ray, Dr. S. M. Reddy and G. Ganguly.

Following collection of oocytes from follicles of ovaries of slaughtered cows and buffaloes, the washed granulosa cell complexes were cultured in 100 μ l droplets of IVM medium under mineral oil at 39°C with 5% CO₂ in air. Alternatively, the oocytes were cultured directly along with some granulosa cells for IVM. Following maturation, *in vitro* fertilization (IVF) medium and the sperms were added to the medium containing oocytes and granulosa cells. The percentage of maturation for different categories of oocytes was 89, 83, 41, 65, 61, 21, 18, 6, respectively for A1, A2; A3, B1, B2; and C1, C2 and C3 oocytes for cattle.

- 3.4.4. *Chromosomal Distribution of Repetitive DNA sequences in farm animal genome*: P. Gupta, S. K. Ghosh, G. Faruk and G. Chowdhuri.

Recently several repetitive DNA sequences have been isolated and characterized from various economically important livestock species viz., cattle, buffalo, goat, sheep and pig. Metaphases obtained from lymphocyte suspension culture of these species were used for *in situ* localization of these repeats. By hybridization with strand specific ³²S-dATP-labelled probe of the repeated DNAs cloned in single stranded bacteriophage M13 mp18/mp19. Goat *Eco* RI 870bp repeat already shown to be arrayed in tandem by Southern blot hybridization analysis, is distributed mainly around the centromeric regions as well as sparsely along the length of almost all the chromosomes of goat. DNA sequence analysis of 510 bp *Pst* I repeat isolated from goat, cattle and buffalo

revealed a considerable degree of homology. *In situ* hybridization results using goat *Pst* I repeat showed intense localization around centromeric regions in most of the goat chromosomes. In both the cases at least one pair of autosome was found to be devoid of these repeats.

- 3.4.5. *A simple method of chromosome preparation from bovine oocytes and murine embryos*: P. Gupta, S. M. Reddy, G. Ganguly and A. K. Indra.

A simple technique for preparation of chromosomes from oocytes and embryos has been standardized in our laboratory. Essentially, the oocytes (0-48 hrs) are picked and cumulus cells are removed by treating with hyaluronidase (10mg/ml) for a brief period and gently pipetting the oocytes in and out of a narrow mouth capillary. Then the oocytes are washed in PBS and treated with 0.75% Na-citrate for 5-10 mins. until the swelling becomes evident. Swollen oocytes are immediately transferred to 50 μ l droplets of distilled water on a pre-marked clean slide for 1 min. Subsequently the water is removed and one drop of freshly prepared ice cold aceto-methanol (1:3) is placed on one side of the slide and the slide is slanted so as to run the fixative over the oocytes. The fixative drop is allowed to dry partially and the process is repeated several times to remove the cellular debris. Finally the slide is kept on a warm surface 40.42°C and stained in 4% Giemsa stain. Murine pre-implantation embryos were treated with colcemid (0.5 μ g/ml) for 4 hrs, treated with dispase (2mg/ml) and 1% KCl each for 5 mins. Then after a final stay in distilled water for 1 min. they were transferred to slides, fixed in acetomethanol and stained in 4% Giemsa. Good metaphases were observed under oil immersion objective.

- 3.4.6. *Fish genetic stock identification using nuclear and mitochondrial DNA polymorphism*: R. K. Mandal and B. K. Padhi.

A simple rapid procedure have been developed for isolating clean mitochondrial DNA from liver and ovary and genomic DNA from erythrocytes of fishes. Restriction fragment length polymorphism (RFLP) analysis of nuclear and mitochondrial has been used to determine the parentage of suspected hybrids of carps and catfishes in a limited scale. This study can be used in identifying fish genetic stock for conserving the genetic diversity. A simple method for cryopreservation of catfish sperm has been developed. (Supported by DBT Postdoc. programme).

Institutional Project No. V : Studies of Microbes and Parasites for Industrial and Medical Application.

5.1. Molecular genetics of *Entamoeba histolytica* : Anuradha Lohia, Sankar Ray, Samudra S. Gangopadhyay and Suparna Dutta.

Entamoeba histolytica is the protozoan parasite which causes amoebiasis in humans. Little is known about its molecular interaction with the host or how the parasite proliferates and differentiates from the infective to the vegetative form. To study the organisation of the genome, we have constructed Yeast Artificial Chromosomes of *E. histolytica* and are in the process of mapping known genes on them. We have also demonstrated that there are approximately 3-4 chromosome sized DNA molecules by Pulsed Field Gradient Gel Electrophoresis. We have isolated a repetitive DNA family from *E. histolytica*, which serve as DNA replication origins in *Saccharomyces cerevisiae*. The DNA sequence of this *E. histolytica* family is homologous to Autonomously Replicating Sequences (ARS) from yeast, hence the functional complementation. We have also identified a nuclear protein from *E. histolytica* which binds to this putative replication origin.

In an effort to better understand the process of growth regulation in *E. histolytica*, we have identified, cloned and sequenced three genes from this parasite, homologues of which are known to regulate the cell cycle in eukaryotes. These genes are the p34cdc2 kinase, the *mos* protein kinase and the *ras* homologue *rho* gene. We have also identified the first intron in the twenty genes sequenced from *E. histolytica* to date. This 79 pp intron is present in the p34cdc2 gene of *E. histolytica* and it has been shown that it is spliced out during processing of the message. The position of the intron and its internal sequence signals are homologous to the intron in the p34cdc2 gene of *Schizosaccharomyces pombe*, suggesting that not only the gene itself but its transcriptional process has been conserved through evolution. We have expressed these genes as fusion proteins in *Escherichia coli*.

F. BIOPHYSICS

Institutional Project No. III : Studies on structure, function and dynamics of Biomolecules.

A. (i) Structural and modelling studies on mycobacterium cell wall constituents : Sampa Pain, Bankim Das, B. N. Das, Sreya Ghosh, Indrani Dey, Bishnu P. Mukhopadhyay and Asok Banerjee.

(a) X-ray diffraction experiment of peptidoglycan and arabinogalactan have been done and experimental parameters are to be correlated with the characterised Computer simulated model of peptidoglycan by us which shows a pseudo twofold symmetry along glycan chain. These results will be very useful for studying the interaction of the chemotherapeutic drug agents with their cell wall peptidoglycan targets.

(b) The computer data-base search of 65Kd antigenic protein of *M. Leprae* have indicated the full secondary structure consisting of the hydrophobic, hydrophilic and epitopic sites. Interestingly the 10-amino acid stretch (potential for vaccine topology) has been studied by modelling studies and have also been synthesised for further biochemical studies.

(ii) Spectral studies of beta-lactamase-beta-lactam interaction & acylation mechanism and their molecular modelling by computer graphics : Sampa Pain and Asok Banerjee.

The interactional studies between the modified beta-lactams with different lactamases have been done by U-V spectral analysis. Further modelling studies have been carried out by docking the lactam in usual beta-lactamase protein and trying to carry out the energy minimisation problem.

(iii) Preliminary x-ray structural studies of Calotropin DII, a cysteine protease from *Calotropis gigantea* : Bankim Das, Sreya Ghosh, Sampa Pain, Indrani Dey, Goutam Biswas, Bishnu P. Mukhopadhyay, N. K. Sinha and Asok Banerjee.

The monoclinic crystals ($P2_1$) of the cysteine protease contains 2 protein molecules (each having mol. wt. 24,000) in the asymmetric unit. The collected data upto 2.2 Å resolution have been used for the structural model calculation by molecular replacement methods. The R factor of the data seems good. The 3-D structure analysis is in progress. Computer modeling of receptor-substrate interaction is done to unveil catalytic mechanism and difference in substrate specificities of cysteine protease.

- (iv) *X-ray structural study of some antibacterial, antiviral agents and model protein-nucleic acid interaction*: Indrani Dey, Sreya Ghosh, Sampa Pain, Goutam Biswas, A. C. Gomes, Bishnu P. Mukhopadhyay and Asok Banerjee.

Several biologically important epoxide, nucleosides and beta-lactam structures have been solved and we are further trying to establish the structure-function relationship. The cocomplex structure at atomic resolution of Inosine-5'-monophosphate with serine in extensive hydrated environment has been solved. This structure gives the answer of some basic question that arise in the nucleotide-amino acid recognition mechanism.

- (v) *Structure activity correlation: the drug design for chemotherapy*: Indrani Dey, Sampa Pain, Chandan Roychowdhury, Partha Bag, Goutam Biswas and Asok Banerjee.

We have developed one expertise programme based on the pattern recognition of the drugs and their analogs which can predict the structure activity relation and thus can predict activity of a designed chemotherapeutic agents and its potentiality as drug with reliability.

- B. (i) *DNA Bending and related areas*: Chhanda Mukhopadhyay, Goutam K. Biswas, and Siddhartha Roy.

We have been studying λ -repressor-operator system where protein binding may induce DNA bending. Occurrence of such protein induced DNA bending, if any, may have important implications for the regulation of λ -genetic switch. We have made important findings about higher order association of lambda repressor. We have also demonstrated domain-domain interaction which we have previously postulated.

- (ii) *Glutamyl-tRNA synthetase (glnRS) and interaction with tRNA^{Gln}*: Tista Bhattacharyya & Siddhartha Roy.

We have shown that ATP induces a conformational change in glutamyl-tRNA synthetase which alters its recognition of tRNA^{Gln}. We are also studying biphasic equilibrium denaturation of glnRS and detailed thermodynamic characterization of tRNA^{Gln} and its interaction with glnRS (in the presence and absence of ATP).

- (iii) *Structure-function studies of λ -repressor*: Sumita Bandyopadhyay, Subhra Bhattacharyya & Siddhartha Roy in collaboration with Prof. B. Bhattacharyya and Prof. N. C. Mandal.

Identification of dimer-dimer interface and role of certain critical residues in DNA recognition of λ -repressor, using site directed mutagenesis is in progress.

- (iv) *Fluorescence Spectroscopic investigation of tubulin structure-function relationship*: Anushree Bhattacharyya, Subhra Bhattacharyya & Siddhartha Roy in collaboration with Prof. B. Bhattacharyya.

We have developed donor quenching methodology to study fluorescence energy transfer. We have shown that two tryptophans are at or near colchicine binding sites. Effect of Mg^{++} on tubulin has been studied using fluorescence spectroscopy. Mg^{++} has been shown to affect tail-body interaction in tubulin. Currently we are developing suitable fluorescent ligand analogs to measure distances between various sites.

G. ANIMAL PHYSIOLOGY SECTION

Institutional Project No. IV: Studies on ecology, environmental pollution and related problem.

A. Environmental physiology and Hormonal Regulation.

1. *Effect of pesticide, carbofuran 75DB technical on growth and maturation of gonads of catfish, singi (Heteropneustes fossilis):* Sudipta Chatterjee and Rama Ghosh.

The carbamate pesticide, carbofuran technical inhibits the growth and maturation of gonads occasionally with damage after exposure of female singi fish to 0.5, 1 and 2 ppm doses for 30 days. At 30 days of experiment stage III oocytes were observed more in number than that of stage I & II in the control fish. In 0.5 ppm pesticide exposure the percentage of stage I oocytes significantly increased ($P < 0.001$) and stage III decreased ($P < 0.01$) with respect to the control. Similar changes in stages I & III oocytes were also noticed after 1 and 2 ppm treatments. The areas of 3 different stages (I, II & III) of oocytes were recorded in the control and pesticide exposed (0.5, 1 & 2 ppm) fish at 30 days of experiment. The significant decrease in the area of mature (stage III) oocytes was observed after 0.5 ($P < 0.02$), 1 ($P < 0.01$) and 2 ppm ($P < 0.01$) doses of pesticide treatment.

Investigation has also been undertaken to understand the role of lipid in relation to reproduction in the female singi fish during their spawning phases of reproductive cycle in response to 30 days exposure to carbofuran technical grade at different sublethal doses. Total lipid and their fatty acids contents in liver and ovary were estimated. The preliminary results show that this pesticide did not affect significantly the total lipid and its fatty acids in both the tissues in comparison to the control. Six major fatty acids of total lipids, viz., palmitic ($C_{16:0}$), stearic ($C_{18:0}$), oleic ($C_{18:1}$), linoleic ($C_{18:2}$), linolenic ($C_{18:3}$) and arachidonic ($C_{20:4}$) were identified both in the control and treated fish. Among them the predominating fatty acids were $C_{18:0}$, $C_{18:1}$ & $C_{18:2}$. Arachidonic acid was present in less amount. The work is in progress.

2. *Down regulation of CYP1A1 protein by glucocorticoids in trout hepatocytes in vitro:* A. K. Dasmahapatra in collaboration with Prof. P. C. Lee of the Medical College of Wisconsin, Milwaukee, U.S.A.

In order to understand glucocorticoid action on CYP1A1, microsomal CYP1A1 protein content prepared from cultured rainbow trout hepatocytes and 7-ethoxy

resorfin deethylase (EROD) activity were measured after 72 hrs of glucocorticoid treatment. A gradual dose-dependent decrease in CYP1A1 protein and EROD activity was seen after treatment of the hepatocytes with different doses of dexamethasone (DEX, 10^{-8} to 13^{-7} M) in comparison to the control. Concomitant addition of 10^{-6} M RU-486, a type-II specific glucocorticoid receptor antagonist, to hepatocytes treated with 10^{-7} M DEX abolished the DEX effect. Spironolactone (10^{-8} M to 10^{-6} M), a type-I specific glucocorticoid receptor antagonist, did not counteract the DEX effect. DEX thus down regulates CYP1A1 in fish cultured hepatocytes and this regulation is mediated through the type-II glucocorticoid receptor.

3. *Role of estrogen in the ovarian development in freshwater prawn, Macrobrachium rosenbergii:* Debjani Ghosh, Manik Bhakta, R. Kirubakaran, Anuradha Chaudhury and A. K. Ray.

Involvement of estrogen in ovarian development in freshwater prawn, *Macrobrachium rosenbergii*, was investigated as a possible inducer of breeding in this commercially important shell-fish.

Estradiol- 17β (E_2) has been identified in hemolymph, hepatopancreas and ovary with its highest concentration in the maturing stage of the freshwater prawn. A corresponding rise in the steroid metabolizing enzyme activities have also been observed in the ovary suggesting high amount of endogenous formation of E_2 in ovary of the maturing prawn. Treatment of the female prawn with various doses of E_2 elicited increased accumulation of vitellogenin-like protein in hepatopancreas, ovary and hemolymph with a corresponding induction of lipogenesis in the two organs (hepatopancreas and ovary), suggesting stimulated formation of lipo-vitellin-like protein. The E_2 -induced ovarian maturation was indicated by the stimulated activity of the marker enzyme, glucose-6-phosphate dehydrogenase. Exfoliation of the ovary occurred with the treatment of HCG (Purgen).

Attempts have been made to characterize the estrogen-inducible protein (vitellogenin-like) in hemolymph and ovary of prawn and also to determine if any homology exists with the vitellogenin present in other species. For immunologic characterization, antibody to the native vitellogenin-like protein has been raised and its immunological similarity to other proteins is being studied by Western blotting and other conventional immunological means. The subunits have been separated by SDS polyacrylamide gel electrophoresis and isolated. Antibodies are being raised to find out which domain is more immunogenic. Peptide mapping and amino acid analysis are being used to determine its homology to other proteins.

In order to exploit the reproductive function of E_2 in breeding in the freshwater prawn in different seasons of the year attempts have been made for *in vitro*

oocyte maturation for onward fertilization and production of fingerlings. As a preliminary step for standardization of prawn cell culture *in vitro*, hepatopancreatic cells have been isolated and made in culture, for the first time in prawn.

4. *Thyroid hormone regulation of mammalian brain function*: P. K. Sarkar and Arun K. Ray.

With reference to our earlier findings that thyroid hormone (T_3) interacts directly in an *in vitro* system with the cerebrocortical synaptosomal membrane-bound $Na^+-K^+-ATPase$ exhibiting an extranuclear-mediated effect on the enzyme activity and that the synaptosomal T_3 concentration is regulated to cope up with the adverse situations raised at different thyroid states (hypo-or hyper-thyroidism), investigation was extended to search T_3 -binding sites in the synaptosomal membrane that could explain the molecular mechanism of the T_3 -induced inhibition of the synaptosomal $Na^+-K^+-ATPase$ activity.

The binding studies revealed the existence of two sets of high affinity T_3 -binding sites: one with a K_d value at $10^{-11}M$ and other with $10^{-9}M$. Such existence of the high affinity T_3 -binding sites in synaptosomes and alterations in the synaptosomal $Na^+-K^+-ATPase$ activity by T_3 suggests that T_3 may have a neurotransmitter or neuromodulator type of role in synaptic transmission of the signals in adult rat brain cerebral cortex.

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

1. *Induced production of silk by estrogen treatment in silk-worm, Bombyx mori L.*: Shantanu Das and Arun K. Ray.

Although estrogenic compounds have been detected in ovary of silkworm, their biological role in this insect remains unexplored. In our experiment estradiol- 17β (E_2) elicited the appearance of lipovitellin (egg-yolk precursor protein) in hemolymph and ovary, and increased lipogenesis in ovary and fat body. The E_2 -induced rise in the activities of NAD-dependent mitochondrial malic dehydrogenase, NADP-dependent cytosolic malic dehydrogenase and cytosolic glucose-6-phosphate dehydrogenase indicated an enhanced state of lipogenesis in ovaries possibly for the formation of lipovitellin. Moreover, E_2 caused shortening of the larval period of silkworm by 2-3 days with the initiation of early spinning of the cocoon which had similar weights in comparison to the control.

About 8-10% increase in the annual crop production with the operation of more life cycle of *Bombyx mori*, per year is predicted after treatment with E_2 .

2. *Study on total lipid and its fatty acid composition of haemolymph serum and fat body of tropical tasar silkworm, Antheraea mylitta D.*: Rama Ghosh in collaboration with A. B. Chaudhury of Central Tasar Research and Training Institute, Ranchi.

As the lipids play a critical metabolic role in insects studies were undertaken to understand the changes in lipid profile in the diapausing state of the tasar silkworm pupae.

The data reveal that lipid concentration remains at higher level in hemolymph cell free serum than the fat body tissue in the diapausing pupae. The predominating fatty acids were palmitic ($C_{16:0}$), palmitoleic ($C_{16:1}$), stearic ($C_{18:0}$), oleic ($C_{18:1}$), linoleic ($C_{18:2}$) and linolenic ($C_{18:3}$). Arachidonic acid ($C_{18:4}$) was also detected in trace amount.

