

# Bose Institute

Set up by Acharya J. C. Bose in 1917, Bose Institute, Kolkata has come a long way in achieving its purpose of investigating fully "the many and ever opening problems of the nascent science which includes both life and non-life".

**F**ounded by Acharya Sir Jagadis Chandra Bose in 1917 for the advancement of science and dissemination of knowledge, the Bose Institute has served the nation for the past 93 years through its pursuit of advancement of knowledge in science and technology and by developing highly competent and able scientific manpower for the country. The Institute has on its staff highly qualified and experienced scientists devoted to original and path breaking research in the fields of Plant Sciences, Structural Biology, Molecular Biology, Biomedical Sciences, Biotechnology, Quantum Mechanics, Astrophysics and Condensed Matter Physics.

Bose Institute started originally with three departments, Botany, Chemistry and Physics. With time more departments like the Animal Physiology Section (1930), Department of Microbiology (1942), Department of Biochemistry (1974), the Plant Tissue Culture Section (1976, subsequently renamed Plant Molecular & Cellular Genetics Section in 1989), Department of Biophysics (1985), the Environmental Science Section (1992) and the

Immunotechnology Section (1992) were added. Very recently, a division of Molecular Medicine has been established, encompassing the sections of Animal Physiology and Immunotechnology, along with the induction of a few scientists from the Departments of Chemistry and Microbiology. In addition, the institute hosts support and service centres like the Central Instruments Facility, the Distributed Information Centre, Library, Workshop, J.C. Bose Centre comprising the Museum and the Publication sections. The wide-ranging and comprehensive base of available scientific infrastructure at Bose Institute also comprises the Acharya J.C. Bose High Altitude Research Centre at Darjeeling and the experimental field stations at Falta, Madhyamgram and Shyamnagar respectively. Recent augmentations include the establishment of a National Facility on Proteomics and Genomics, a National Facility on Astroparticle Physics and Space Sciences, a Centre of Excellence in Bioinformatics, a Rural Biotech-nology Training Centre at Falta and the J.C. Bose Biotechnology Innovation Centre based at the Madhyamgram campus.

The facilities available in the institute for scientific enquiry and its applications also cater regularly to the scientists from several universities and research centres in the country. Special efforts have been undertaken to upgrade and modernize the library of The Bose Institute during the recent years.

The eminence of Bose Institute scientific research spanning a wide range of disciplines is evident from the large number of research publications in the most competitive peer reviewed international and national journals, the recognition received by the scientists in the form of S.S. Bhatnagar Prize, INSA young scientist award, fellowship of the National Science Academies, fellowship of the Third World Academy of Science, Nehru Fellowship, K.S. Krishnan Fellowship, Rockefeller Foundation fellowship and Homi Bhabha fellowship. The institute has over the years provided yeoman service in manpower development, having trained a large number of Ph.D. students many of whom are now reputed experts in their fields in India and abroad. On an average, 30-40 scholars are awarded Ph.D. degree ►►



Bose Institute, 93/1, Acharya Prafulla Chandra Road, Kolkata-700 009, West Bengal, India ([www.boseinst.ernet.in](http://www.boseinst.ernet.in))

► every year. Over the past decade, scientists of Bose Institute have maintained an enviable record of publication in peer reviewed journals. A number of its scientists and research scholars participate every year in numerous academic activities (seminars, conferences, workshops) in India and abroad as invited speakers, chairpersons and resource persons. A large number of extramural research projects, with support from various government agencies as well as international funding agencies, are carried out at Bose Institute.

### **Research Activities**

At the time of founding Bose Institute, the illustrious founder, Sir J. C. Bose had unequivocally declared that the objective of this Institute would be to practice seamless science, without compartmentalisation on the basis of specialisation. Bose Institute strives to achieve this ideal, encouraging inter-disciplinary research to the fullest. Broadly, the current research activities of our scientists cover the following areas:

#### **Improvement of Plants**

Biotechnological, Genomic and Proteomic Approaches:

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

#### **Protein Structure, Function and Engineering**

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

#### **Bioinformatics & Computational Biology**

Bioinformatics Centre was inception in 1988 as one of the nine nodal centres under the programme, Biotechnology Information System of the DBT with genetic engineering and molecular modelling as the two major thrust areas. Since then the centre is functioning as a repertoire of information related to bio-informatics and its dissemination in Eastern India. It provides computational facilities to carry out research in genome analysis, molecular modelling, plant genomics and proteomics, biomolecular structure determination (through NMR and X-ray crystallography), protein structure analysis, protein-protein interaction, docking and molecular recognition, protein folding and threading etc. The Bioinformatics Centre has the distinction of being designated as Centre of Excellence of the Department of Biotechnology, Government of India.

#### **Molecular Medicine**

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

#### **Microbial Genomics and Infection Biology**

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

#### **Development of Systems Biology**

Scientists have taken system level approaches combining mathematical modeling with cell biological experiments to dissect the functional organization of various genes, proteins and transcription factors in relation to development of cancer, tuberculosis and other diseases; and the biology of pathogens.

#### **Basic and Applied Problems in Physical and Environmental Sciences**

The Department of Physics contributes both to fundamental knowledge as well as applications relevant to industry and society in general. The Department's current research activities are in the areas of ►►

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- Radiation Physics; Statistical Mechanics; Foundations of Quantum Mechanics and Quantum Entanglement; Astrophysics of Strongly Interacting Matter; Characterization of Detector Materials for Heavy Ions; Preparation and Characterization of Dielectric Materials, Condensed Matter Physics, Nuclear and High Energy Physics, Astroparticle Physics and Cosmology. Recently, intense activities have also been initiated in Millimeter Wave and Microwaves as well as atmospheric sciences. In other experimental stations attempts are being put forward to translate the knowledge acquired at plant molecular biological

laboratories to the field.

