CSIR-IICB वार्षिक प्रतिवेदन ANNUAL REPORT- 2013-14

वार्षिक प्रतिवेदन

Annual Report 2013-14

सी एस आई आर - भारतीय रासायनिक जीवविज्ञान संस्थान

CSIR- Indian Institute of Chemical Biology

4. Raja S. C. Mullick Road, Kolkata- 700 032

सीएसआईआर-आईआईसीबी

CSIR-IICB

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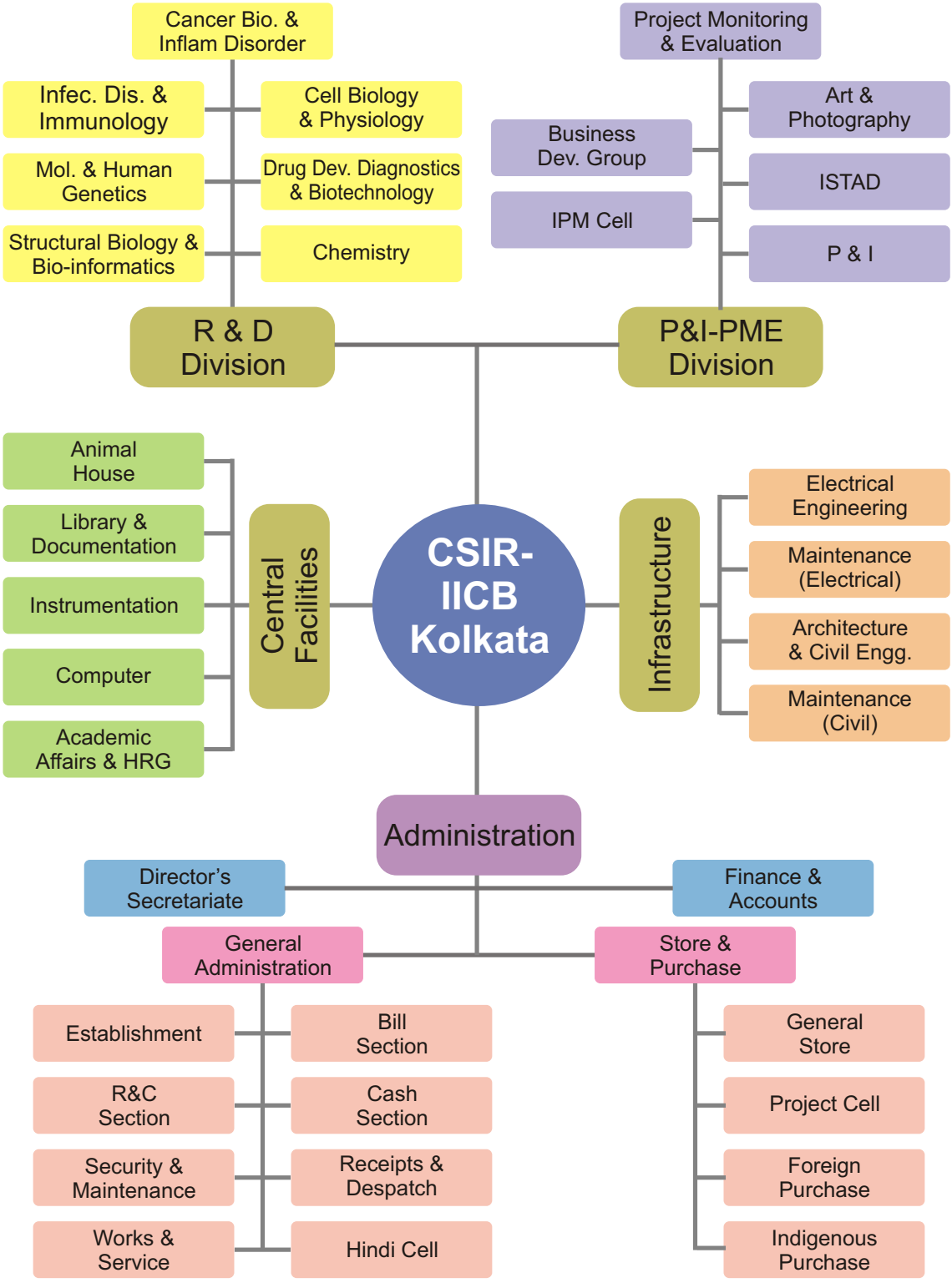
CSIR-IICB Kolkata
R & D Division
Cancer Bio. & Inflam Disorder
Infec. Dis. & Immunology
Cell Biology & Physiology
Mol. & Human Genetics
Drug Dev. Diagnostics & Biotechnology
Structural Biology & Bio-informatics
Chemistry
P&I-PME Division
Project Monitoring & Evaluation
Art & Photography
Business Dev. Group
ISTAD
IPM Cell
P & I
Central Facilities
Animal House
Library & Documentation
Instrumentation
Computer
Academic Affairs & HRG
Infrastructure
Electrical Engineering
Maintenance (Electrical)
Architecture & Civil Engg.
Maintenance (Civil)
Administration
Director's Secretariate
Finance & Accounts
General Administration
Store & Purchase
Establishment
Bill Section
R&C Section
Cash Section
Security & Maintenance
Receipts & Despatch
Works & Service
Hindi Cell
General Store
Project Cell
Foreign Purchase
Indigenous Purchase