H. PLANT MOLECULAR & CELLULAR GENETICS SECTION

Institutional Project No. I: "Improvement of plant productivity using biotechnology.

I. Transgenic Plant Engineering.

- (a) *Development of Insect resistant crops*: A. S. Rishi, T. Johnson, D. Banerjee, A. Nandi, D. Ghosh, S. Kar, K. Roy, P. Mukherjee, N. Bag, T. Mandal, T. Saha, S. R. Sikdar, P. Nayak, D. Basu, S. Das, S. K. Sen.

One of the major programmes of this laboratory is to develop transgenic crop plants resistant against insect pests. Since natural resistance is a complex blend of inherent genetic factors and ecological conditions which are difficult to define, we approached to meet this challenge by transferring single genes through genetic transformation to plants encoding insecticidal properties. Various forms of the insecticidal crystal protein (ICP) genes from strains of *Bacillus thuringiensis*, a bacterium, have turned out to be one of our major candidate genes. Thus, various crystal protein genes (CryIA (a), CryIA (b), CryIA (c), CryIIA and CryIIIA) have been cloned and modified in order to express them stably in plants. Identification of the appropriate genes with regard to their sensitivity to the target insect pests has been carried out through insect feeding tests and through judging the capacity of the receptor binding proteins of the insect gut epithelial cell surface with the toxin. Additionally, monoclonal antibodies (Mabs) against ICP of 2 different strains of *Bacillus thuringiensis* have been developed. These Mabs are being used for monitoring the expression of the ICP gene in bacteria and plants. The cloned ICP genes have been truncated at the 3' end upto the 620 to 700 amino acid. The 5' upstream end of the coding region has also been tailored to include Kozak sequences. Expression of such a truncated gene has been tested against several plant promoters, enhancers and use of introns at the 5' end. Finally, generation of transgenics with ICP genes have been accomplished in rice, chickpea and mustard. Active efforts to transfer these genes to cotton and jute are on. The transgenics developed so far with ICP genes reveal that the level of expression of the ICP gene *in planta* seems to fall short of the required level of expression for protection against the insect attack. It is visualise that the coding capacity of the bacterial ICP genes in plant is needed to be improved. Our future goal has been fixed to satisfy this requirement.

Additionally, we are also supplementing our efforts by attempting to transfer the trypsin inhibitor gene from cowpea and soybean seeds. We initially assayed the potentiality of such inhibitors to prevent activity of the trypsin, found in the insect gut. Both the genes have been cloned from the cDNA library of developing seeds of cowpea and soybean.

- (b) *Development of transgenics with hormone regulatory plant development genes*: N. S. Banerjee, C. Ganguli, S. R. Sikdar, S. Das, D. Basu, S. K. Sen.

rol genes of the TL-DNA of *Agrobacterium rhizogenes* when transferred to plant have been known to influence the endogeneous levels of auxin, cytokinin and polyamines, thereby influencing the developmental pattern of the plant. Since, developmental pattern if altered in a predictable fashion may open up a possibility to influence the potentiality of a crop species, a programme on generation of transgenic mustard plants has been undertaken. A series of transgenic mustard plants with *rolA*, *rolB* and *rolC* have been generated. The T1 generation of *rolA* transgenics have shown that the stable morphological character alterations could be of agronomic significance. Alterations in characters like time of flowering, increase in number of fruit set per plant etc. may carry economic potentiality.

- (c) *Towards production of nuclear coded male sterile lines*: S. Roy Choudhury, P. Nayak, D. Basu, S. Das, S. K. Sen.

Intensive efforts are on to identify another specific promoters in mustard and rice. The microspore development specific promoters are destined to be used to express gene products that can inhibit/perturb microspore development. This should consequently result male sterility. In order to fulfill this requirement, search for microspore development specific promoters is being carried out.

Additionally, tapetum specific promoters of tobacco and *Arabidopsis* are being tested for their heterologous expression in transgenic rice and mustard. Cloning of the ribonuclease gene to be used as the killer has been accomplished. So is the status of the specific gene which acts as the inhibitor for the ribonuclease. This programme is being pursued to generate hybrid seeds of these two crops.

- (d) *Transfer of high sulfur containing storage protein gene in Mungbean*: Monalisa Chandra, Amita Pal.

High sulfur containing storage protein gene transfer in different cultivars of *Vigna radiata* by co-cultivation method and by direct DNA uptake is underway.

- (e) *Development of transformation techniques in crop plants*: S. Pal, K. Roy, P. Mukherjee, N. Bag, S. Sikdar, S. R. Sikdar, P. Nayak, S. K. Sen.

An intensive search for possibilities to cause *Agrobacterium* mediated genetic

transformation in rice, is being carried out. Evidences collected so far from this laboratory and elsewhere indicate that in situations when the function of the *vir* genes are specially realised, a low frequency of T-DNA transfer occurs in rice. Our goal has been to improve upon this phenomenon so that the Agrobacterium mediated genetic transformation in rice can be developed into a regular method for usage.

Additionally, attempts for development of efficient methods for transformation in case of Cotton, pigeonpea and *Brassica campestris* are under trial.

II. Plant cellular engineering through genetic manipulation of protoplasts :

- (a) *Genetic introgression* : S. Pal, T. Saha, S. Majumdar, Ferdosi Begum, S. R. Sikdar, S. K. Sen.

Protoplast fusion methodology has been adopted to develop somatic hybrids in order to cause genetic introgression between two genetic systems where sexual cross between them is not possible due to sexual incompatibility. In case of jute, protoplast fusion between *Corchorus olitorius* and *C. capsularis* has been achieved. It could be documented that the genomes of both the species remain stable in the heterokaryotic state. Generation of complete somatic hybrid plant has not yet been achieved as the jute cells in culture are found to be nonresponsive to plant regeneration. The scope for genetic introgression between the two cultivated jute species is also being judged through molecular analysis of the relatedness of the nuclear DNA. It is observed that there exists intermediate genetic forms of both the species. Genetic variability contained within one species, in certain cases, extends to the characters of the other species.

In mustard, plant regeneration from protoplast fusion between *Brassica juncea* and *Diplotaxis harra*, a distantly related plant species to mustard, has been achieved. Attempts are being made to raise such somatic hybrids between *B. juncea* and distantly related other plant members.

- (b) *Generation of Cms male sterile lines* : S. Sen Gupta, P. Roychoudhury, S. R. Sikdar, S. K. Sen.

Attempts to transfer the cytoplasm of Cms lines of *B. napus* (Pollima and Ogu) to the nuclear background of a cultivar of *Brassica juncea* have been made through protoplast fusion. The cytoplasm of the *B. juncea* was inactivated through the use of iodoacetate, whereas the nucleus of Cms donor has been inactivated through gamma

irradiation. As the result of such fusion, some plant regenerants conferring male sterility have been generated. Analyses of these plants revealed that they contained the *Brassica juncea* nuclear genome and the cytoplasm of the Pollima line.

Mitochondrial genomic organisations of two Cms lines of *indica* rice, viz 20A and 29A are being analysed with a view to understand the mechanism of male sterility governed by the mitochondrial genes in *indica* rice.

Miscellaneous :

Plant tissue culture for secondary products : Aparajita Mitra, Amita Pal.

Embryo clones of *Costus speciosus*, raised in vitro and established in soil are consistent in their respective diosgenin yield in the second vegetative generation. A rapid screening method has been established to ensure genetic fidelity of the poplar culture regenerants at an early stage of development.

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Department of Botany

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Department of Microbiology

INSTITUTIONAL PROJECT—I

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Department of Biochemistry

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Department of Biophysics

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Animal Physiology Section

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Plant Molecular & Cellular Genetics Section

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Participation in Academic activities, Conferences/Symposia/Training Programmes/Awards and Honours.

Department of Physics

Prof. S. C. Roy

- (i) visited University of Pittsburgh, Pittsburgh, USA for two months to work in the area of photon-atom scattering.
- (ii) nominated as a member of the International Advisory Board of the 6th International Symposium on Radiation Physics to be held in Morocco in 1994.
- (iii) nominated as a member of the Technical Program Committee of the 10th National Symposium on Radiation Physics to be held at Kalpakkam in August, 1993.
- (iv) presented invited talk in the National Seminar on Recent Trends in Photon Atom Interactions held at Dharwad in November 1992.
- (v) participated as a panelist in the Panel Discussion on the Future Directions of Photon Atom Interactions at Dharwad.

Dr. A. K. Chatterjee

- (i) attended the 12th National Symposium on Cryogenics held at Indian Association for the Cultivation of Science, Calcutta during March 29-30, 1993.

Dr. S. N. Changdar

- (i) attended the Nuclear and Radiochemistry Symposium held at Andhra University, December 21-24, 1992.

Dr. S. Raha

- (i) delivered a set of lectures at the Inter-University Advanced Graduate School on Relativistic Astrophysics, Gravitation and Cosmology, Oct. 14-Nov. 3, 1992 at North Bengal University.
- (ii) acted as a member of the Organising Committee for the Second International Conference on the Physics and Astrophysics of Quark-Gluon Plasma (ICPA-QGP '93), Jan. 19-23, 1993 at Calcutta. He attended the conference and delivered an invited plenary session lecture.

- (iii) attended, on invitation, the National Workshop on the role of Quark Matter in Physics and Astrophysics at T.I.F.R., Bombay, April 6-10, 1992 and delivered a talk there.
- (iv) has been serving as a Council Member, Indian Physical Society.

Dr. I. Bose

- (ii) was invited to deliver a popular talk titled, The Exciting World of High Temperature Superconductors on 3.4.92 in the Birla Industrial and Technological Museum.
- (ii) was invited to participate in the Spring College on Superconductivity organised by the International Centre for Theoretical Physics, Trieste, Italy (April 27-June 19, 1992) and gave two lectures while there.
- (iii) was invited to give a talk at the symposium on Recent Trends in Theoretical Physics and Applied Mathematics held on 19.9.92 and organised by the Institute of Theoretical Physics, Calcutta.
- (iv) was invited to give a talk at the Platinum Jubilee Symposium of the Bose Institute Unity of Physical Principles: from Simplicity to Complexity held on 24.11.92.
- (v) chaired a session at the Tenth Young Physicists Colloquium of the Indian Physical Society in Calcutta, 1992.
- (vi) was selected as a Theoretical Physics Seminar Circuit Speaker (financed by D.S.T) for the year 1992-1993 and was invited to give lectures at the Department of Physics, Poona University, the Tata Institute of Fundamental Research, Bombay and the Institute of Mathematical Sciences, Madras.
- (vii) was invited to participate in the Discussion meeting on Common Problems in Low Dimensional Field Theory and Condensed Matter Physics held in the Institute of Mathematical Sciences, Madras (February 8-12, 1993) and chaired a session at the meeting.
- (viii) gave a set of lectures (Solid State Physics, Special Paper) as invited Guest Lecturer in the M. Sc. Physics Course of Calcutta University.
- (ix) was invited to give a talk at the Discussion Meeting on High-T_c Superconductors held at the Variable Energy Cyclotron Centre, Calcutta (March 10-12, 1993).

BOSE INSTITUTE

Dr. B. K. Chatterjee

- (i) delivered an invited talk at the Bose Institute Platinum Jubilee Symposium of Unity of Physics: Simplicity to Complexity on 24th November, 1993.

Dr. D. Home

- (i) invited talk at the 4th Int. Symp on Found. Of Quantum Mechanics in the Light of New Technology, 27-31 August 1992, Tokyo (Hitachi Ltd, and Physical Society of Japan.)
- (ii) Invited talk at the L. De. Broglie Birth Centenary Int. Conference, 24-30 September 1992, Trani, Italy (Commission of the European Communities).

Prof. M. H. Engineer

- (i) invited to give a talk at the International Workshop on polarons, Pushchino, CIS, June 1992.
- (ii) invited to participate in the topical conference on High Temperature superconductivity, IISc, Bangalore, Feb. 1993.
- (iii) coconvenor, with Prof. S. C. Roy, Physics Dept., BI of Conf. on Unity of Physical Principles: from simplicity to complexity, Platinum Jubilee Celebrations of BI, 24.11.92.
- (iv) taught a course on Physics and Maths. at the Dept. of Biophysics and Mol. Biology, Cal. University.
- (v) taught an Advanced course on Statistics in Bose Inst. as part of the Inst. teaching program.
- (vi) served as Member, National Committee for the Theoretical Physics Seminar Circuit, financed by the DST, GOI.

Mrs. Aparna Das

- (i) attended and presented her paper at Nuclear and Radiochemistry Symposium, held at Andhra University. She was given a certificate of merit by IANCAS (Indian Association of Nuclear Chemists and Allied Scientists) for her work and presentation at the Symposium.

Department of Chemistry

Prof. Parul Chakrabarti

- (i) Organized the 14th International Lectin Meeting in Darjeeling in May, 1992.

- (ii) Delivered a lecture in July, 1992 in the Indian Institute of Science, Bangalore in the symposium "Molecular insights into Metabolic Regulation".
- (iii) Taught an advance course in membrane biology in the Ph. D. programme of Bose Institute.
- (iv) Delivered a lecture on "Membranes and receptors" for the DBT Post-doctoral Training Programme.

Dr. Manas Chakrabarty

- (i) Delivered lectures on the "Chemistry of Natural Products" in the Advanced Course of the Course Work Programme for pre doctoral students of Bose Institute.
- (ii) Delivered an Invited Lecture and Chaired a Session in the 29th Annual Convention of Chemists, held at A.P.S. University, Rewa, M.P. on 24-27th February, 1993.
- (iii) Presented a paper in the Poster Session of the Mini-Symposium 'Structure, Function and Dynamics of Biomolecules' held as a part of the Platinum Jubilee Symposium 'Life and Non-Life: Unity and Diversity' at Bose Institute.
- (iv) Have been acting as a member, Board of Associate Editors and a Council Member in the *Journal of Indian Chemical Society* and the Society, respectively.

Dr. Kalipada Das

- (i) Delivered a talk at the Local Calcutta Chapter of the Society of Biological Chemists, India on September 30, 1992.
- (ii) Acted as a member of the Bose Institute pre-doctoral course committee. Taught a course on "Physical Science for Biologist".

Dr. Achintya K. Sarkar

- (i) Delivered an invited lecture at Durgapur Government College, Durgapur.
- (ii) Delivered an invited lecture at IIT, Kharagpur.

Dr. Joyoti Dasu

- (i) Delivered a lecture in the 14th International Lectin Meeting in Darjeeling in May, 1992 and was one of the Organizers.
- (ii) Presented a paper in the first IUBMB Conference on "The Biochemistry of Disease" held in Nagoya, Japan in June, 1992 with support from the organizers.

- (iii) Presented a paper in the "Fifth International Congress on cell Biology" in Madrid, Spain in July, 1992 with support from the organizers.

Dr. Manikuntala Kundu

Dr. Manikuntala Kundu was one of the organizers of the 14th International Lectin Meeting in Darjeeling in May, 1992.

The following attended the 14th International Lectin Meeting in Darjeeling :

1. Sri Amit K. Das
2. Sri Seababrata Mahapatra
3. Sri Subhansu Ray
4. Dr. Saurav K. Sarkar

Department of Botany

Prof. Bharati Ghosh

- (i) Nominated as member of the Ph. D. Committee for Botany in Calcutta University.
- (ii) Delivered an invited lecture in the national refresher course in Botany, in the Dept. of Botany, University of Calcutta.
- (iii) Presented a paper in group monitoring committee meeting of plant Molecular Biology in DBT, New Delhi.

Prof. A. N. Lahiri Majumder

- (i) Teaching M. Sc. classes in Plant Physiology & Biochemistry in Calcutta University and Kalyani University.
- (ii) Serving as External Member, School Board in Life Sciences, North Eastern Hill University, Shillong.
- (iii) Served as an expert in various selection/assessment committees at IICB, Calcutta.

Dr. B. Majumder and Mr. Somen Nandi attended and presented papers on 80th Session of Indian Science Congress.

Prof. Sunirmal Chanda

- (i) Delivered an invited lecture on "Palaeoclimate and Palaeoenvironment of Bengal Basin during Holocene" on the occasion of "World Environment Day" held at the Centre for Study of Man and Environment on 8.6.92 under the auspices of a seminar entitled "Past climatic changes in the context of International Geosphere-Biosphere Programme".

- (ii) Attended a seminar on "Environmental management of Calcutta-some issues" jointly organized by Bengal National Chamber of Commerce and Industry, Centre for Studies of Man and Environment and Association of Ventilation Engineers on 3.7.92 at the Bengal National Chamber of Commerce and Industry Auditorium where led the Plenary discussion.
- (iii) Inaugurated the aerobiology laboratory, Botany Dept. at the Magadh University, Bodh Gaya on 4.12.92 and delivered the inaugural address entitled "Aerobiology-a synthetic science in progress".
- (iv) Attended the "Meeting to identify thrust/gap areas in palaeoclimatology" jointly organized by Indian Institute of Tropical Meteorology, Pune; Deccan Research and Institute, Pune and Department of Science and Technology, New Delhi, Govt. of India held at the IITM, Pune on 21 and 22 January 1993 and delivered a key-note address entitled "Recent Research on palaeoclimate and environment in Bengal Basin".
- (v) Attended the "Indo-British Workshop on Diversity (Wetlands Ecosystems)" sponsored by the British Council, Calcutta held on 8 and 9 February 1993 at Oberoi Grand Hotel, Calcutta and led the Plenary discussion.
- (vi) Delivered a lecture as resource person of "on the role of Palaeopalynology in understanding the past vegetational history" under the auspices of 6th Refresher Course in the Dept. of Botany, University of Calcutta on 12.2.93.
- (vii) Attended the seminar on "Aerobiology and Agriculture" at Rothamsted Experimental Station, Harpenden, Herts., U.K. on 29.3.93 as a leader of the Bose's-Symposium discussion. The seminar was jointly sponsored by the British Aerobiology Federation and Rothamsted Experimental Station under the auspices of AFRC.

Elected President of the National Botanical Society, Calcutta.

Department of Microbiology

Prof. A. C. Ghose

- (i) acted as a member of the Scientific Panel of PRC's of ICMR.
- (ii) acted as a member of the SAC of the National Institute of Cholera & Enteric Diseases, Calcutta.
- (iii) was associated with the teaching of M.Sc. students of the Dept. of Biochemistry, University of Calcutta & Dept. of Physiology, Vidyasagar University, Midnapur.