### Human Resource Development

Bose Institute has recently started a new chapter in the realm of manpower development. In collaboration with the University of Calcutta, an integrated M.Sc.-Ph.D. course in Plant Molecular Biology & Technology has been initiated in September 2007. This is the first time in India that a national institute and a university are awarding joint degrees; rather than depleting the resources of a university, this may serve as a model for cooperation and collaboration for the overall growth in the academic sphere. Also in September 2007, a four semester

M.Sc. course in Physics, with specialisation in Astrophysics & Space Sciences has been started in collaboration with St. Xavier's College, Kolkata.

### Science and Society

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



**Sibaji Raha**, Senior Professor of Physics and Director, Bose Institute obtained his M.S. in Physics from the University of Delaware, USA and Doctor of Philosophy in Physics from the University of Texas at Austin, USA. After several years of research in Germany and France, he returned to India to join the faculty of Saha Institute of Nuclear Physics, Kolkata and moved to Bose Institute in 1991 where he has been since then. He assumed the office of the Director, Bose Institute in 2006. He has held a number of prestigious concurrent appointments like the Centre of Excellence Professorship at Osaka University, Invited Professorship (National Contingent) of the Ministry of Education, France, Visiting Director of Research of the Centre National de Recherche Scientifique (CNRS), France, Visiting Professorship at the University of Sao Paulo, Brazil, Senior Visiting Scientist, Brookhaven National Laboratory, USA and many more. His research interests are quite diverse, including nuclear and particle physics (both experimental and theoretical), atmospheric and environmental sciences and global change.

### Biotech News (BTN): What are the three most important research findings at the Institute during the last five years?

#### Prof. S Raha: (SR):

- i) In the area of plant biotechnology, two molecular markers have been developed to screen Mung bean Yellow Mosaic India Virus-resistant germplasms of *V. mungo* and *V. radiata*. This method of genotyping would replace time consuming rigorous phenotyping procedure which is in vogue.
- ii. Antibiotic resistance selection marker free insect resistant transgenic rice plants were generated (with DBT support)
- iii. Two markers [CYR1 (EU 258701) and YR4 (EU 258700)] linked with Mungbean Yellow Mosaic India Virus (MYMIV)-resistance in *Vigna mungo* have been developed using RGA- primers. These two markers have been successfully employed to screen MYMIV-resistant germplasms of *V. mungo* and *V. radiata*. This method of genotyping would replace time consuming rigorous phenotyping procedure which is in vogue.

### BTN: Which are the five best publications emanating from the institute during the last three years?

#### SR:

I. Gupta, S., Chakrabort, D., Sengupta, A., Basu, D. and

- Das, S. (2010) Primary Metabolism of Chickpea is The Initial Target of Wound Inducing Early Sensed Fusarium oxysporum f.sp. ciceri Race I. *PLoS ONE*, Volume 5 | Issue 2 | e9030
2. Roy Choudhury S, Roy S, Singh S K and Sengupta D N (2010) Understanding the molecular mechanism of transcriptional regulation of banana Sucrose phosphate synthase (SPS) gene during fruit ripening: an insight into the functions of various cis-acting regulatory elements, *Plant Signaling & Behavior*, 5:5, 1-5.
3. Chakraborty J, Banerjee S, Ray P, Hossain DMS, Bhattacharyya S, Adhikary A, Chattopadhyay S, Das T & Sa G. Gain of cellular adaptation due to prolonged p53 impairment leads to functional switch-over from p53 to p73 during DNA damage in acute myeloid leukemia cells. *J. Biol. Chem.* 285: 33104-33112, 2010
4. Kundu M., Pathak S K, Kumawat K, Basu S, Chatterjee G, Pathak S, Noguchi T, Takeda K, Ichijo H, Thien C B F, Langdon W Y and Basu J (2009) A tumor necrosis factor- and c-Cbl-dependent FLIPS degradation pathway and its role in Mycobacterium tuberculosis-induced macrophage apoptosis, *Nature Immunol.* 10, 918-925.
5. Sarkar, A., Hess, D., Mondal, H.A., Banerjee, S., Sharma, H.C. and Das, S. (2009) Homodimeric alkaline phosphatase located at *Helicoverpa armigera* midgut, a putative receptor of CryIAc contains -GalNAc in terminal glycan structure as interactive epitope. *Journal of Proteome Research* 8, 1838-1848

### BTN: Which technologies have been transferred to industry/user agencies recently?

**SR:** 1. Salt-tolerant L-myo-inositol 1-phosphate synthase and the process of obtaining the same.  
2. *Allium sativum* leaf lectin (ASAL) expression technology developed at Bose Institute for generating insect resistance in plants had been transferred to MAHYCO Ltd in August, 2009

### BTN: How is Bose Institute promoting innovation?

**SR:** Scientists of Bose Institute are involved both in Basic and Applied Research. Scientists are being encouraged to get patent(s) for their invention followed by initiate discussion with potential Entrepreneurs for developing programme(s) of mutual interest.

### BTN: What measures is Bose Institute taking to attract first-rate human resource?

**SR:** Bose Institute has taken initiative to start an integrated M.Sc. Ph.D. Programme in Plant Molecular Biology & Biotechnology in collaboration with the University of Calcutta to attract human resource from level of graduation to nurture them to become practicing scientists at the cutting edge of research. ■