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Director's Report

It is my great privilege to present the Annual Report of CSIR-Indian Institute of Chemical Biology with a quick look of major activities of this Institute for the period from April 2013 to March 2014. This report is an indication of our growth and a document of our accountability when Prof. Siddhartha Roy was the Director of this Institute. The role of CSIR-IICB in 'Affordable healthcare through modern science' is well recognized since its early days. Every year the Institute publishes its Annual Report to disseminate a brief description of our research activities to our friends, well wishers and scientific communities across the globe. Apart from the scientific contributions, this report also includes critical information about our infrastructure, extramural funding, intellectual property and other various aspects of scientific management and administration.

The institute embodies a symbiosis between chemistry and biology that translates to a commitment to advance affordable healthcare for all. The institute is engaged in research on diseases of national importance and biological problems of global interest, employing sophisticated state-of-the-art technology in keeping pace with the rapid and unprecedented momentum that life science research has gained globally over the last 50 years. CSIR-IICB is one of the major institutes in India which initiated, right from its inception, multi-disciplinary concerted efforts for conducting basic research on infectious diseases, specifically leishmaniasis and cholera, along with the development of technologies for the diagnosis, immunoprophylaxis and chemotherapy of the diseases. We have offered substantial attention in developing drug from our indigenous and natural resources like native Indian plants.

CSIR-IICB Infrastructure continues to be upgraded. The new campus at Salt Lake is completed. The institute made considerable progress in setting up the CSIR Innovation Complex, Kolkata initially at its Salt Lake

campus. In near future the innovation complex involving six Eastern zonal laboratories will be established in the Southern fringe of Kolkata (at Baruipur). CSIR-IICB is continuing to function as the mentor institute for National Institute of Pharmaceutical Education and Research (NIPER), Kolkata.

CSIR-IICB now holds seven major scientific divisions: Cell Biology & Physiology, Infectious Disease & Immunology, Cancer Biology & Inflammatory Disorder, Chemistry, Drug Development, Diagnostics & Biotechnology, Molecular & Human Genetics and Structural Biology & Bioinformatics. Scientists are continuing their efforts to unravel the molecular basis of cancer, altered immune responses during chronic infection and inflammation, and the pathophysiology of several metabolic and neurodegenerative disorders such as diabetes and Parkinson's disease. The successful implementation of the human genome project has raised new hopes of identifying genes responsible for complex human diseases at a much faster rate than ever. Accordingly, a project has been initiated to identify risk alleles accountable for susceptibility to oral and cervical cancers.

The **Cell Biology & Physiology Division** consists of a group of scientists with varied interests in the various pathophysiology of disease states and employ cellular and animal models for understanding the mechanisms thereof. The group consists of team of cell biologists, physiologists and molecular biologists. Neurodegenerative diseases, cardiac hypertrophy, obesity, diabetes, drug addiction, uteroovarian dysfunction, ovarian development, developmental neurobiology, placental morphogenesis, sperm motility are the major areas of interest for the group. A number of intra- and inter-institutional collaborative programs are being undertaken for this purpose, with much success.