- (iv) delivered invited lectures at the Academic Staff College Refresher Course, Dept. of Botany, Calcutta University, February, 1993.

Prof. S. L. Chakrabarty

- (i) acted as a member of the Scientific Panel of Indian Council of Agricultural Research (Fisheries) and participated in evaluating the project proposals.
- (ii) nominated as a member of Scientific Committee of Tropical Botanical Garden and Research Institute, Trivandrum, Kerala.
- (iii) acted as a member of the Selection Committee of the Gauhati University, Guwahati, Assam.

Dr. Geeta Nanda

- (i) presented paper at the 33rd Annual Conference of Association of Microbiologists of India, held at Goa University during 5-7 November, 1992.

Dr. P. K. Chakraborty

- (i) participated in teaching Microbiology to M.Sc. class (Dept. of Physiology with Community Development) of Vidyasagar University, Midnapore and supervised the dissertation work of one student of this class.

Dr. Roma Chakravarty

- (i) organised departmental seminars with the help of Mousumi Ghosh & Tapas Sen Gupta.
- (ii) attended and presented a paper entitled "Biopollution in Agricultural environment by threshing operations", in the 33rd Annual Conference of Association of Microbiologists of India, held at Goa University in November 5-7, 1992.

Department of Biochemistry

Prof. R. K. Maudal

1. DBT-sponsored workshop on 'Rice Biotechnology' at Botany Department, Calcutta University in May, 1992.
2. Biotechnology and its scope for National Development sponsored by Institution of Chemists (India) and Science for Society, Calcutta in August, 1992.
3. Guha Research Conference at Toshali, Puri in October, 1992.
4. J.B.S. Haldane Symposium on Biotechnology at University of Burdwan in January, 1993.

5. Academic Staff College, Botany Department of Calcutta University in February, 1993.
6. Acted as Member of Research Council, IICB, Calcutta.
7. Acted as Expert member of DST, Govt. of West Bengal.
8. Acted as Honorary Lecturer of Calcutta and Vidyasagar University.
9. Elected Vice President of Society of Biological Chemistry (India).

Prof. N. C. Mandal

1. Participated in the teaching of molecular biology/virology in the M. Sc. classes in Biochemistry of the Calcutta University and Physiology of the Vidyasagar University.
2. Acted as a member of the Ph. D. Committee in Biochemistry of the Calcutta University.
3. Acted as a member of the Assessment Committee in Indian Institute of Chemical Biology, Calcutta.
4. Attended Guha Research Conference held at Toshali Sands, Orissa.

Dr. P. Gupta

1. Chaired a session and presented a lead talk on "Sexing of embryos/gametes in farm animals" in the seminar on "Embryo transfer and associated technologies in livestock improvement-Present status and future needs" held at IVRI, Izatnagar in April 1992.
2. Delivered an invited talk on "Strategies of PCR in plant improvement in DBT sponsored short term training workshop on "Cloning and analysis of rice genome" organized by Botany Department, Calcutta University in May 1992.
3. Presented a lead paper on "Animal reproduction in a Scientific symposium organized by the Department of Animal Gynaecology and Obstetrics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia.
4. Delivered two lectures in the 5th refresher programme in Zoology, held in August 1992 at the Academic Staff College, Burdwan University.
5. Invited to present a lead talk on "Present status of embryo sexing research in farm animals in the National Seminar on "Animal genetics and breeding

research and education: Present status and future thrusts" sponsored by the Indian Society of Animal Genetics and Breeding and IVRI held at IVRI, Izatnagar in October 1992.

6. Participated in the International Conference on Fertility Regulation held in Bombay Hospital, Bombay in November 1992.
7. Delivered an invited talk on *In vitro* production of embryos in farm animals at a meeting on reproductive biology organized by the Department of Biochemistry, Calcutta University in November 1992.
8. Delivered an invited talk on "Application of DNA technology in the diagnosis of chromosomal diseases" in a workshop on DNA technology: Application in the diagnosis of human disease organized by the Department of Biochemistry, Pathology and Genetics of the Vivekananda Institute of Medical Sciences, Ramkrishna Mission Seva Pratisthan in December 1992.
9. Delivered a talk on "Animal Biotechnology Programme of our Institute" in the Platinum Jubilee Celebration Symposium on Biotechnology from lab to lab held in November 1992 at Bose Institute, Calcutta.
10. Elected member, Executive Committee, Indian Society of Cell Biology.
11. Member, International Goat Association, USA.
12. Life member Indian Society for the Study of Reproduction and Fertility.
13. Member, Editorial Board, Indian Society of Animal Genetics and Breeding.
14. Member, Board of Studies, Department of Biochemistry and Department of Biophysics, Molecular Biology and Genetics, Calcutta University.
15. Member, Ph. D. Advisory Committee, National Dairy Research Institute, Karnal.
16. Convener, Course Committee for the Ph. D. course work programme of Bose Institute during 1990-92.
17. Member of Committee for Biotechnology in West Bengal of the West Bengal Science and Technology Department.

Dr. A. Lohia :

1. Visited Harvard School of Public Health, USA from April-July, 1992 on a Rockefeller Foundation Fellowship.

Dr. S. M. Reddy :

1. Participated in the International Conference in fertility regulation held in Bombay in November, 1992 and won the best poster presentation award for the work "Co-culture system for *in vitro* embryo production in farm animals" in the symposium session on Recent advances in reproduction of farm animals.
2. Presented a paper entitled "Oocyte reserves of indigenous cattle (*Bos indicus*) their *in vitro* maturation fertilization and development" in the Seminar on "Embryo transfer and associated technologies in livestock improvement—present status and future needs"—held at IVRI, Izatnagar in April 1992.
3. Presented a poster on "Simple method of chromosome preparation from bovine system and murine embryos" at XVI All India Cell Biology Conference held in January 1993 at BHU, Varanasi.

Dr. Sankar Ghosh :

1. Delivered a talk on "Chromosomal distribution of repetitive DNA sequences in farm animal genome" at XVI All India Cell Biology Conference and Symposium held in January 1993 at BHU, Varanasi.

Mr. Arup Kr. Indra :

1. Attended the Indo-US workshop on Frontiers of Reproductive Biology held at IICB, Jadavpur in Nov-Dec. 1992.
Dr. B. K. Padhi, Mr. Sudip Ghosh, Mr. Sudip Ghosh, Mr. Nrisingha Dey, Mr. Biswajit Roy and Mr. Biswendu Chaudhuri attended and presented posters in the Annual General Meeting of the SBC(I) held at CCMB, Hyderabad.

Honors/Award :

Prof. N. C. Mandal and Prof. B. Bhattacharyya were elected Fellows of the Indian Academy of Sciences, Bangalore.

Animal Physiology

- Dr. Arun K. Ray participated in the symposium "Life and non-life : Unity and diversity" held in Bose Institute, Calcutta, in November, 1992, during celebration of the Platinum Jubilee of the Institute.
- Dr. Rama Ghosh presented paper in the International Symposium. Third Asian Fisheries Forum held in Singapore from October 26-30, 1992.

Dr. Rama Ghosh participated in the symposium "Life and non-life : Unity and diversity" held in Bose Institute, Calcutta, in November, 1992, during celebration of the Platinum Jubilee of the Institute.

Dr. A. K. Dasmahapatra spent two years (on lien from Bose Institute) at the Medical College of Wisconsin, Milwaukee, U. S. A., as a Post-Doctoral Research Associate with Prof. P. C. Lee, and joined Animal Physiology Section on 11.3.93.

Dr. Anuradha Chaudhury, Smt. Debjani Ghosh, Sri Pradip Sarkar and Sri Shantanu Das attended 4th Annual Conference of The Physiological Society of India, held in November, 1992, at Kalyani University for presentation of papers.

Sri Shantanu Das attended Annual General Body Meeting of the Society of Biological Chemists (India), held in December, 1992, at CCMB, Hyderabad, for presentation of paper.

Honours and Awards

Dr. A. K. Ray has received an Ultracentrifuge (Beckman Model L₇ 55) as a gift from Alexander von Humboldt Foundation, Federal Republic of Germany, for promotion of research in Animal Physiology Section, Bose Institute, Calcutta.

Plant Molecular & Cellular Genetics

Dr. S. R. Sikdar received advanced training in chloroplast transformation at the Rutgers University, U.S.A. through a fellowship of the UNDP/FAO programme.

Drs. S. Das, D. Basu, P. Nayak and S. K. Sen attended and presented papers at Rockefeller Foundation International Conference on Rice Biotechnology in Chiang Mai, Thailand.

VISITORS :

The following scientists visited the laboratory and delivered seminar lectures :

1. Dr. Guy Vancaniet of the Plant Gene Expression Centre at Albany, University of California, Berkeley.
2. Dr. H. Uchimiya, University of Tokyo, Japan.
3. Dr. J. Kozuka, Plantech Res. Institute, Yokohama, Japan.

4. Dr. Barbara Hohn, Friedrich Mischer Institute, Basel, Switzerland.
5. Dr. Thomas Hohn, Friedrich Mischer Institute, Basel, Switzerland.
6. Dr. Victor Villalobos, F.A.O. Rome.
7. Dr. R. P. Sharma, Biotechnology Centre, IARI, New Delhi, India.
8. Dr. C. R. Bhatia, BARC, Trombay, India.
9. Dr. Bharat Chattoo, M. S. University, Baroda, India.

J. C. Bose Unit & Musium

Dibakar Sen

- (i) Delivered a lecture with slides on "Acharya J. C. Bose and Science in India" on the Golden Jubilee Celebration of Rameswarpur V. A. Vidyalay, Basirhat, W. B. on 15.4.92.
- (ii) Delivered Door Darshan talk from Calcutta Door Darshan entitled "J. C. Bose's Scientific 'instruments'" on the Foundation day of Bose Institute on 30th November 1992.

Ph.D. Degree Awarded

Name of the Candidate	Title of the thesis	Name of the Research Guide
<i>Department of Physics</i>		
1. Sm. Lipika Santra	Development of differential viscometer and its application in the measurement of radiation-induced changes in viscosity of polymers.	Prof. S. C. Roy
2. Sm. Tuktuk Sur	Study of radiation-induced free radicals in tissue-equivalent organic compounds by lyoluminescence technique and ESR spectroscopy.	Prof. S. C. Roy

BOSE INSTITUTE

Department of Chemistry

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|-------------------------|---|---------------|
| 3. Shri Subir K. NagDas | Biochemical studies of bovine sperm acrosomal enzymes | Dr. P. C. Sen |
| 4. Sm. Sucheta Chandra | The interactions of chloroquine with adenosine triphosphatase and lipids in natural and model membranes | Dr. P. C. Sen |

Department of Botany

- | | | |
|------------------|--|--------------------|
| 5. Sm. Rina Basu | Physiological responses of corp plants due to environmental stresses | Prof Bharati Ghosh |
|------------------|--|--------------------|

Department of Microbiology

- | | | |
|--------------------------------|--|--------------------------|
| 6. Shri Narayan Chandra Mandal | Carbon metabolism in <i>Rhizobium</i> sp. (<i>Cicer arietinum</i>) | Dr. Pran K. Chakrabartty |
|--------------------------------|--|--------------------------|

Department of Biochemistry

- | | | |
|-----------------------------|--|----------------------|
| 7. Shri Jaydip Das Gupta | Studies on genomic DNA of some <i>Brassica</i> species with special reference to repetitive DNA | Prof. R. K. Mandal |
| 8. Smt. Mita Pal | Studies on contractile proteins in higher plants | Dr. (Mrs.) S. Biswas |
| 9. Shri Asish Ray Chaudhury | Physicochemical characterization of tubulin and its molecular organization in <i>Mimosa pudica</i> | Dr. (Mrs.) S. Biswas |

GRANTS-IN-AID SCHEMES DEPARTMENT OF PHYSICS

Indo-US Collaborative Project

Title : Investigation on the Primary interactions of Gamma Rays with Matter.
Principal Investigator : Prof. S. C. Roy.

C. S. I. R. Ad-hoc Fellow

1. Shri Saurabh Gayen, J. R. F.

DEPARTMENT OF CHEMISTRY

Indian National Science Academy

Title : Studies on the role of fatty acylation of human erythrocyte ankyrin.
Investigator : Dr. Joyoti Basu
Research Fellow : Sri Amit K. Das

Department of Science & Technology

Title : Phospholipid transfer proteins : Physiological roles and use in membrane research.
Investigator : Dr. Manikuntala Kundu

Indian Council of Medical Research

Title : Beta-lactam antibiotics and Shigella : Studies on penicillin-binding proteins of Shigella.
Investigator : Dr. Manikuntala Kundu
Research Fellow : Sri Anindya Sundar Ghosh (from 31st December, 1992)

I. C. M. R. (Contd.)

Title : Bio-immunomodulator in improving vaccine failure states of malnourished immunosuppressed animals (upto 31st May, 1992).

Investigator : Prof. A. K. Barua
Research Associate : Dr. Debasis Chosal

Council of Scientific & Industrial Research

Title : Effect of oxidative stress on erythrocyte membrane structure and function in chronic myelogenous leukemia.

Investigator : Dr. Joyoti Basu
Research Fellow : Sri Dhiman Basu (1.9.92-28.2.93)

Title : Regulation of membrane structure and function during seasonal adaptation in *Channa punctatus* (upto 15th February, 1993).

Investigators : Dr. (Mrs) Dolly Ghosh
Prof. A. B. Das, Visva Bharati
Research Associate : Dr. Ramaballav Roy

Title : Investigation on the role of Ca^{2+} in the regulation of prostaglandin biosynthesis. (upto 31st August, 1992).

Investigator : Dr. (Mrs) Dolly Ghosh
Research Fellows : Shri Manas Pathak
Sm Mallika Ray

Title : The interaction of drugs with transport adenosine triphosphatase and lipids in model membranes Part II (upto 30th Sept., 1992).

Investigator : Dr. Parimal C. Sen
Senior Research Fellow : Sri Goutam Adhikary

Title : Synthetic approaches to indolocarbazoles. (upto 28th February, 1993)

Investigator : Dr. Manas Chakrabarty

Senior Research Fellow : Sm. Archana Batabyal

Emeritus Scientist Scheme (C. S. I. R.)

Title : Search for bioactive compounds from Bay of Bengal.

Emeritus Scientist : Prof. A. K. Barua (from 31st October, 1992)

Research Associate : Dr. Sarmila Ray (from 3rd March, 1993)

Department of Atomic Energy

Title : The interaction of drugs with transport abenosine triphosphatase and lipids in model membranes Part I (from 1st October, 1992).

Investigator : Dr. Parimal C. Sen

Senior Research Fellow : Sri Gautam Adhikary

INDO-EC

Title : Penicillin-binding proteins and beta-lactamase of Mycobacteria.

Investigator : Prof. Parul Chakrabarti

Co-investigators : Dr. Joyoti Basu
Dr. Manikuntala Kundu

Research Fellows : Sri Mukul Ghosh (21.12.92-28.2.93)
: Sri Swapnanjan Goswami (from 21.12.92)

INDO-US

Title : Functional significance of abnormalities of the erythrocyte membrane in myeloproliferative disorders.

Investigator : Prof. Parul Chakrabarti

Co-investigators : Dr. Joyoti Basu
Dr. Manikuntala Kundu

Research Fellows : Sri Raja Bhattacharyya (from 5.11.92)
Sri P. T. Srinivasan (from 5.11.92)

Department of Biotechnology

Title : Development of scale up technology for the production of biologically active fatty acids and lectins from marine organisms.

Investigator : Dr. Amitabha Ghosh

Co-investigators : Prof. Amalesh Choudhury, Dept. of Marine Science, C. U.
Dr. Suniti Misra, Dept. of Marine Science, C. U.

Research Fellows : Sri Tarun K. Patra
Sri Dipankar Bandyopadhyay
Sri Chiradip Bandyopadhyay

U G C Teacher Fellow

Sri Amar Chandra Nath (upto 12th March, 1993)

C. S. I. R Ad-hoc Fellows

1. Shri Goutam K Biswas (upto 31st July, 1992)
2. Shri Umesh Chandra Halder, S.R.F.
3. Sm. Rita Sikdar, S.R.F.
4. Sm. Eli Mukherjee (upto 31st March, 1992)
5. Shri Dhiman Basu (from 1st February, 1993)
6. Shri Alok Kanti Kar (from 1st March, 1993)

C. S. I. R. Ad-hoc Research Associate

1. Dr. Debasis Ghosal (from 1st June, 1992)
2. Dr. Ramaballav Roy (upto 15th February, 1993)

DBT Post-doc Fellow (Medical Biotechnology)

Dr. Saurav K Sarkar

C. S. I. R. Pool Officer

Dr. Mrinal K Guha (upto 1st August, 1992)

DEPARTMENT OF BOTANY**Council of Scientific and Industrial Research**

Title : Heat induced cellular events in crop plants.

Investigator : Prof. Bharati Ghosh

Title : Soluble and organelle-bound myo-inositol synthase of plant origin :
Biochemical and molecular studies.

Investigator : Prof. A. N. Lahiri Majumder

Title : Plant DNA polymerase : Possibility of cDNA cloning and expression in
E. coli.

Investigator : Dr. D. N. Sengupta

Indian Council of Agricultural ResearchTitle : Studies on the nature of sink induced senescence and its continued
by polyamine.

Investigator : Prof. Bharati Ghosh

DBT Post-doc Fellows

Dr. Tirthajyoti Bhaduri
Dr. S. K. Gupta
Dr. J. P. Sharma

CSIR Research Associate

Dr. Sanghita Bhattacharya

DBT National Associate

Dr. Asok Biswas

DEPARTMENT OF MICROBIOLOGY**Indian Council of Medical Research**

Title : Immunological characterisation of the 63 kd and 54 kd glycoproteins of
Leishmania donovani promastigotes and evaluation of their role in protective
immunity against visceral leishmaniasis.

Investigator-in-Charge : Prof. A. C. Ghose
Research Associate : Dr. Bhudeb Bhattacharya
(upto 20.08.92)
Research Assistant : Shri Amit Chakrabarty
(upto 20.08.92)

Council of Scientific and Industrial Research

Title : Characterisation of cell-associated hemagglutinin/adherence factor of
enteropathogenic *E. coli* by biochemical, immunological and genetic
approaches Development of immunological assay and genetic probes for
the organism.

Investigator-in-Charge : Prof. A. C. Ghose
Junior Research Fellow : Shri Samir Kumar Barari
(upto 07.05.92)

Council of Scientific and Industrial Research

Title : Immobilization of steroid transforming microorganisms

Investigator-in-Charge : Dr. Timir B. Samanta
 Senior Research Fellow : Shri Tapan K. Dutta
 (upto 30.6.92)
 Junior Research Fellow : Sm. Kajari Ghosh
 (upto 30.6.92)

Department of Atomic Energy

Title : Studies on the outer membrane proteins of *V. cholerae* and development of an immunoprophylactic against cholera.

Investigator-in-Charge : Prof. A. C. Ghose
 Senior Research Fellow : Shri Dilip Sen Gupta
 (upto 30.09.92)

Department of Science & Technology (Govt. of West Bengal)

Title : Application of *Streptomyces* protease in unhairing of hides and skins.

Investigator-in-Charge : Dr. (Mrs.) A. L. Chandra
 Junior Research Fellow : Sm. Papia Mitra (from 21.9.92)

Department of Biotechnology

Title : Microbial production of enzymes-xylanase and β -amylase.

Investigator-in Charge : Dr. Geeta Nanda
 Research Associate : Dr. Subhas Jana
 Junior Research Fellow : Ms. Rina Rani Roy
 Research Assistant : Shri Amitabha Das

Title : Development of a non replicating vaccine against Cholera based on protective antigens of *Vibrio cholerae*.

Investigator-in-Charge : Prof. A. C. Ghose
 Senior Research Fellow : Shri Dilip Kumar Sengupta (from 2.2.03)
 Junior Research Fellow : Miss. Sharmistha Mukherjee (from 1.2.93)

DBT (Contd.)

Title : Genetics of *Thiobacillus ferrooxidans*, and strain improvement by advanced genetic techniques.

Investigator-in-Charge : Dr. Pradosh Roy
 Senior Research Fellow : Shri Chirajyoti Deb
 Junior Research Fellow : Shri Pratap Mukherjee
 Senior Scientific Assistant : Ms. Keya Banerjee

Burn Standard Co. Ltd.

Title : Beneficiation of magnesite ore through microbial removal of silica.

Investigator-in-Charge : Prof. A. K. Mishra

Title : Biotechnological enrichment of bauxite ore.

Investigator-in-Charge : Prof. A. K. Mishra
 Research Associate : Dr. Anup Kumar Halder

DBT-Burn Standard Co. Ltd.

Title : Biotechnological enrichment of magnesite ore with antibiotics as products.

Investigator-in-Charge : Prof. A. K. Mishra
 Research Scientist : Dr. B. K. Mohanty

DBT-Post Doc. Fellows

Dr. Mrinal K. Ghosh, M. Sc., Ph. D.
 Dr. Monoranjan Chatterjee, M. Sc., Ph. D. (from 14.7.92)
 Dr. Sankar Lal Poddar, M. Sc., Ph. D. (from 10.8.92 to 19.2.93)

CSIR Ad-hoc Fellows

Shri Tapas Kumar Sen Gupta, M. Sc.
Shri Ashis Kumar Ghosh, M. Sc.
Naim Uddin, M. Sc. (upto 21.1.93)
Shri Ranjan Kumar Nandi (from 1.1.93)
Smt. Anupama Saha (from 2.9.92)
Smt. Rittika Chanda (from 21.1.93)

ICMR Ad-hoc Fellows

Shri Subha Manna, M. Sc. (upto 9.5.92)
Dr. Ramprosad Mukhopadhyay

DEPARTMENT OF BIOCHEMISTRY

UNDP

Title : Plant improvement using modern biotechnology.

Project Co-ordinator : Prof S. K. Sen

Project Directors : Prof S. Ghosh
Prof. R. K. Mandal
Prof. S. K. Sen (Section of PMCG)

Research scholar : Shri Niranjana Das

Title : Eradication of Leprosy in India.

Project Director : Prof. N. C. Mandal
(Resigned from 12th June, 1992).

Indian Council of Agricultural Research

Title : Biotechnological application of siderophores of *Azospirillum brasilense* for improvement of plant productivity. (Upto September, 1992).

Investigator-In-Charge : Prof. S. Ghosh
Co-Investigator : Dr. (Mrs.) Pratima Sinha
Research Fellow : Dr. Asitava Basu (Upto 31.8.92)

BOSE INSTITUTE

Title : A pilot project directed at the expression of proteins of biomedical importance in the milk of farm animals.

Investigator-In-Charge : Dr. Prabhakar Gupta
Co-Investigator : Prof. R. K. Mandal
Research Associate : Dr. S. M. Reddy (Upto 28.2.93)
Research Fellows : Sm. Gitali Ganguly
: Shri Sudit Sekhar Mukhopadhyay
(From 7.9.92)

Council of Scientific and Industrial Research

Title : Studies on the gene regulation of temperate mycobacteriophage LI.

Investigator-In-Charge : Prof. N. C. Mandal
Research Fellows : Sri Hirok Jyoti Datta
Sm. Sarbani Maity (Upto 1.10.92)

Title : Myoinositol tris-and tetrakis-phosphate generated by Phytase action on myoinositol hexakis-phosphate and its involvement in signal transduction process in plant cell.

Investigator-In-Charge : Dr. (Mrs.) Susweta Biswas
Research Fellow : Shri, Basudeb Dalal (From 1.9.92)

Title : Organisation of the *Entamoeba histolytica* genome.

Investigator-In-Charge : Dr. Anuradha Lohia
Rerearch Fellows : Shri Samir K. Sil (Upto 6.8.92)
Shri Samudra S. Gangopadhyay
(From 1.8.92)

Centre for Plant Molecular Biology (Supported by DBT)

Principal Investigators : Prof. S. K. Sen (Section of PMCG)
: Prof. R. K. Mandal
Research Fellow : Shri Somenath Bhattacharyya

C.S.I.R. Ad-hoc Fellows

1. Sm. Dipta Bhattacharyya (Upto 30.8.92)
2. Shri Amit Maity (Upto 30.5.92)
3. Shri Asim Kumar Mandal
4. Shri Dulal Panda
5. Shri Mahadev Pal
6. Shri Santanu Roychaudhury
7. Shri Mrinal K. Maity
8. Shri Biswendu Chowdhury
9. Shri Nandan K. Jana
10. Shri Subrata Sau
11. Shri Sudip K. Ghosh
12. Sm. Suparna Sengupta
13. Shri Nrishingha Dey
14. Sm. Lopa Adhikary
15. Shri Sibsankar Roy
16. Shri Gopal Chakraborty
17. Shri Biswajit Roy
18. Dr. Sankar K. Ghosh (From 1.4.92)
19. Sm. Nabanita Sarkar (From 15.6.92)
20. Sm. Pampi Basu (From 1.8.92)
21. Shri Pallab Kundu (From 18.8.92)
22. Sm. Mausami Maitra (From 11.1.93)
23. Sm. Suparna Datta (From 1.2.93)

DEPARTMENT OF BIOPHYSICS**Council of Scientific and Industrial Research**

Title : Studies on correlation of special antiviral, antibacterial drug conformations with function using specific experiment and computer data base.

Investigator-in-Charge : Dr. Asok Banerjee

Research Fellow : Ms. Indrani De (Sarkar)

Title : Fluorescence Spectroscopic Studies of Two Aminoacyl-Synthetases belonging to two different classes.

Investigator : Dr. Siddhartha Roy

Indian Council of Medical Research

Title : Fundamentals of Chemotherapeutic drugs at molecular level.

Investigator-in-Charge : Prof. Asok Banerjee

Research Fellow : Dr. Bishnu Prasad Mukhopadhyay

Department of Science and Technology

Title : Nuclear Magnetic Resonance Study of Structure and Dynamics of Bent DNA.

Investigator-in-Charge : Dr. Siddhartha Roy

Research Fellow : Shri Goutam Kumar Biswas (from 18.9.92)

CSIR Ad-hoc Fellows

1. Ms. Anushree Bhattacharyya
2. Ms. Sumita Bandopadhyay
3. Shri Ashim Kr. Bothra
4. Ms. Sampa Pain

CSIR Research Associate

1. Dr. Asoke Kr. Nandi (2.5.92-10.2.93)

DBT Post-doc Fellow

1. Dr. (Sm) Subhra Bhattacharyya

DST Research Associate

1. Dr. (Sm) Chhanda Mukhopadhyay

ICMR Ad-hoc Fellow

1. Dr. (Miss) Malabika Pandit

ANIMAL PHYSIOLOGY SECTION**CSIR Ad-hoc Fellows**

1. Smt. Debjani Ghosh (from 1.10.92)
2. Shri Pradip Kumar Sarkar
3. Shri Basanta Tiwari (from 5.8.92)
4. Smt. Bela Keshan (from 1.11.92)

DBT Post-doctoral Fellow

1. Dr. R. Kirubakaran (from 1.9.92)

LIBRARY

The Bose Institute Library is one of the best Science Reference Libraries in Eastern India. A wing of the Library has been opened at Acharya J. C. Bose Centenary Laboratory Building in 1983 with reading and lending facilities. The Library is primarily meant for the use of its research staff, but it is frequently used and consulted by many research workers and teaching staff of the seven Universities of West Bengal including STM, Medical College, Indian Institute of Chemical Biology (IICB), Central Glass & Ceramic Research Institute (CGCRI), Saha Institute of Nuclear Physics (SINP), Indian Institute of Technology (IITKharagpur), BHU, BSI, ZSI and other educational organizations and institutions.

The research activities of the Institute have considerably increased resulting in the increase in number of readers and in number of journals and periodicals. A number of rare and costly journals and periodicals have been subscribed along with annual and serial (foreign) publications. These appear to be inadequate, to overcome this difficulties, library resorted to inter-library loan facilities, which are available within the city of Calcutta. Reprographic (xeroxing) services are rendered to all faculty members, scholars and staff of the Institute.

Library contain 28065 volumes of Books, bound Journals and Maps including Theses (18261 Journals, 9649 Books, 4 Maps and 151 Theses), upto 31.3.93. During the period under report (1992-93) 352 Journals, 208 Books and 5 Theses were added to the Library stock. The total number of periodicals received was 137 out of which 87 were subscribed (87 foreign & Indian) and remaining 50 were received either in exchange of Institute publication or as gift. Due to increased cost of subscription the Library Committee again pruned foreign Journals with the approval of the authority from the subscriptions lists. The Library also received a fairly good number of technical pamphlets, circular report, etc.

The both campus of the Library are kept open from 9-30 a.m. to 7-00 p.m. on weekdays and from 10-00 a.m. to 7-00 p.m. on Saturday (except 2nd and 4th Saturday).

During the year under report (1992-93) following Institute publications were published.

A. Annual Report 1991-92 both English & Hindi Versions.

B. Transaction of Bose Res. Institute, Vol. 54(1-2) and 54(3-4), 1991.

During this year (1992) 278 permission cards were issued to out side readers and 6743[(3857(CB)+3886(MB))] readers used the library for reference work.

During (1992-93) 6 (six) Theses from the following Departments were received and duly accessioned in the thesis register of the Library :

1. Botany	—	2
2. Biochemistry	—	1
3. Biophysics	—	1
4. Chemistry	—	2
		6

Under Inter-Library loan system 7 volumes of Books and Journals were taken on loan and 31 volumes were issued on the same system to other educational organisation and Institutions including INSDOC.

During the year (1992-93) 2,09268 copies of reprographic (xerox) services were given to faculty members and staff of the Institute.

Budget for 1992-93) is Rs. 24,27,000.

WORKSHOP

During the year under report the following units of the workshop e.g. Mechanical, Electrical, Refrigeration, Carpentry, Glass blowing and Drafting in joint collaboration received and attended about 2100 nos. requisitions from various departments of the Institute.

Most of them are completed.

The following noteworthy jobs were undertaken and completed during the year under review.

(a) Designing and fabrication of Instruments and gadgets :

1. 4 nos. Super Heated Drop Detector (Pressure Reactor) for Defence Laboratory, Jodhpur were done and handed over.
2. Tube Gel Apparatus
3. Plexi Glass Chamber
4. Slab Gel Electrophoresis Apparatus
5. T. L. C. Applicator
6. Copper foil electrode
7. Perpex combs
8. Photographic stand
9. Radio active chamber
10. Innoculation Tray
11. Notice Board, Working Tables fitting with sunmica, Standing wooden drawing board, Wooden pattern, Wooden fume chamber, etc.
12. Radio active chamber
13. Perspex Test Tube holder, Al. Test Tube, Perspex Box etc.
14. Lamp shed for Laminar flow.
15. Teflon mounting for quartz cristal
16. Brass coupling for mixture filter
17. Brass regulator for Nitrozen Cylinder

(b) Repair and maintenance of Instruments of laboratories :

Circular stainless still water bath, Pully for cold room, Godrej lock, Tulu pump, Stabilized regulated power supply units, various type of Centrifuges, various types of Shakers, Autoclaves, Magnetic stirrer, Fraction collector, Rotary Evaporator, Vacuum Pump etc.

(c) Some varieties of work as follows :

Al. adapter, Brass nozzels, plunger Holder, Al. Box. Air inlet valve, wall clock, wooden pipet, Pipet can, spindle of Microfuge Instrument, out let pipe for X-ray tank, Al. stubs, Brass metal flanges, TLC plate carrier, Al. Tray and key for Microscope etc

(d) The following works have been completed by the Electricians :

Repairing and maintenance of 400 amps, 200 amps, 100 amps and 60 amps Main Switches, several new line drawn at Centenary Building and Main Campus. New Scholars Hostel at Saltlake, electrical maintenance work has been taken over departmentally. The capacitor bank of both the campuses have been successfully maintained through out the year keeping power factor 0.95-0.99 which specified as 'Unity' as per the regulation of C.E.S.C. and obtained the rebate all through against load factor.

(e) Maintenance of cold rooms, Airconditioners, controlled temperature B.O.D. incubator equipments/Refrigerators and Deefreezes are looking after by the Refrigeration Unit

(f) Repairing and making all shorts of glass apparatus as per sketch for the requirement of scholars and scientists.

(g) Prepare drawing and ammonia for Mechanical, and Civil works, Graphs and drawing for thesis, research publications have completed as per requisitions.

(h) Renovation and fabrication of the Acharya J. C. Bose's original Instruments as well as necessary drawing of various posters have been done. Arrangements of lectures and seminars by providing slide projects, Overhead Projectors and public address system were made. About 350 Institute's and Seminars were attended to at both the campuses. A number of lectures and seminars organised by outside organisation/agency were attended.

The Workshop purchased workshop materials, tools, building materials and furniture and also maintained stock books and records of these materials.

Huge old materials have been assessed to dispose them of purchasing a new computer to modernise the store.

In addition, the following works were carried out under the supervision of the Workshop Supdt.

Maintenancs, repair and daily allotments of 6 nos. Institute Vehicles were carried out.

Maintenance of Internal Telephone system by M/s. Mishra Telecom Enterprise at Main Campus and New Campus internally done.

Maintenance and regular check up of various Fire Fighting Equipments installed in the Institute.

Maintenance and repair of irrigation pumps and Engine at Experimental Stations. Also maintenance of scholars Hostel is being done through workshop.

REGIONAL SOPHISTICATED INSTRUMENTATION CENTRE

The RSIC continued to provide analytical instrumentation services to users in the region. An overall resume of services provided by the Centre during the year 1992-93 is given in the table :

The services of Mass Spectrometer, X-ray Diffractometer, Scanning Electron Microscope and other instruments in old wing of RSIC were severally affected due to problems in Central Airconditioning Plant during first quarter of the year under report. Normal services resumed after airconditioning problems were solved in July, 1992.

The X-ray Diffractometer suffered from frequent faults in its computer systems. CMC Ltd., who holds the service contract, often found it difficult to rectify the faults. The instrument became inoperable during the last quarter of the year due to hard disk problems which have not been solved yet by CMC.

The Mass Spectrometer, SEM, CW NMR and Gas Chromatograph were in operation with intermittent faults. Servicing work associated with these instruments were affected at times due to non-availability of spare parts. The instruments like EPR Spectrometer, Atomic Absorption Spectrophotometer and Spectrofluorimeter provided routine services without any major faults.

The Transmission Electron Microscope became operational since June, 1992 after a major problem in screen drive system was solved by M/s Chemito Ltd. In order to enhance utilisation of this instrument, certain actions were initiated to develop specimen preparation facilities in the Centre for biological as well as non-biological applications. A set of equipments like Twin-jet Electropolisher and low speed saw were installed to facilitate metallurgical sample preparation.

The FT-NMR suffered a major breakdown as the superconducting magnet quenched. Necessary actions to be taken are in progress to get the system up. The Ultracentrifuge remained non-functional throughout the year due to faults in the cooling system. The UV-Vis Spectrophotometer developed a problem in the optical system during the latter part of the year.

The charge structure was revised at a meeting of the Steering Committee of RSICs, headed by the Secretary, DST. The revised charge structure was made effective from 16th November, 1992.

RESUME OF ACTIVITIES

(From 1.4.92 to 31.3.93)

Instruments	Outside user		Bose Institute user	
	No. of samples	Revenue earned	No. of Samples	Revenue (Unpaid)
N.M.R.	7	Rs. 280.00	16	Rs. 465.00
MASS	2	720.00	32	3660.00
X-RAY DIFF.	2	2840.00	NIL	NIL
UV-VIS SPEC.	6	76.00	40	80.00
AT. AB.SPEC.	80	6165.00	53	2750.00
E.P.R.	85	3550.00	31	650.00
FT-N.M.R.	NIL	NIL	NIL	NIL
	Time of use (IN HRS.)		Time of use (IN HRS.)	
S.E.M.	133	12134.00	126	20572.00
F.L.S.	133	4320.00	64	1909.00
G.L.C.	57	3330.00	19	1290.00
T.E.M.	95	19120.00	78	11160.00
PREP. ULTRA	NIL	NIL	NIL	NIL

OUTSIDE USER : Total No. of samples = 182

" time of use (hrs.) = 418

" revenue earned = Rs. 52475.00

BOSE INSTITUTE USER : Total No. of samples = 172

" time of use (hrs.) = 296

" revenue (UNPAID) Rs. 42527.00

Revenue both outside + B.I. Users = Rs. 95002.00

J. C. BOSE UNIT AND MUSEUM

The task of setting up of a Museum and display of Acharya J. C. Bose's instruments was initiated by Acharya J. C. Bose himself. The process is still continuing and has been reported in the previous Annual Reports. The activities during the year under review of this part of Bose Institute is enumerated below.