The major research focus of the **Infectious Disease & Immunology Division** includes understanding the molecular pathology of leishmaniasis, cholera, malaria and gastropathy. Work on leishmaniasis is comprised of (i) studies on how *Leishmania* parasite frustrates macrophage defense, (ii) comprehensive assessment of liposome-encapsulated drugs as therapeutic agent and (iii) studies on the immunobiology of leishmaniasis towards identifying potential vaccine candidates. Work on cholera is comprised of (i) studies on diverse CTX, their role in microgenome diversity of *Vibrio cholerae* and evolution of new clones, (ii) to explore the integration of pathways sensing environmental cues with virulence regulation and pathogenicity and (iii) to understand stress related and epigenetic gene expressions in *V. cholera* and *Helicobacter pylori.* Malaria and gastropathy work is comprised of (i) to study the role of *Plasmodium falciparum* mitochondria for the parasite growth and survival and liver mitochondrial dysfunction and associated apoptosis during host-malaria interaction and (ii) to study the gastric mucosal apoptosis during *H. pylori*-mediated and non-mediated gastropathy.

Cancer is the most difficult disease to treat because of its unresponsiveness and resistance. So, one or two magic drugs would be required which behave like a multi-target hitting agent. To explore this, cancer cells should be studied at molecular and cellular levels by different approaches like, proteomic, glycoproteomic and also by *in silico* modeling. **Cancer Biology & Inflammatory Disorder Division** has been created recently with long term goals to focus on the comprehensive understanding of cancer

at many levels ranging from the investigation of molecular and genetic basis of cancer, the elucidation of cellular processes altered during development of cancers, immune response and inflammation. The scientists in this division conduct both basic and translational research on a range of topics that include lung, brain, oral, breast, pancreatic and cervical cancers and leukemias etc. The current focus is on (i) studying cancer cells from different tissue origins at molecular and cellular levels by different approaches, (ii)biology of cancer initiating stem cells, both in solid tumors and in hematologic malignancies, (iii) identification of cellular signaling, probable target proteins and signal cross-talking, (iv) investigating RNA helicases, EGFR and Wnt signaling, autophagy pathway and molecular regulation of chromosomal instability and (v) Cancer immunosurveillance mechanisms and evolution of tumor immunome is being explored to gain insights into the key regulatory pathways that may point out to key immunotherapeutic targets. The studies would be helpful for development of anticancer therapy.

Development of synthetic methodologies and synthesis of bioactive natural products or natural product like molecules are the major areas of research in **Chemistry Division**. Besides, isolation of bioactive natural products from medicinal plants in determining their efficacies, herbal preparations for treatment of some major ailments is the other area of research of this division. Based on the background, the research activities of the division is also focused on development of chiral ligands and their transition metal complexes for asymmetric organic transformations, synthesis of peptidomimetic macrocycles, isolation of bioactive natural products from medicinal plants, discovery of small molecules binding Hepatitis C virus RNA internal ribosome entry site (IRES) and nucleic acid binding properties of natural products. This division intensively pursues interdisciplinary research activities in the fields of synthetic and natural product chemistry, carbohydrate chemistry, biophysical chemistry and chemical biology. The division is engaged in active collaboration with biologists of this institute and other CSIR laboratories in utilizing the synthetic and isolated natural products for studying their efficacy and potential application in biology and medicine. The division is fully equipped with MS facility (LCMS, HRMS and MALDI-TOF), NMR facility, X-ray crystallographic facility, CD spectrometer, micro-calorimeter etc.

The major objectives of **Drug Development, Diagnostics & Biotechnology Division** involve basic and applied research covering areas of health, agriculture and process biotechnology with focus on development of new products, processes and technologies of commercial and industrial importance. The specific objectives of this division include studying regulatory mechanisms for production and secretion of hydrolytic enzymes and use of biomass from *Termitomyces clypeatus* for biotechnological and biomedical applications in the area of biofuel, bioremediation in tannery sector, food industries and for anticancer activities; functional polymorphism of matrix metalloproteinases and the risk of gastric cancer, to establish the mechanism of gastric ulceration; tissue targeted drug delivery etc.

The principal objectives of the **Molecular & Human Genetics Division** are to identify the role of pathogens in modulating small RNAs in the host; to find whether telomere length or senescence factors are responsible for the carcinogenic effects of arsenic; to determine the molecular basis of gene delivery to

mitochondria, and to understand the eukaryotic transcriptional regulatory mechanisms and their role in human diseases. Emphases are placed on determination of the function of microRNAs in parasitic disease (leishmaniasis) and also in cancer. Mechanistic understanding and regulation transcription process at molecular level is also under investigation. The experiments are mostly a combination of basic and applied approaches to study the molecular basis of genetic disease and gene therapy.