As in previous years, the Museum took the responsibility of conducting a five-day practical training with J. C. Bose's Millimeter wave equipments as a part of the Man-power Training Programme in Millimeter wave Technology sponsored by the Department of Electronics, Government of India, organised by the Institute of Radio physics and Electronics, Calcutta University. The Trainees were, in fact, exposed and moved by the functioning of the various Millimeter wave components developed by Acharya Bose and the original instrument for Millimeter wave communication developed by him were also demonstrated. The trainees were also exposed to the workshop facilities where duplication work of these instruments are in progress. The Training Programme operated throughout a week commencing from the 23rd November, 1992.

An exhibition entitled "J. B. S. Haldane and Indian Science" was organised in collaboration with Birla Industrial & Technological Museum at the J. C. Bose Museum from 23rd September to 30th September, 1992, as a part of the Platinum Jubilee Celebration of Bose Institute.

The Platinum Jubilee Exhibition of Bose Institute held during 23rd November, 1992. On this occasion efforts were made to highlight the works of Acharya J. C. Bose and Bose Institute in details as far as practicable. As the convenor of the Bose Institute Platinum Jubilee Exhibition Committee, Dibakar Sen, In-charge, J. C. Bose Unit & Museum, undertook the responsibility of displaying the past scientific works of different Departments of the Institute. The present activities of the Institute were also highlighted. It would be imperative to make permanent display of the outstanding works of the Institute including those of Dr. D. M. Bose, in the Institute Museum.

During "Boses' Symposium" in March 1993, an Exhibition on the History of Bose Institute was arranged. Besides, the scientific works of both Acharya J. C. Bose and Dr. D. M. Bose were highlighted.

Participation in other Exhibitions

- | | |
|--|--|
| 1. Rameswarpur V. A. Vidyalaya
(Golden Jubilee Exhibition) | 15.04.1992 to 17.04.1992 (with Charts, Photographs, etc.) |
| 2. Model Kindergarten School
158/1, Bireswar Chatterjee Street,
Bally, Howrah (Silver Jubilee
Festival Exhibition) | Five-day long Exhibition w.e.f.
25.01.1993 (with Instruments, Photographs, Charts, etc.) |
| 3. Exhibition by the Reception
Committee of 3rd All India
Conference of Electrical Employees
Federation of India at Barrackpore,
North 24-Parganas | From 25th September to 28th September,
1992 (with Instruments, Photographs, Charts, etc.) |
| 4. Science Day Celebration Exhibition | 28th February, 1993 |

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 & Museum furnished information, xerox copies of papers & photographs of Acharya J. C. Bose and the Bose Institute to various organisation, eminent persons on request.

DISTRIBUTED INFORMATION CENTRE (DIC)

The progress made during the year (1992-1993) is mentioned below :

1. *Personnel :*

At present, we have a staff-strength of 7, consisting of one Information Scientist, two Junior Information Scientist-II, two Senior Technical Assistants, one Junior Technical Assistant and one Messenger-cum-Peon.

2. *Resource augmentation/redistribution :*

We have reoriented the existing resource in an efficient manner so that the system is being utilized in an optimal manner—one more terminal has been connected to microvax system (this is an intelligent terminal).

3. *Networking :*

The DIC microvax is now networked with other microvax of other DIC's situated in the various parts of our country. Users are regularly using this facility for supplementing the existing resource in our DIC.

4. *Communication facility :*

E-mail, NICMAIL and FAX usage are steadily increasing—ICGEBnet is being used for retrieval/mail purpose.

5. *Book and Journals :*

Till date, DIC is having 400 technical books and a whole suite of manuals in the PC as well as Micro Vax range. DIC is also subscribing to 23 journals which are enriching our library collection.

6. The bibliography search facility has been extended by incorporating more bibliographic databases, like Biotechnology Abstracts, Agricola etc.

7. The operating system of MicroVax System has been updated from version 4.6 to version 5.4—some new programs are developed and a few new programs are implemented, both for PC platform as well as for VMS platform.

8. All the on-going activities are maintained—databases, generated here, are maintained and updated.

9. On behalf of the BTIS programs, DIC, Bose Institute was invited to present the experience on ICGEBnet in the first National Meet on CD-ROM and ON-LINE searching at New Delhi.

10. Till date 12 sequences were deposited in the EMBL data bank using the facilities of our DIC.

11. DIC is imparting training to students in the North-East Hill region—till date 4 students had completed their B. Tech projects in problems suggested by DIC, using DIC's facilities.

12. In the Microvax-II system, there are about 70 users—while the bibliography search facilities are being utilized by scientists and researchers in and around the city—users from Manipur, Sambalpur, JNU are using our facilities time to time apart from in-house users. About 350 users from other institutions are benefitted from our bibliographic services.

Statement of Accounts
for the year
1992-93

Bose Institute

AUDITOR'S REPORT

CALCUTTA

we have audited the attached Balance Sheet of the BOSE INSTITUTE as at 31st March, 1993 and the annexed Income and Expenditure Accounts of the Governing Body and the Council for the year ended on that date, which are in agreement with the books of account and records produced to us.

In our opinion and to the best of our information and explanations given to us, the Balance Sheet and Income and Expenditure Account read with the notes given separately in SCHEDULE XI and subject to our following observations, give a true and fair view in the case of Balance Sheet of the the state of affairs of the Institute as at 31st March, 1993 and in the case of Income & Expenditure Account, of the surplus for the year ended on that date.

1. The requirement of Section 17 of the Societies Registration Act 1961 in regard to filling of Returns were not complied with. No Minute Book was available in respect of Annual General Meeting of the Institute reported to have been held on 23rd March, 1993.

2. *Amount Receivable* : Rs. 17,09,798.40
Schedule-IX

The above amount includes Rs. 3,67,431.34 being general advance in which a sum of Rs. 67,717 has been brought forward from last account. The said amount also includes Rs. 6,892.04 (net) being amount debited by Bank that remained unreconciled.

3. *Security Deposits* : Rs. 1,03,404.00
Schedule-VIII

Of the above Rs. 88,404.00 has been brought forward from the previous year for which confirmations of receipt of deposits were not made available for our verification.

4. As per certificate issued by the State Bank of India, 3% Conversion Loan 1946 for Rs. 8,800.00 vide Schedule-VI was duly encashed

and credited to the Bank Account of the Governing Body in 1987. Proper adjustment for the same, however, has not been made in the Books of the Institute.

5. 100 Debentures of Rs. 100/- each for Rs. 20,000/- in Birla Jute & Industries Ltd. had become redeemable as on 31st March, 1991. No interest has been accounted for in respect of the said Debentures lodged with the State Bank of India. Steps should be taken to realise the redeemable amount of Debentures at an early date.
6. An honorarium of Rs. 6,000/- was paid to the Secretary in terms of the Resolution passed at the Governing Body Meeting on 18.7.92, as modified on 27.8.92. Legal opinion should be obtained to determine if this payment could be made in view of the provision of Clause 4 of the Memorandum of Association of Bose Institute.
7. The surplus, i.e. net income of the Governing Body of Rs. 79,718.15 instead of being handed over to the Council as required under Regulation 11(v) has been transferred to the following Funds newly created, for which no Resolution of the Governing Body was passed.

	Rs.
Darjeeling Experimental Station Development Fund	29,718.15
Shyamnagar Experimental Station Repair Fund	38,000.00
Falta Experimental Station Repair Fund	12,000.00
	<u>79,718.15</u>

However, the Governing Body at the Meeting held on 29.11.92 approved Provisional Budgeted Expenditure during December 1992 to March, 1993 of:

Rs. 12,000/- for Falta Tubewell Sinking

Rs. 38,000/- for Shyamnagar Farm wall and Fencing Expenses.

In the books of the Council Darjeeling Experimental Development Fund has been brought Forward with a balance of Rs. 46,946.90 and the above amount of Rs. 29,718.15 has been provided in the books of the Governing Body.

8. In respect of the Employees Pension Fund established from 1.4.91 on the basis of the Regulation approved by Government of India, Department of Science and Technology, no provision has been made in the Income and Expenditure Account for contribution payable by the Employer (i.e. Bose Institute) in terms of Regulation 7(b) and (c) from 1.4.91. Pension paid to the retired employees during 1991-92 and 1992-94 for Rs. 14,53,173.40 and Rs. 6,56,280.00 respectively by the Institute has been charged to Income and Expenditure Account instead of to the Pension Fund.
9. Amount receivable from Governing Body Rs. 20,988/- represents salary paid by the Council to an employee at Darjeeling which has not been accounted for by the Governing Body in the Income and Expenditure Account, though such payment in 1991-92 was accounted for by them under the head "Administrative Charges".
10. Depreciation on Fixed Assets has not been charged in the Account. We are advised, according to past practice of the Institute arrear depreciation on Fixed Assets has not been determined.
11. For the purpose of Income and Expenditure Account the allocation between Plan and Non-Plan items as made by the Institute has been accepted by us.

Calcutta, 31st August, 1993

Sd/-
G. Basu & Co.
Chartered Accountants

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Balance Sheet as

As at 31st March, 1992	FUNDS AND LIABILITIES	SCHEDULE NO.	As at 31st March, 1993
Rs. P.			Rs. P.
23,25,783.11	Capital Account (GB) (as per last Account)		23,25,783.11
5,97,53,541.84	Grant for Capital Expenditure (C)	I	6,40,25,182.90
1,07,56,168.03	Acharya J. C. Bose Centenary Building Fund (C) (as per last Account)		1,07,56,168.03
15,99,768.40	Acharya J. C. Bose Centenary Lab. Fund (GB) as per last Account		15,99,768.40
14,46,213.80	Salt Lake Land Procurement Fund (GB) (as per last Account)		14,46,213.80
11,87,271.33	Special Fund	II	13,56,629.48
28,54,986.00	House Building Advance Fund (C)	III	31,14,574.00
1,17,62,698.18	Excess of Receipts over Expenditure in respect of different Grant-in-Aid Schemes (C)		44,47,515.89
	Add : Transfer from Income and Expenditure Account		6,00,000.00
14,22,265.12	Deposits and other Liabilities	IV	50,47,515.89
—	Excess of Income over Expenditure as per annexed Income & Expenditure Account (C)		46,27,143.17
93,48,944.74	Employees Pension Fund as per Balance Sheet attached		10,14,612.02
1,04,11,767.60	Employees General Provident Fund as per Balance Sheet attached		1,12,06,497.82
7,81,804.66	Employees Contributory Provident Fund as per Balance Sheet attached		1,31,28,821.06
	Notes on Accounts	XI	9,80,248.66
11,36,51,212.81		Total	12,06,29,158.34

Sd/-
S. Pal
Accountant
Bose InstituteSd/-
B. Chakraborty
Accounts Officer
Bose InstituteSd/-
T. K. Ghorui
Dy. Registrar
Bose Institute**Institute**

Calcutta—700 009

Council :

31st March, 1993

As at 31st March, 1992	PROPERTIES AND ASSETS	SCHEDULE No.	As at 31st March, 1993
Rs. P.			Rs. P.
23,25,783.11	Investment & other Properties (GB) (as per last Account)		23,25,783.11
5,91,86,280.71	Fixed Assets from N. R. Grant (C)	V	6,34,57,921.77
1,07,56,168.03	Sir J. C. Bose Centenary Building (C) (as per last Account)		1,07,56,168.03
15,96,685.19	Sir J. C. Bose Centenary Laboratory Madhyamgram (GB) (as per last Account)		15,96,685.19
14,46,213.80	Land at Salt Lake City (GB) (as per last Account)		14,46,213.80
8,61,305.63	Special Fund Investment	VI	11,04,805.63
27,75,513.00	House Building Advance (C)	VII	30,08,640.00
11,206.19	Workshop Stores (C) (as per last Account)		11,206.19
88,404.00	Security Deposit (C)	VIII	1,03,404.00
15,75,803.58	Receivable Account	IX	17,09,798.40
—	Receivable from Governing body Body (C)		53,303.53
	Less : Amount Admitted (GB)		31,315.53
64,02,092.45	Margin Deposit against letter of Credit (C)		20,988.00
52,259.00	Margin Deposit against Bank Guarantee (C)		23,52,543.34
47,19,092.90	Cash and Bank Balances	X	52,959.00
13,11,188.22	Excess of Expenditure over Income (as per annexed Accounts)		73,66,474.34
93,48,944.74	Employees Pension Fund Investment (as per Balance Sheet attached)		—
1,04,11,767.60	Employees General Provident Fund Investment (as per Balance Sheet attached)		1,12,06,497.82
7,81,804.66	Employees Contributory Provident Fund Investment (as per Balance Sheet attached)		1,31,28,821.06
			9,80,248.66
11,36,51,212.81		Total	12,06,29,158.34

This is the Balance Sheet referred to in our Report of even date.

Sd/-
A. J. Datta
Registrar
Bose InstituteSd/-
Prof. P. K. Ray
Director
Bose InstituteSdj-
G. Basu & Co.
Chartered Accountants
Bose Institute

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Income and Expenditure Account for the year ended

1991—1992		EXPENDITURE		Non-Plan		Plan		Total	
Rs.	P.			Rs.	P.	Rs.	P.	Rs.	P.
To									
A. Salaries, Scholarship & Allowances									
12,84,557.00		Director and Administration	11,62,403.50		2,44,512.00			14,06,915.50	
70,75,275.00		Research Staff (including Farms)	62,93,766.00		10,95,120.00			73,88,886.00	
11,59,507.00		Workshop	11,80,197.00		51,624.00			12,31,821.00	
3,07,594.00		Library	2,95,563.00		9,864.00			3,05,427.00	
3,74,054.00		Lower Sub-Ordinate	3,27,385.00		48,120.00			3,75,505.00	
49,13,722.20		Dearness Allowance	56,93,751.00		16,19,620.00			73,13,371.00	
3,07,261.00		City Compensatory Allowances	2,88,687.00		24,840.00			3,13,527.00	
20,19,519.40		House Rent Allowances	13,55,600.00		8,06,600.00			21,62,200.00	
47,945.20		Arrear Dues	8,87,651.50		3,00,000.00			11,87,651.50	
14,53,173.40		Pension	8,56,280.00		8,00,000.00			16,56,280.00	
4,13,420.00		Gratuity	2,40,225.00		45,000.00			2,85,225.00	
2,60,176.00		Leave Encashment	2,33,935.00		—			2,33,935.00	
2,23,635.00		Ad-hoc Bonus	77,740.00		1,00,000.00			1,77,740.00	
13,610.50		Exgratia	9,900.00		—			9,900.00	
33,359.13		Provident Fund			—				
		Office Contribution	20,619.00		—			20,619.00	
4,57,583.85		Medical Benefit	3,04,272.27		1,69,566.28			4,74,238.55	
2,03,44,412.68		Total A	1,92,27,975.27		53,15,266.28			2,45,43,241.55	

Carried Over

Institute

Calcutta-700 009

COUNCIL

31st March 1993,

1991—1992		INCOME		Non-Plan		Plan		Total	
Rs.	P.			Rs.	P.	Rs.	P.	Rs.	P.
By									
A. Grants and Other Receipts									
2,31,00,000.00		Grant from Govt. of India (D.S.T.)							
		Non-Plan	2,39,00,000.00		—			2,39,00,000.00	
1,04,00,000.00		Grant from Govt. of India (D.S.T.)							
		Plan				1,40,00,000.00		1,40,00,000.00	
63,700.00		Service Charges	2,06,240.00		—			2,06,240.00	
53,641.66		Overhead Charges	1,74,240.00		—			1,74,240.00	
1,98,567.60		Governing Body : Surplus Revenue	—		—			—	
13,74,764.04		Interest from Banks	1,71,235.67		—			1,71,235.67	
91,470.31		Miscellaneous Receipts	67,859.92		—			67,859.92	
—		Grant from DBT (National Science Day)	40,000.00		—			40,000.00	
3,52,82,143.61		Total A	2,45,59,575.59		1,40,00,00.00			3,85,59,575.59	

Carried Over

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Income and Expenditure Account for the year ended

1991—1992	EXPENDITURE	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
B/F							
B. Office Maintenance & other Establishment Expenses :							
3,28,967.27	Office Expenses including general maintenance	3,72,682.92				3,72,682.92	
22,752.75	Stationary and Printing	7,857.50				7,857.50	
48,000.00	Postage	64,000.00				64,000.00	
38,986.00	Advertisement	66,966.00				66,966.00	
9,300.00	Audit Fees (for 91-92)	9,300.00				9,300.00	
2,73,136.00	Telephone, Telex and Fax	2,56,546.00				2,56,546.00	
16,87,830.79	Electric and Gas Bills	24,83,013.12				24,83,013.12	
1,26,986.00	Travelling Expenses	1,95,247.40				1,95,247.40	
2,860.00	Children Education Assistance	5,125.00				5,125.00	
2,26,602.43	Building Repairing and Maintenance	2,45,704.57				2,45,704.57	
2,58,921.51	Car Repair and Maintenance	4,21,704.37				4,21,704.37	
55,273.00	Garden Maintenance	61,461.65				61,461.65	
3,570.00	Legal Expenses	3,060.00				3,060.00	
1,87,799.30	Security Guard	1,72,324.00				1,72,324.00	
13,417.00	Fire Insurance	9,397.00				9,397.00	
7,388.40	Liveries	—				—	
4,214.80	Course Works	19,749.26				19,749.26	
8,046.45	Rent and Taxes	39,120.00				39,120.00	
32,609.00	Leave Travel Concession	69,957.00				69,957.00	
—	National Science Day Celebration	23,790.90				23,790.90	
33,36,660.70	Total 'B'	45,27,006.69				45,27,006.69	

Carried Over

Institute

Calcutta-700 009

COUNCIL

31st March, 1993

1991—1992	INCOME	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
B/F		2,45,59,575.59		1,40,00,000.00		3,85,59,575.59	

Carried Over

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Income and Expenditure Account for the year ended

1991-1992	EXPENDITURE	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
B/F							
C. Laboratory Expenses							
79,382.02	Physics			1,25,820.26		1,25,820.26	
2,14,088.01	Chemistry			2,15,036.45		2,15,036.45	
1,64,562.45	Botany			2,71,363.92		2,71,363.92	
2,34,620.79	Microbiology			1,56,235.18		1,56,235.18	
1,99,776.18	Bio-Chemistry			2,41,764.85		2,41,764.85	
97,868.46	Bio-Physics			74,365.05		74,365.05	
86,864.34	Animal Physiology			1,10,704.63		1,10,704.63	
61,658.12	Library			48,663.61		48,663.61	
1,10,075.37	P.M.C.G.			97,682.86		97,682.86	
1,96,175.60	Workshop			2,74,172.68		2,74,172.68	
1,53,804.35	Experimental Farms			1,28,008.19		1,28,008.19	
1,02,046.95	Publication			1,43,340.25		1,43,340.25	
66,099.97	Scholars' Hostel			2,51,601.12		2,51,601.12	
15,748.22	Written off			—		—	
<u>17,82,770.83</u>	TOTAL C			<u>21,38,759.05</u>		<u>21,38,759.05</u>	

Carried Over

Institute

Calcutta—700 009

COUNCIL

31st March, 1992

1991-1992	INCOME	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
B/F							
		2,45,59,575.59		1,40,00,000.00		3,85,59,575.59	

Carried Over

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Section :

Income and Expenditure Account for the year ended

1991-1992		EXPENDITURE		Non-Plan		Plan		Total	
B/F		Rs.	P.	Rs.	P.	Rs.	P.	Rs.	P.
To									
D. Transferred to :									
Grant for Capital Expenditure :									
15,00,000.00	Scholar Hostel Building Construction								
51,99,984.10	Books and Journals								
3,77,832.70	Calibnet								
78,648.65	N.R. APPARATUS—(A) Physics							25,05,151.47	
41,946.25	N.R. APPARATUS—(B) Chemistry								
31,009.55	N.R. APPARATUS—(C) Botany							1,77,055.50	
5,41,179.40	N.R. APPARATUS—(D) Microbiology							19,142.00	
51,920.00	N.R. APPARATUS—(E) Bio-Chemistry							15,371.92	
23,194.20	N.R. APPARATUS—(F) Library							80,608.00	
1,34,898.74	N.R. APPARATUS—(G) Office Expenses							3,800.00	
—	N.R. APPARATUS—(H) Bio-Physics								
—	N.R. APPARATUS—(I) Workshop							3,68,932.45	
—	N.R. APPARATUS—(J) Scholar's Hostel							11,315.11	
8,66,850.05	J. C. Bose Cent Building (3rd floor)							19,453.88	
—	Air-Conditioner							18,278.00	
—	Furniture								
—	Water Treatment Plant							1,14,318.75	
—	EPABX System							67,963.98	
	Grant in Aid Scheme :							1,03,750.00	
11,05,000.00	U. N. D. P.							7,66,500.00	
6,29,507.00	House Building								
	Advance Fund							6,00,000.00	
1,05,81,971.34	Total D							1,53,127.00	
								50,24,768.06	
3,60,45,815.55	Total A+B+C+D								
				2,37,54,981.96		1,24,78,793.39		3,62,33,775.35	
To									
	Excess of Income over Expenditure for this year carried down								
3,60,45,815.55	Total			8,04,593.63		15,21,206.61		23,25,800.24	
				2,45,59,575.59		1,10,00,000.00		3,85,59,575.59	

Institute

Calcutta—700,009

COUNCIL

31st March, 1992

1991-1992		INCOME		Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.	Rs.	P.
B/F		2,45,59,575.59		1,40,00,000.00		3,85,59,575.59			
3,52,82,143.61		2,45,59,575.59		1,40,00,000.00		3,85,59,575.59			
7,63,671.94	Excess of Expenditure over Income								
3,60,45,815.55	Total	2,45,59,575.59		1,40,00,000.00		3,85,59,575.59			

Bose

93/1, Acharya Prafulla Chandra Road

Section :

Income and Expenditure Account for the year ended

1991—1992 Rs. P.	EXPENDITURE	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
	To						
5,47,516.28	Excess of Expenditure over Income Brought Forward	7,95,356.37		5,15,831.85		13,11,188.22	
7,63,671.94	Excess of Expenditure over Income for this year	—		—		—	
—	Net Balance transferred to Balance Sheet	9,237.26		10,05,374.76		10,15,612.02	
<u>13,11,188.22</u>		<u>8,04,593.63</u>		<u>15,21,206.61</u>		<u>23,25,800.24</u>	

Sd/-
S. Pal
Accountant
Bose InstituteSd/-
B. Chakraborty
Accounts Officer
Bose InstituteSd/-
T. K. Ghorui
Dy. Registrar
Bose Institute**Institute**

Calcutta-700 009

COUNCIL

31st March, 1993

1991—1992 Rs. P.	INCOME	Non-Plan		Plan		Total	
		Rs.	P.	Rs.	P.	Rs.	P.
	By						
—	Excess of Income over, Expenditure for this year Brought down	8,04,593.63		15,21,206.61		23,25,800.24	
13,11,188.22	Balance transferred to Balance Sheet	—		—		—	
<u>13,11,188.12</u>	Total	<u>8,04,593.63</u>		<u>15,21,206.61</u>		<u>23,25,800.24</u>	

Sd/-
A. J. Datta
Registrar
Bose InstituteSd/-
Prof. P. K. Ray
Director
Bose InstituteSd/-
G. Basu & Co.
Chartered Accountants
Bose Institute

Bose

93/1, Acharya Pratulla Chandra Road
Income & Expenditure of Governing

1991—1992	EXPENDITURE	Rs.	P.
Rs.			
	To		
14,070.00	Administrative charges		
82,364.95	Building Repairs & Maintenance		
20,551.80	General Charges	11,287.25	
—	Honorarium	2,017.50	
405.25	Meeting Expenses	19,000.00	
868.80	Rent & Taxes	948.55	
3,121.25	Sir J. C. Bose Museum Expenses	1,737.60	
—	Security Guard	5,746.00	
15,659.00	Travelling Expenses	61,692.20	
5,000.00	Donation	2,400.00	
65.00	Insurance Premium	—	
425.60	Printing & Stationery	—	
—	Transferred to ;	—	
	Darjeeling Experimental Station		
	Development Fund	29,718.15	
	Falta Station Enpair Fund	12,000.00	
	Shyamnagar Experimental		
	Station Repair Fund	38,000.00	
1,98,567.60	Excess of Income over Expenditure	79,718.15	
	TOTAL		
3,41,099.25		1,84,547.25	

Sd/-
R. Bhattacharya
Accountant
Bose Institute

Sd/-
Debabrata Bose
Secretary
Governing Body

Sd/-
B. Chakraborty
Account Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta-700-009

Body for the year ended 31st March, 1993

1991—1992	INCOME	Rs.	P.
Rs.			
	By		
3,24,695.00	Interest on Investments, General	1,63,795.00	
9,832.25	Interest on R. M. Keating Scholarship Fund	11,672.25	
5,500.00	Interest on J. C. Bose Scholarship Fund	6,500.00	
1,072.00	Membership Subscription	560.00	
—	Donation Received	2,020.00	
3,41,099.25		1,84,547.25	

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants
Bose Institute

Bose

93/1, Acharya Prafulla Chandra Road
Income & Expenditure Account of Employees' Pension

1991—1992 Rs. P.	EXPENDITURE	Rs. P.
7,60,535.84	Interest transferred to Capital Fund	14,97,427.08
<u>7,60,535.84</u>	TOTAL	<u>14,97,472.08</u>

Balance Sheet as

As at 31st March 1992 Rs. P.	LIABILITIES	As at 31st March, 1993 Rs. P.
	Capital Fund :	
84,51,433.90	As per Last Account	93,48,944.74
1,36,975.00	Add : Contributions Recruit	3,60,081.00
7,60,535.84	Add : Interest Earned as per Income & Expenditure Account	14,97,472.08
<u>93,48,944.74</u>	TOTAL	<u>1,12,06,497.82</u>

Sd/-
S. Pal
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta-700 009

Fund for the year ended 31st March, 1993

1991—1992 Rs. P.	INCOME	Rs. P.
7,60,535.84	Interest on Term Deposit Saving	14,64,125.00
—	Interest on Bank Deposit	33,347.08
<u>7,60,535.84</u>	TOTAL	<u>14,97,472.08</u>

at, 31st March, 1993

As at 31st March, 1992 Rs. P.	ASSETS	As at 31st March, 1993 Rs. P.
84,50,000.00	Investment :	
—	Term Deposit with State Bank of India	98,50,000.00
	Accrued Interest on Term Deposit	2,74,625.00
8,98,944.74	Bank Balance :	
—	With State Bank of India in Savings Bank	10,67,259.82
	Receivable from DIC Towards Contribution	14,613.00
<u>93,48,944.74</u>	TOTAL	<u>1,12,06,497.82</u>

As per our Report attached.

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants
Bose Institute

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31. 3. 1993

	Council		Governing Body		Total	
	Rs.	P.	Rs.	P.	Rs.	P.
SCHEDULE NO. I						
Grants for Capital Expenditure :						
(a) From Government of India :						
As per last Account	4,09,24,517.89					
(b) From Government of West Bengal :						
As per last Account	40,000.00					
(c) From Sir J. C. Bose Contribution through Trust Fund No. 1. :						
As per last Account	1,23,402.49					
(d) Transferred from Grant-in-Aid Schemes :						
As per last Account	69,72,452.75					
(e) Transferred from Council Revenue A/c :						
As per last Account	1,16,93,168.71					
Add : This year	42,71,641.06		1,59,64,809.77		6,40,25,182.90	

SCHEDULE NO. II**Special Funds :****Sir J. C. Bose Scholarship Fund :**

As per last Account	50,000.00	50,000.00
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Sir J. C. Bose Medal Fund :

As per last Account	1,23,153.96	
Add : Income this year	13,076.00	1,36,169.96

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31. 3. 1993

	Council		Governing Body		Total	
	Rs.	P.	Rs.	P.	Rs.	P.
Sir J. C. Bose Endowment Fund :						
As per last Account			7,03,624.77			
Add : Income this year			75,500.00		7,79,124.77	
Richard Marry Keating Fund :						
As per last Account			1,04,541.67		1,04,541.67	
Birla Scholarship Fund :						
As per last Account			20,000.00		20,000.00	
Urmila Devi Benevolent Fund :						
As per last Account			8,800.00		8,800.00	
Sri Nilratan Sarkar Prize Fund :						
As per last Account			29,513.33			
Add : This year			1,500.00		31,013.33	
Samir Sinha Memorial Fund :						
As per last Account			13,500.00			
Add : This year			1,150.00		14,650.00	
Sir J. C. Bose's Contribution through Trust Fund No. 1 (Created by him)						
As per last Account			46,794.54			
Add : This year			5,940.00		52,734.54	
Darjeeling Experimental Station Development Fund (newly created 1992-93)						
			29,718.15			
Falta Experimental Station :						
Repair Fund			12,000.00			
Shyamnagar Experimental Station :						
Repair Fund			38,000.00		79,718.15	

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council		Governing Body		Total	
	Rs.	P.	Rs.	P.	Rs.	P.
Prof. S. M. Sarkar Memorial Lecture Fund :						
As per last Account	4,138.20				4,138.20	
Darjeling Experimental Station Development Fund :						
As per last Account	46,946.90				46,946.90	
Director's Discretionary Fund :						
As per last Account	15,350.61				15,350.61	
A.E.C.D. Fund (Employees) :						
As per last Account	6,529.76				6,529.76	
Apparatus & Book Purchase Fund :						
As per last Account	6,911.59				6,911.59	
	<u>79,877.06</u>		<u>12,76,752.42</u>		<u>13,56,629.48</u>	

SCHEDULE NO. III

House Building Advance Fund :			
As per last Account	28,54,986.00		
Add: Transfer from Plan Recurring Grant this year	1,53,127.00		
Add: Transfer from DIC (91-92)	80,000.00		
Add: Interest Received on H.B.L. Loan	26,461.00		31,14,574.00

Bose Institute

CALCUTTA-700009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council		Governing Body		Total	
	Rs.	P.	Rs.	P.	Rs.	P.

SCHEDULE NO. IV**Deposit & Other Liabilities :**

Goods and Expenses	24,73,985.94		
Earnest Money Deposit (Works)	89,201.75		
Party Income Tax	3,712.02		
Fire Damane Compensation	10,520.00		
Cumulative Time Deposit	176.50		
Postal Recurring	572.80		
Professional Tax	587.15		
Provident Fund Suspense	1,139.65		
P. M. Drought Relief fund	113.00		
P. F. Payable	48,353.00		
Symposium on Radiation Physics	7,932.77		
Suspense	498.00		
Payable to Overseas Suppliers	14,847.65		
Undisbursed Cheque	18,51,484.74		
Donation from Institute Staff	37,050.00		
D. M. Bose Birth Centenary	8,706.78		
Int. Lect-in-Prof. P. Chakraborty	48,563.56		
Insurance Premium	2,801.46		
Co-operative	23,496.40	1,000.00	
Bank Suspense		2,400.00	
Payable to R. Bhattacharya			
	<u>46,23,743.17</u>	<u>3,400.00</u>	<u>46,27,143.17</u>

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. P.	Governing body Rs. P.	Total Rs. P.
SCHEDULE V			
Fixed Assets from Non-Recurring Grant			
As per last account :			
a) Buildings :			
at Calcutta	8,74,350.09		
at Shyamnagar	92,647.99		
at MaDhyamgram	5,89,767.27	—	15,56,765.35
b) Apparatus & Equipments :			
As per last Account	1,70,05,398.88		
Add : During this year	6,76,224.98	—	1,76,81,623.86
c) Transferred from Terminated Schemes :			
As per last Account	69,02,452.75	—	69,02,452.75
d) Workshop Apparatus :			
As per last Account	6,16,885.98		
Add : This year	19,453.88	—	6,36,339.86
e) Air-conditioning :			
As per last Account	1,79,225.56		
Add : This year	1,14,318.75	—	2,93,544.31
f) Furniture & Fitting :			
As per last Account	14,67,400.38		
Add : This year	67,963.98		
Add : This year for Scholar's Hostel	18,278.00	—	15,53,642.36
g) Laboratory & Remodelling : (Built Dark & Cold Room)			
As per last Account	11,68,735.36	—	11,68,735.36

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. P.	Governing Body Rs. P.	Total Rs. P.
h) Books & Journals :			
As per last Account	1,94,62,081.41		
Add : This year	25,05,151.47	—	2,19,67,232.88
i) Electrical Installation : (including S. D. Rs. 39,000/- with CESC)			
As per last Account	10,44,329.38	—	10,44,329.38
j) Renovation works at Main Campus :			
As per last Account	17,67,234.30	—	17,67,234.30
k) Tube-well :			
As per last Account	2,43,170.01	—	2,43,170.01
l) Motor Car : (including a Car received from DST valued at Rs. 70,000)			
As per last Account	2,89,785.17	—	2,89,785.17
m) Gas Plant :			
As per last Account	46,256.00	—	46,256.00
n) Glass House :			
As per last Account	14,432.46	—	14,432.46
o) Boundary wall at Madhyamgram :			
As per last Account	2,85,737.27	—	2,85,737.27
p) Internal Telephone :			
As per last Account	466.75	—	466.75

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. P.	Governing Body Rs. P.	Total Rs. P.
q) Hostel Building :			
As per last Account	67,14,276.00	—	67,14,276.00
r) Calibnet :			
As per last Account	4,21,647.70	—	4,21,647.70
s) Water Treatment System (1992-93)	1,03,750.00	—	1,03,750.00
t) EPABX System (1992-93)	7,66,500.00	—	7,66,500.00
		TOTAL	6,34,57,921.77

SCHEDULE NO. VI**Special Fund Investment****Sir J. C. Bose Scholarship Fund :****Fixed Deposit with SBI :**

As per last Account	50,000.00	50,000.00
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Sir J. C. Bose Medal Fund :**Fixed Deposit with SBI :**

As per last Account	1,06,750.00	
Add: This year	16,000.00	1,22,750.00

Sir J. C. Bose Endowment Fund :**Fixed Deposit with SBI :**

As per last Account	5,00,000.00	
Add: This year	2,00,000.00	7,00,000.00

Richard Marry Keating Fund :**Fixed Deposit with SBI :**

As per last Account	98,500.00	
843 Eq. Shares (CESC)	6,041.67	1,04,541.67

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. P.	Governing Body Rs. P.	Total Rs. P.
Birla Scholarship Fund :			
200 Nos. 15% Non-Convertible Debenture of Birla Jute & Industries Ltd.			
As per last Account		20,000.00	20,000.00
Urmila Devi Benevolent Fund :			
3% Conversion Loan ledged with Govt. of West Bengal			
As per last Account		8,800.00	8,800.00
Sri Nilratan Sarkar Prize Fund :			
Fixed Deposit with SBI :			
As per last Account		15,000.00	
Add: This year		14,000.00	29,000.00
Sir J. C. Bose's Contribution through Trust Fund No. 1 :			
Fixed Deposit with SBI :			
As per last Account		36,000.00	
Add: This year		10,000.00	46,000.00
Samir Sinha Memorial Prize Fund :			
Fixed deposit with SBI :			
As per last Account		10,000.00	
Add: This year		3,500.00	13,500.00
Prof. S. M. Sarkar Lecture Fund :			
Fixed Deposit with SBI :			
As per last Account	4,000.00		4,000.00
A.E.C.D. Fund with P.F. Commissioner :			
As per last Account	6,213.96		6,213.96
Total	10,213.96	10,94,591.67	11,04,805.63

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. P.	Governing Body Rs. P.	Total Rs. P.
SCHEDULE NO. VII			
House Building Advance :			
As per last Account	27,75,513.00		
Add : Loan sanctioned during this year	4,60,250.00		
	32,35,763.00		
Less : Recovery during this year	3,07,123.00		
	29,28,640.00		
Add : For DIC 91-92	80,000.00	—	30,08,640.00

SCHEDULE NO. VIII

Security Deposit :			
Electric & Telephone			
As per last Account	57,369.00	75.00	57,444.00
Gas Cylinder			
As per last Account	12,550.00		12,550.00
Director's Bungalow			
Add : This year	15,000.00		15,000.00
As per last Account :			
Other	250.00		250.00
Petrol	5,000.00		5,000.00
Telex	10,000.00		10,000.00
Electric (WBSEB)			
Madhyamgram	2,160.00		2,160.00
Regional Computer Centre	1,000.00		1,000.00
	1,03,329.00	75.00	1,03,404.00

Bose Institute

CALCUTTA-700 009

Schedules to Consolidated Balance Sheet as at 31.3.1993

	Council Rs. p.	Governing Body Rs. P.	Total Rs. P.
SCHEDULE NO. IX			
Receivable Account :			
RSIC	37,859.79		37,859.79
Advance	3,12,831.34	54,600.00	3,67,431.34
Income Tax Staff	115.02		115.02
Festival Advance	2,12,417.03		2,21,417.03
Bank Suspense	6,892.04		6,892.04
Advance Remittance	2,75,987.00		2,75,987.00
Suspense (M.T.)	6,14,863.97		6,14,863.97
Receivable from overseas suppliers	76,518.54		76,518.54
Platinum Jubilee Celebration	1,03,355.17		1,03,355.17
Receivable from Institute Staff	14,358.50		14,358.50
	16,55,198.40	54,600.00	17,09,798.40

SCHEDULE NO. X

Cash & Bank Balances :			
In hand	941.96	2,003.00	2,944.96
With United Bank of India	28,47,182.16		28,47,182.16
With Union Bank of India (On Savings Account)	3,58,651.45		3,58,651.45
With Grindlays Bank plc. (On Savings Account)	39,93,414.28		39,93,414.28
With State Bank of India	—	1,64,281.49	1,64,281.49
	72,00,189.85	1,66,284.49	73,66,474.34

Sd/-
S. Pal
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
P. K. Ray
Director
Bose Institute

Bose Institute

CALCUTTA

**SCHEDULE NO. XI: NOTES FORMING PART
OF ACCOUNTS FOR 1992-93****1. Land :**

Madhyamgram : Government of West Bengal acquired plots of land measuring 40.99 acres for Sir J. C. Bose Centenary Laboratory Building, out of which a total of 18.73 acres was handed over to the Institute through certificate of possession on different dates. The balance land could not be handed over as the same was disputed. The Governing Body in its meeting held on 31.7.89 has decided not to claim the balance land from the Government of West Bengal, considering other related factors.

2. Fixed Assets :

(a) Register of Fixed Assets could not be compiled for identification, location, physical verification, valuation of fixed assets and for ascertainment of damaged and unserviceable items of fixed assets. Steps have been taken to prepare a Register of Fixed Assets at an early date.

(b) As per past practice no depreciation is being charged on fixed assets.

(c) The Institute has not sold or otherwise disposed off or mortgaged any property acquired by it with the Grants received from the Central Government.

3. Grant-in-Aid Scheme :

(a) The scheme accounts are usually treated on cash basis except for terminated schemes where all outstanding expenses and accrued incomes are taken into account.

(b) Unutilised portions of Grants-in-Aid schemes, sponsored by various bodies are included in Cash & Bank balance of the Institute. No separate Bank accounts are maintained for the same.

(c) Steps are taken for recovery of the receivables in respect of terminated Grand-in Aid Schemes. Where any amount is considered unrecoverable in the opinion of the Council the same is written off. A sum of Rs. 1,25,045.52 has been adjusted against Liability during the year under review.

4. As per consistently followed practice, the Institute has a hybrid system of accounting. In respect of items salary, gratuity, leave salary, interests on Banks deposits, prepaid service contract values, rates and taxes etc. cash basis is followed.

5. Funds required during the year for capital expenditure have been generated by transferring requisite amount from Plan grants. This has been done as the Central Government has provided grants during the year in lump-sum without earmarking any part thereof as Plan non-recurring Grant.

6. In respect of House Building Loans given to employees, interest becomes receivable after recovery of the principal amount in full. Interest is, therefore, accounted as and when they become receivable. This is being done as per Central Government guidelines.

7. In respect of festival advances given to employees there is a difference of Rs. 72.97 between the Ledger balance and the schedule. This has been reported in earlier years also and yet to be reconciled and adjusted.

8. Itemwise details in respect of workshop stores brought forward from 1991-92 amounting to Rs. 11,206.19 could not be prepared and produced to the Auditors for verification.

9. Bank Reconciliation :

ANZ Grindlays Bank Ltd. Cheques for Rs. 4,230/- deposited on 4.7.89 and Rs. 15,000 deposited on 2.2.91 have not been credited by the Bank till 31.3.93.

10. Contingent Liabilities :

(a) Letter of Credit	Rs. 23,52,543.34
(b) Bank Guarantee	Rs. Nil

In respect of the Bank Guarantees amounting to Rs. 2,64,713.00 issued by the Union Bank of India, margin deposits were made on various dates since

1982 aggregating to Rs. 52,959.00. Although all the Guarantees have since expired, the Bank continues to hold the deposit pending return of the Guarantee Bonds. Steps have been taken to recover the same from the Bank as early as possible.

11. Although by virtue of the provisions of Regulation 9 of the "Bose Institute Employees Pension Scheme Regulation" approved by the Government of India, Department of Science and Technology and Rule 3.3 of the "Bose Institute Contributory Provident Fund Rules", the Pension Fund, General Provident Fund and Contributory Provident Fund vested with the Bose Institute, separate Balance Sheet and Income and Expenditures Accounts have been drawn in respect of the said three Funds and appended hereto.

Sd/- S. Paul <i>Accountant</i> Bose Institute	Sd/- B. Chakraborty <i>Accounts Officer</i> Bose Institute	Sd/- T. K. Ghorui <i>Deputy Registrar</i> Bose Institute
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Sd/- A. J. Datta <i>Registrar</i> Bose Institute	Sd/- P. K. Ray <i>Director</i> Bose Institute
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Dated 12th July, 1993

Sd/-
G. BASU & CO.
Chartered Accountants

Bose Institute

CALCUTTA-700 009

*Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993*

Sl. No. (1)	Name of the Projects (2)	Balance Receivable (3)		Balance Payable (4)	
		Rs.	P.	Rs.	P.
1.	A.E.R.B.—Prof. S. C. Roy			16,569.13	
2.	Barun Standard No. 2, Prof. A.K. Mishra			6,255.96	
3.	Barun Standard No. 2, Prof. A.K. Mishra			50,070.78	
4.	DBT-Burn Standar—Prof. A.K. Mishra			50,623.32	
C. S. I. R. Schemes					
5.	Prof. A. K. Barua			95,064.00	
6.	Dr. Susweta Biswas			67,750.74	
7.	Prof. Bharati Ghosh			12,109.25	
8.	Prof. Asok Banerjee			49,392.72	
9.	Dr. Siddhartha Ray (Old)	1,403.87			
10.	Dr. Siddhartha Ray (New)	1,92,695.50			
11.	Prof. B. Bhattacharyya (Old)	514.96			
12.	Prof. B. Bhattacharyya (New)	15,525.20			
13.	Prof. B. B. Biswas	5,627.78			
14.	Prof. N. K. Sinha			1,622.74	
15.	Dr. Dolly Ghosh	1,240.98			
16.	Dr. Parimal Charan Sen	13,528.33			
17.	Prof. A. C. Ghosh			5,203.20	
18.	Dr. T. B. Samanta	9,238.34			
19.	Dr. Mrnas Ghakraborty			8,272.68	
20.	Prof. S. Ghosh	9,080.41			
21.	Prof. S. K. Sen			26,004.68	
22.	Prof. N. C. Mandal			1,709.70	
23.	Dr. Pratima Sinha			8,773.53	

(Contd.)

Bose Institute**CALCUTTA-700 009**

*Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993*

Sl. NO.	Name of the Projects	Balance Receivable		Balance Payable	
(1)	(2)	(3)		(4)	
		Rs.	P.	Rs.	P.
C. S. I. R. Schemes					
24.	Dr. Anuradha Lohia			28,16.74	
25.	Dr. D. N. Sengupta	2,971.59			
26.	Prof. A. N. Lahiri Mazumdar			73,920.61	
27.	Prof. Asok Banerjee (Old)			315.12	
28.	Dr. Amita Pal			2,996.72	
29.	Prof. Bharati Ghosh (Old)			21,644s51	
30.	Dr. Joyoti Basu	7,767.71			
31.	Dr. Monisha Bose	3.00			
32.	Dr. Swati Gupta			45,593.11	
C. S. I. R. Ad-hoc Fellowship					
33.	Biswajit Bera	438.33			
34.	Durba Bondhopadhyay			5,435.04	
35.	Papiya Roy Choudhuri			2,978.76	
36.	Thakurdas Saha			3,411.73	
37.	Sampa Pain	821.18			
38.	Tista Bhattacharyya			10,401.41	
39.	Sumita Bondhopadhyay	456.45			
40.	Anushree Bhattacharyya	7,395.53			
41.	Pradip Sarkar	7,843.15			
42.	Tapas Kumar Sengupta			117.63	
43.	Ashis Kumar Ghosh	9,318.24			
44.	Prankrishna Dutta			29,586.47	
45.	Ramaballav Roy			14,420.25	
46.	Goutam Riswas (Chem.)			18,946.46	
(Contd.)					

Bose Institute**CALCUTTA-700 009**

*Summary of the Grants-in-Aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993*

Sl. No. (1)	Name of the Projects (2)	Balance Receivable (3)		Balance Payable (4)	
		Rs.	P.	Rs.	P.
C. S. I. R. Ad-hoc					
47.	Rita Sarkar			3,651.43	
48.	Umesh Haldar	10,218.94			
49.	Sucheta Chanda	4,575.43			
50.	Eli Mukherjee			2,447.84	
51.	Nandan Lumar Jana	3,960.71			
52.	Sudip kumar Ghosh			15,430.48	
53.	Subrata Sow			1,746.60	
54.	Mrinal Kanti Maity	3,470.65			
55.	Biswendu Chowdhury			2,872.16	
56.	Santanu Roy Chowdhury			2,918.76	
57.	Suparna Sengupta			16,505.35	
58.	Dipti Bhattacharyya			3,687.35	
59.	Nirsingha Dey			2,558.73	
60.	Lopa Adhikari	2,713.33			
61.	Nizam Haidar			21,297.50	
62.	Dulal Panda			4,788.98	
63.	Ashis Kumar Mandal	3,795.06			
64.	Mahadev Pal	921.30			
65.	Alo Pal			3,254.20	
66.	Soumen Chottopadhyoy			11,356.89	
67.	Samir Ranjan Sikdar			7,869.13	
68.	Goutam Biswas (Bio)	5,413.81			
69.	Monikuntala Kundu			3,007.76	
70.	Joyoti Basu			12,472.18	
71.	Nabonita Sarkar			6,662.87	
72.	Sumita Seal			12,318.35	
73.	Utpal Dutta			25,923.88	
74.	Pritilata Nayak			9,207.12	
75.	Debjani Dutta			9,248.77	
76.	Narayan Chandra Mondal			4,223.11	
77.	Sadhana Majumdar			630.00	

(Contd.)

Bose Institute**CALCUTTA-700 009**

Summary of the Grant-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993

Sl. No.	Name of the Projects	Balance Receivable		Balance Payable	
(1)	(2)	(3)		(4)	
		Rs.	P.	Rs.	P.
C. S. I. R. Ad-hoc					
78.	Silvamenā Das				7,549.45
79.	Ashim Kumar Bhotra				2,515.62
80.	Samir Kumar Ray				13,338.01
81.	Naimuddin				5,423.18
82.	Sibsankar Roy	426.40			
83.	Goutam Adhikari				3,284.00
84.	Uptal Basu				3,850.00
85.	Bidyut Ghosh				10,560.03
86.	V. S. Reddy	534.25			
87.	Sadhu Leela Vati				17,554.07
88.	Chitnmoy Nandi				129.30
89.	Aparna Pal				27,369.12
90.	Susanta Kumar Dey				13,141.65
91.	Sagar Sona Jas				21,335.01
92.	Shymal Kumar Raha				17,806.67
93.	Neena Ghosh Dastidar				7,810.45
94.	Sujata Saha				322.44
95.	Rama Srinivasan				3,275.62
96.	Indranil Biswas				18,893.94
97.	Chaitali Bhowmik				18,876.30
98.	Subir Kumar Nag Das				643.45
99.	Subrata Majumdar				19,073.10
100.	Ashis Kumar Nandi				1,897.05

(Contd.)

Bose Institute**CALCUTTA-700 009**

Summary of the Grants-in-Aid Scheme and Ad-hoc Fellowships
Accounts of the year 1992-1993

Sl. No. (1)	Name of the Projects (2)	Balance Receivable (3)		Balance Payable (4)	
		Rs,	P,	Rs,	P,
C. S. I. R. Ad-hoc					
101.	Soma Pal			2,102.27	
102.	Pompi Basu			3,084.00	
103.	Debasish Ghosal			1,121.52	
104.	Debjani Ghosh			624.35	
105.	Amit Kumar Maity			5,205.21	
106.	Basanta Kumar Tiwary			1,705.15	
107.	Sankar Kumar Ghosh	2,371.05			
103.	Ranjan Kumar Nandi	4,627.00			
107.	Pallav Kumar Kundu			3,589.00	
110.	Anupama Saha		109.69		
111.	Bela Kishen			1,528.45	
112.	Saurav Gayen			3,352.00	
113.	Gopal Chakraborti	3,434.74			
114.	Mousumi Mitra	3,974.00			
115.	Chandana Roy Chowdhury	1,500.00			
116.	Suparna Dutta			625.00	
117.	Biswajit Roy	2,973.45			
118.	Ritikka Chanda	3,049.00			
C. S. I. R. Pool					
119.	Dr. Mrinal Kanti Guha			430.94	
120.	Dr. Anjana Banerjee			654.20	
121.	Dr. Manick Chandra Das			5,355.06	
122.	Dr. Anuradha Lohia			143.92	
123.	Dr. Anuradha Choudhury	4.58			

(Contd.)

Bose Institute**CALCUTTA-700 009**

Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993

Sl. No. (1)	Name of the Projects (2)	Balance Receivable (3)		Balance Payable (4)	
		Rs.	P.	Rs.	P.
D. A. E.—Schema					
124.	Prof. A. C. Ghosh	5,554.35			
125.	Dr. Parimal Chandra Sen			29,213.96	
D. A. E.—Fellows					
126.	Sri A. S. Risht			238.57	
Govt. of West Bengal					
127.	Dr. Sukumar Gupta			16,581.27	
128.	Dr. B. B. Mukherjee	8,600.00			
129.	Prof. S. K. Sen			17,765.73	
130.	Prof. Bharati Ghosh (N)			23,400.00	
131.	Prof. Bharati Ghosh (O)			11,603.77	
132.	Dr. A. L. Chanda			58,577.40	
D. S. T.—Schemes					
133.	Dr. S. Roy	2,08,448.96			
134.	Dr. T. B. Jaha			0.41	
135.	Dr. Monikuntala Kundu	9,863.05			
136.	D.S.T.—Gen. Eng.—Prof. B. B. Biswas	12,932.85			
137.	D.S.T.—Dr. Bimalendu Mitra	85,897.69			
138.	D.S.T.—S.E.R.C.—Prof. S. k. Sen			40,190.62	
139.	D.S.T.—Prof. D. P. Chakraborty	14,299.51			
140.	„ Prof. B. Ghosh	19,321.44			

(Contd.)

Bose Institute**CALCUTTA-700 009**

Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993

Sl. No.	Name of the Projects	Balance Receivable		Balance Payable	
(1)	(2)	(3)		(4)	
		Rs.	P.	Rs.	P.
D. B. T.					
141.	Dr. Pravakar Gupta	35,381.09			
142.	Dr. P. Gupta (Cloning)	95,718.03			
I.N.S.A.					
143.	Dr. Joyoti Basu				2,604.15
144.	Prof. S. Chanda	13.00			
I. C. A. R.—Scheme					
145.	Prof. Bharati Ghosh	59,535.40			
146.	Prof. S. Ghosh (Old)	67,063.01			
147.	Dr. Pravakar Gupta	1,88,698.32			
148.	Prof. Bharati Ghosh (O)	15,232.99			
149.	Dr. Susweta Biswas	1,92,078.10			
150.	Prof. S. Ghosh (New)				1,231.21
151.	Dr. Swati Sen Mandi	11,784.67			
152.	Prof. S. K. Sen No.-1	23,793.58			
153.	Prof. S. K. Sen No.-2	38,197.64			
154.	Prof. S. K. Sen No.-3				10,474.32
155.	Prof. D. P. Chakraborty	0.20			
I. C. M. R.—Scheme					
156.	Prof. Asoke Banerjee	8,894.53			
157.	Prof. A. C. Ghosh				2,899.72
158.	Prof. A. K. Barua				575.72
159.	Prof. Parul Chakraborty				31,019.29
160.	Prof. J. Dutta (New)	2,814.81			
161.	Prof. J. Dutta (Old)	13,228.60			
162.	Prof. S. Ghosh	14,086.62			
163.	Dr. Monikuntala Kundu				28,066.25

(Contd.)

Bose Institute**CALCUTTA-700 009**

*Summary of the Grants-in-aid Scheme and Ad-hoc Fellowship
Accounts for the year 1992-1993*

Sl. No.	Name of the Projects	Balance Receivable	Balance Payable
(1)	(2)	(3)	(4)
		Rs. P.	Rs. P.
I. C. M. R. Ad-hoc Fellows			
164.	Subha Manna	2,630.76	
165.	Sharmila Chattopadhyay	3,550.85	
166.	Mitali Pramanik		5.46
167.	Ram Prasad Mukherjee		12,807.74
168.	Rupali Sarkar		365.50
169.	Suohra Lahiri		774.56
170.	Debjani Dutta		6,595.00
INDO-US-Project			
171.	Prof. A. K. Barua		4,28,657.32
172.	Dr. S. C. Roy		48,505.62
173.	Prof. Parul Chakraborty		5,84,662.57
174.	ISM-No. 3 Prof. A. K. Mishra		19,954.02
175.	ONGC-ISM-No. 6 Prof. A. K. Mishra	31,985.60	
176.	ONGC-ISM-No. 5 Prof. A. K. Mishra	77,907.35	
177.	ORGANON PROJECT—Dr. T. B. Samanta		4,191.70
178.	CPT No. 1 Prof. P. K. Ray	55,801.30	
179.	CPT No. 2 Prof. P. K. Ray		4,50,114.28
180.	INDO-Bangladesh Cult Prog.		13,700.00

(Contd.)

Bose Institute**CALCUTTA-700 009**

*Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993*

Sl. No.	Name of the Projects	Balance Receivable	Balance Payable
(1)	(2)	(3)	(4)
		Rs. P.	Rs. P.
DBT—Projects			
181.	Dr. Prodosh Roy		8,714.98
182.	Dr. Amitava Ghosh	6,65,896.58	
183.	Dr. Ashalata Chandra		82.39
184.	Dr. P. Gupta (Course Work)	5,447.35	
185.	Dr. P. Gupta (W/Shop)	7,021.20	
186.	Prof. P. K. Ray		24,900.00
187.	Dr. Asoke Biswas		18,676.76
188.	Prof. A. C. Ghosh		5,44,994.14
189.	Dr. Geeta Nanda		2,91,458.41
190.	Dr. Pratima Sinha	54,577.04	
191.	Dr. P. Gupta	1,30,302.06	
192.	Yest Dr. P. Sinha	1,500.00	
193.	Dr. Gurupada Sarkar	451.80	
D. B. T.—Projects			
194.	U. N. D. P.—Project		6,55,177.12
195.	C. P. M. B. —Project		3,07,336.63
196.	Post Doctoral Training Programme		7,39,356.57
197.	U. S. D. A. (Ferro) Prof. S. K. Sen	2,09,170.99	
N. I. H.—Scheme			
198.	Prof. P. Chakraborty		16,792.92
Dept. of Environment			
199.	Dr. Kalyani Sen		3.08

(Contd.)

Bose Institute

CALCUTTA-700 009

Summary of the Grants-in-aid Scheme and Ad-hoc Fellowships
Accounts for the year 1992-1993

Sl. No.	Name of the Projects	Balance Receivable	Balance Payable
		(3)	(4)
(1)	(2)	Rs. P.	Rs. P.
U. G. C.			
200.	Dr. Asima Lahiri Mazumdar	17,293.65	
201.	Dr. Pritilata Nayak	32,274.06	
202.	Dr. Nalini Jasani Gupta	16,690.94	
203.	Sudip Chatterjee		32,100.00
204.	Nilam Sanjib Banerjee		64,200.00
205.	Purba Mal		64,200.00
206.	Golam Faruk		56,655.10
207.	Dr. A. C. Nath		14,754.82
208.	Dr. Arun Banerjee	0.20	
209.	Mousumi Mondal		31,222.40
210.	Amitava Chatterjee	9,404.62	
211.	T. Anoop Kumar		21,876.44
212.	Dr. Uma Bhattacharyya		.04

Rockefeller Foundation

213.	Prof. S. K. Sen		34,792.47
214.	S. D. D. Prof. S. C. Ray		12,334.83
215.	INDO-EC Prof. P. Chakraborty		17,60,821.20
216.	D. I. C.		2,39,518.12

(Contd.)

Bose Institute

CALCUTTA-700 009

Summary of the Grants-in-aid Scheme Ad-hoc Fellowships
Accounts for the year 1992-1993

Sl. No.	Name of the Project	Balance Receivable	Balance Payable
		(3)	(4)
(1)	(2)	Rs. P.	Rs. P.
217.	D. N. E. S. Prof. P. Chakraborty	722.91	
218.	Hindusthan Lever Dr. B. Ghosh		985.99
219.	Hindusthan Lever Prof. S. K. Sen	459.00	
		<u>27,98,470.64</u>	<u>78,45,986.53</u>
	Balance Payable	Rs. 78,45,986.53	
	Balance Receivable	Rs. 27,98,470.64	
		<u>Rs. 50,47,515.89</u>	

Net Balance Payable in respect Grants-in-aid Projects transferred to Balance Sheet—Rs. 50,47,515.89

Sd/- S. P. Sith Accountant Bose Institute	Sd/- B. Chakraborty Accounts Officer Bose Institute	Sd/- T. Ghorui Dy. Registrar Bose Institute	Sd/- A. J. Dutta Registrar Bose Institute	Sd/- Prof. P. K. Ray Director Bose Institute
--	--	--	--	---

Bose

93/1, Acharya Prafulla Chandra Road
EMPLOYEES' GENERAL PROVIDENT

Balance Sheet as

As at 31st March, 1992 Rs. P.	FUND & LIABILITIES	Rs.	P.	Rs.	P.	As at 31st March, 1993 Rs. P.
	G. P. F. Accumulation Bose Institute Members :					
97,02,846.00	Balance as per last Account	97,02,846.00				
	Add : Subscription for 1992-93	25,88,143.00				
	Interest allowed to Subscriber for 1992-93 @ 12%	11,00,770.00		1,33,91,759.00		
	Less : Withdrawal during 1992-93	11,65,979.00				
	Excess Interest recovered from Subscribers	3,387.00				
	Amount Transferred to R.S.I.C.	11,514.00		11,80,880.00		1,22,10,879.00
7,06,922.00	R.S.I.C. Members :					
	Balance as per last account	7,06,922.00				
	Add : Subscriptions for 1992-93	1,61,894.00				
	Amount transferred from Bose Institute	11,514.00				
	Interest paid to Subscribers for 1992-93 @ 12%	81,439.00		9,61,769.00		
	Less : Withdrawal during 1992-93			1,00,000.00		8,61,769.00
1,999.60	Amount Payable Excess of Income over Expenditure carried forward					56,173.06
1,04,11,767.60				Total		1,31,28,821.06

31st August—1993
Calcutta

Sd/-
T. K. Mukherjee
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta—700 009
FUND

31st March, 1993

As at 31st March, 1992 Rs. P.	PROPERTIES & ASSETS	Rs.	P.	As at 31st March, 1993 Rs. P.
	Investments :			
85,30,800.00	Fixed Deposit with State Bank of India (as per last Account)	85,30,800.00		
	Add : Addition in 1992-93	23,00,000.00		1,08,30,800.00
3,460.00	Income tax Recoverable (as per last Account)			3,460.00
15,09,406.00	Advance outstanding from Subscribers of : Bose Institute	15,17,915.00		
	R. S. I. C.	1,04,819.00		16,22,734.00
58,482.00	Amount Receivable from : Bose Institute	36,108.00		
	R. S. I. C.	2,700.00		38,808.00
2,12,251.00	Interest Accrued but not received on Fixed Deposit			2,40,085.00
	Bank Balance : With State Bank of India :			
83,275.66	Savings Bank Account			3,92,934.06
14,092.94	Excess of Expenditure over Income			—
1,04,11,767.60				Total 1,31,28,821.06

In terms of our Report of even date.

Sd/-
A. J. Datta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants

Bose

93/1, Acharya Prafulla Chandra Road
EMPLOYEES' GENERAL

Income and Expenditure Account for the year ended

1991-92		EXPENDITURE		1992-93	
Rs.	P.			Rs.	P.
		To			
		Interest @ of 12% for 1992-93 to			
		Subscribers of :			
9,16,665.00		Bose Institute	11,00,770.00		
70,707.00		R. S. I. C.	81,439.00	11,82,209.00	
200.00		Bank charges		200.00	
6,70,517.03		Bose Institute Contributory			
		Provident Fund Account			
89,37,344.74		Bose Institute Employee's			
		Pension Fund Account			
4,09,843.47		Balance Carried Down		70,266.00	
1,10,05,277.24				12,52,675.00	
		TOTAL			
		To			
4,23,936.41		Balance Brought Forward			
		from last year		14,092.94	
		Excess of Income over Expenditure			
		carried forward to Balance Sheet		56,173.06	
4,23,936.41				70,266.00	
		TOTAL			

31st August—1993
Calcutta

Sd/-
T. K. Mukherjee
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta-700 009
PROVIDENT FUND

31st March, 1993

1991-1992		INCOME	1992-93	
Rs.	P.		Rs.	P.
13,89,810.97		By Interest on Fixed Deposit	12,35,838.00	
2,157.50		Interest on Savings Bank	13,450.00	
5,447.00		Interest recovered from Subscriber	3,387.00	
6,70,517.03		C. P. F. Accumulation :		
		Bose Institute		
		R. S. I. C.		
89,37,344.74		P. F. Officer Contribution :		
		Bose Institute		
		R. S. I. S.		
1,10,05,277.24				
		TOTAL	12,52,675.00	
4,09,843.47		By Balance Brought Down	70,266.00	
14,092.94		Excess of Expenditure over Income		
		carried forward to Balance Sheet for 1991-92		
4,23,936.41				
		TOTAL	70,266.00	

In terms of our Report of even date,

Sd/-
A. J. Dutta
Registrar
Bose Institute
7

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants

Bose

93/1, Acharya Prafulla Chandra Road
COUNTRIBUTORY PROVIDENT

Income & Expenditure Account for the year ended

1991-92		EXPENDITURE	1992-93	
Rs.	P.		Rs.	P.
		To Interest @ 12% for 1992-1993 to Subscribers of :		
61,178.00		Bose Institute	79,262.00	
9,075.00		R. S. I. C.	<u>10,164.00</u>	89,426.00
100.00		Bank charges		—
—		Balance Carried Down		8,750.67
<u>70,353.00</u>		TOTAL		<u>98,176.67</u>
—		To Balance Brought Forward from last year		26,565.67
26,565.67		Balance Brought down		—
<u>26,565.67</u>		TOTAL		<u>26,565.67</u>

31st August—1993
Calcutta

Sd/-
T. K. Mukherjee
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta—700 009

FUND

31st March, 1993

1991-92	INCOME	1992-93
Rs. P.		Rs. P.
23,833.33	By Interest on Fixed Deposit	92,374.67
16,266.00	—do— Savings Bank	5,802.00
3,688.00	—do— received from Employees	—
26,565.67	Balance carried down	—
<u>70,353.00</u>	TOTAL	<u>98,176.67</u>
—	By Balance Brought down	8,750.67
26,565.67	Excess of Expenditure over Income, Transferred to balance Sheet	17,815.00
<u>26,565.67</u>	TOTAL	<u>26,565.67</u>

In terms of our Report of even date.

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants

Bose

93/1, Acharya Prafulla Chandra Road
CONTRIBUTORY PROVIDENT

Balance Sheet as

As at 31st March, 1992 Rs. P.	FUND & LIABILITIES				As at 31st March, 1993 Rs. P.
	Rs.	P.	Rs.	P.	
	C. P. F. Accumulation :				
6,84,096.79	Bose Institute :				
	Balance as per last Account				6,84,096.79
	Add : Member's Subscription				
	Subscription	20,619.00			
	Employee's Contribution	20,619.00			
	Voluntary Subscription	80,790.00	1,22,028.00		
	Add : Interest allowed				
	@ 12% for 1992-93				79,262.00
			8,85,386.79		8,85,386.79
	R. S. I. C. :				
84,697.87	Balance as per last Account				84,697.87
	Add : Member's				
	Subscription				NIL
	Employer's Contribution				NIL
	Voluntary Subscription				NIL
	Interest allowed				
	@ 12% for 1992-93				10,164.00
		10,164.00	10,164.00		94,961.87
13,010.00	Amount Payable				—
7,81,804.66	TOTAL				9,80,248.66

31st August—1993
Calcutta

Sd/-
T. K. Mukherjee
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

Institute

Calcutta-700 009

FUND

at 31st March, 1993

As at 31st March, 1992 Rs. P.	ASSETS & PROPERTIES		As at 31st March, 1993 Rs. P.
		Rs. P.	
	Investment :		
	Fixed Deposit with State Bank of India :		
5,50,000.00	Balance as per last Account		5,50,000.00
	Add : Addition in 1992-93		2,50,000.00
2,570.00	Advance outstanding		
	from Subscriber of Bose Institute		18,640.00
10,464.60	Amount Receivable		
	from Bose Institute Account		12,245.00
	Interest Accrued but not		
5,958.33	received on Fixed Deposit		9,208.00
	On Savings Bank		5,802.00
	Bank Balance with State Bank of India :		
1,86,246.06	Savings Bank Account		1,27,549.06
	Less : Cheques Issued from		
	Current Account		11,010.40
1,26,565.67	Excess of Expenditure over Income		
	transferred from Income and		
	Expenditure Account		17,815.00
7,81,804.66	TOTAL		9,80,248.66

In terms of our Report of even date.

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants

Regional Sophisticated Instrumentation Centre, Calcutta

AUDITOR'S REPORT

We have audited the attached Balance Sheet of Regional Sophisticated Instrumentation Centre as at 31st March, 1993 and the Income and Expenditure Account for the year ended on that date which are in agreement with the books of Account and records produced to us.

Subject to the following observations, in our opinion and on the basis of the information and explanations given to us, the Balance Sheet gives a true and fair view of the state of affairs of the Centre as at 31st March, 1993 and the Income and Expenditure Account gives a true and fair view of the deficit, i.e., excess of expenditure over Income for the year ended on that date.

(1) Details of Fixed Assets were not made available for our verification.

(2) No depreciation has been provided on Fixed Assets as per consistent past practice. The amount of arrear depreciation has not been ascertained.

(3) Sundry Creditors for goods includes a sum of Rs. 13,37,382 for which no document could be produced for our verification. The said account also includes a sum of Rs. 58,439.36 lying unpaid for nine (9) years.

(4) Additions to Equipment this year for Rs. 11,47,232 and additions to Spares this year for a sum of Rs. 1,90,150 could not be verified in the absence of relevant documents.

(5) Margin Money against Bank Guarantee amounting to Rs. 16,400 against Letter of Credit opened through Union Bank of India is lying unadjusted for nine (9) years. No confirmation certificate from the Bank in respect of the above amount was produced for our verification.

Sd/-

G. BASU & CO.

Chartered Accountants

REGIONAL SOPHISTICATED

Managed by
Calcutta

Balance Sheet as at

As at 31st March 1992		1992-93		As at 31st March 1993	
Rs.	P.	Rs.	P.	Rs.	P.
FUND & LIABILITIES					
Grant-in-Aid Account :					
2,42,27,812.93	As per last Account	2,47,27,812.93			
5,00,000.00	Add : Grants Non-Recurring from D.S.T.	10,00,000.00		2,57,27,812.93	
Sundry Creditors					
58,439.36	For Goods	13,95,821.36			
7,732.00	P. F. Contribution	2,400.00			
4,338.00	P. F. Advance	300.00			
12.00	Professional Tax	42.00		13,98,563.36	
30,783.25	Advances from Customers (Sample Testing)			28,774.25	
410.22	Co-operative A/c.			410.22	
18,325.20	Insurance Payable (Salary Saving)				
7,87,416.39	Bose Institute A/c. For salary and Medical			37,859.79	
2,56,35,269.35	Total			2,71,93,420.55	

Sd/-
S. P. Sath
Accountant
Bose InstituteSd/-
B. Chakraborty
Accounts Officer
Bose InstituteSd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

INSTRUMENTATION CENTRE

Bose Institute
700 009

31st March, 1993

As at 31st March 1992		1992-93		As at 31st March 1993	
Rs.	P.	Rs.	P.	Rs.	P.
ASSETS & PROPERTIES					
Fixed Assets :					
Equipment :					
1,92,09,345.73	As per last A/c.	1,92,09,345.73			
	Add : Addition during the year	11,47,232.00		2,03,56,577.73	
Spares (Plan) :					
41,74,991.17	As per last A/c.	41,74,991.17			
	Addition during the year	3,32,186.20		45,07,177.37	
Furniture & Air Conditioner :					
3,13,773.20	As per last A/c.			3,13,773.20	
Current Assets, Loan and Advances :					
12,92,220.52	Cash & Bank Balances				
	Cash in hand	17,251.84			
	Cash with Scheduled Bank in Savings Bank A/c.	8,41,606.53			
	Margin Money against Bank Guarantee	16,400.00		8,75,258.37	
Advances Recoverable in Cash or in kind or for value to be Received :					
14,8000.00	Advance	1,000.00			
	Festival Advance	15,360.00			
	House Building Advance	1,26,250.00		1,42,610.00	
Accrued Grant Account :					
2,00,000.00	Receivable from D.S.T.			5,00,000.00	
4,30,138.73	Excess of Expenditure over Income Transferred from Income & expenditure Account			4,98,023.88	
2,56,35,269.35	Total			2,71,93,420.55	

As per our Report attached.

Sd/-
A. J. Datta
Registrar
Bose InstituteSd/-
Prof. P. K. Ray
Director
Bose InstituteSd/-
G. Basu & Co.
Chartered Accountants

REGIONAL SOPHISTICATED

Managed by

Calcutta

Income & Expenditure Account for the

1991-92		EXPENDITURE		1992-93		1992-1993	
Rs.	P.			Rs.	P.	Rs.	P.
To							
Staff Remuneration and Benefit :							
6,91,202.00		„ Pay (Incluning Arrear dues on 608 C.P.I.)		8,04,599.00			
3,86,768.00		„ Dearness Allowances		5,55,533.00			
1,37,538.00		„ House Rent Allowances		1,33,981.00			
24,173.00		„ City Compensatory Allowances		23,297.00			
31,027.00		„ Medical Reimbursement		27,000.00			
28,560.00		„ Leave Salary		—			
35,700.00		„ Pension & Gratuity Contribution		2,95,000.00			
7,033.00		„ Bonous		4,213.00		18,43,623.00	
5,050.00		„ Travelling Expenses				23,548.00	
„ Consumable/Laboratory Expenses :							
69,007.70		„ Laboratory Expenses		1,68,159.00			
22,274.81		„ Contingency		21,802.38			
46,051.02		„ Expenditure for FTNMR		11,802.12		2,01,763.50	
„ Other Expenses :							
1,91,413.50		„ Maintenance/Repair		61,504.00			
13,454.23		„ General Charges		7,563.15			
—		„ Bank Charges		476.00		69,543.15	
16,89,252.26		Total				21,38,477.65	
2,02,781.97		„ Excess of Expenditure over Income Brought Forward				4,30,138.73	
2,27,356.76		„ Excess of Expenditure over Income for this year				67,885.15	
4,30,138.73		Total				4,98,023.88	

Sd/-
S. P. Sith
Accountant
Bose Institute

Sd/-
B. Chakraborty
Accounts Officer
Bose Institute

Sd/-
T. K. Ghorui
Dy. Registrar
Bose Institute

INSTRUMENTATION CENTRE

Bose Institute

700 009

year ended 31st March, 1993 (Non-Plan)

1991-92		INCOME		1992-1993		1992-93	
Rs.	P.			Rs.	P.	Rs.	P.
By							
SOURCE OF INCOME							
14,00,000.00		Grants Received from DST (Govt. of India)				20,00,000.00	
11,400.00		Miscellaneous Receipt				3,000.00	
11,845.50		Bank Interest				22,159.00	
38,650.00		Consultancy Fees (Sample Testing)				45,433.50	
By							
2,37,356.76		Excess of Expenditure over Income for this year carried down				67,885.15	
16,89,252.26		Total				21,38,477.65	
4,30,138.73		By Balance Transferred to Balance Sheet				4,98,023.88	
4,30,138.73		Total				4,98,023.88	

Sd/-
A. J. Dutta
Registrar
Bose Institute

Sd/-
Prof. P. K. Ray
Director
Bose Institute

Sd/-
G. Basu & Co.
Chartered Accountants

CB-SV-2010

Acc No.

Handwritten text at the bottom of the right page, appearing to be a list or index of items, possibly related to the account number CB-SV-2010.