The **Structural Biology & Bioinformatics Division** is engaged in studies of various macromolecular machines and cellular pathways of biomedical interest from structural as well as mechanistic perspective. There are two parallel wings of the division - experimental structural biology and computational biology. A team of scientists from diverse areas of biological, chemical, physical, mathematical and computational sciences is engaged in probing macromolecular interactions at different levels of biological organization using integrative, trans-disciplinary approaches. One of the major objectives of such studies is to gain a better insight into the quality control mechanisms in protein folding. Projects have been designed to address the key issues on protein misfolding, aggregation and amyloid formation, e.g, explicating the molecular/sub-molecular processes responsible for the onset and progress of protein aggregation / amyloidogenesis; characterizing the pre-amyloidogenic states of proteins along the aggregation pathway, delineating the physicochemical features of natively unfolded proteins and peptides of clinical importance, navigating the native protein folding routes in various pathogenic microbes, elucidating cellular defenses against aberrant protein folding and developing novel strategies for amelioration of protein misfolding disorders. State-of-the-art facilities and technologies and other biochemical and biophysical methods are being employed for structural characterization of different macromolecules at atomic resolution. Various other studies such as enzyme kinetics, oxidative stress responses in *Leishmania*, structural analysis of RNA-Protein complexes, cryo-EM studies of ribosomal complexes, structure and dynamics of macromolecular systems responsible for cancer, tuberculosis and other diseases etc are also being conducted by the experimental wing of the division. In parallel, *in-silico* studies are being pursued to address the issues pertaining to genome harvesting, pathway simulation, protein-protein interactions, rational drug design, and evolution of extremophilic microbes and metagenomic analysis of human microflora. A number of software packages and knowledgebases have been designed and developed for high throughput genome/ transcriptome/proteome analysis.

During the reporting period thirty nine (**39**) extramural projects from different funding agencies are continued by different scientists of the institute, which include European Union, UK-India Education & Research Initiative (UKIERI) and Wellcome Trust, London. Twelve (**12**) new projects have been sanctioned in the reporting year. Based on the expertise available through scientific endeavor, CSIR-IICB was assigned with nineteen (**19**) Planned Projects of CSIR in the **Twelfth Five Year Plan** of which five **(5)** are **Nodal Network Projects** and fourteen (**14**) are **Partner Network Projects** and the research progress of these projects have been highly appreciated by the Research Council (RC) of this Institute. These projects networked with other CSIR labs, will exploit the potential of CSIR-IICBs scientists.

CSIR-IICB, Kolkata celebrated its **57th Foundation Day** on **April 02, 2013**. Prof. Samir Bhattacharyya, Emeritus Professor, Visva-Bharati and former Director, CSIR-IICB, Kolkata was present in the occasion as Guest-in chief. Prof. Avadhesha Surolia, Professor of Biophysics, IISc, Bangalore and former Director, NII, New Delhi delivered the 25th Dr. J.C. Ray Memorial Lecture.

On **June 18, 2013** the institute organized a one day Seminar on Facets of Insilico Chemical Biology for Novel Therapeutics (FICBNIT-2013).The main objective of this seminar was to highlight various aspects of Insilico Chemical Biology.

A one day Symposium was organized on Leishmaniasis on **July 20, 2013**. The meeting was attended by the doctoral students of different institutes in and around Kolkata. The Ph.D. students presented their own work and awarded for poster presentation, an event which was held during "100 years of Antimonials, an international congress".

CSIR-IICB observed 71st CSIR Foundation Day in the Institute Auditorium on **September 26, 2013**. Inaugural address was delivered by Chief Guest Prof. Souvik Bhattacharyya, Vice-Chancellor of Jadavpur University. Foundation day lecture "Networks in Biology" was delivered by Special Guest Prof. Shekhar C. Mande, Director, and National Centre for Cell Science, Pune.

On **October 23, 2013** the institute signed a MoU with Bangalore based Narayana Health to work together to establish joint collaborative research in niche areas of translational research by utilizing the facilities and expertise in both the institutes. A team of eight specialists from Narayana Health visited CSIR-IICB to sign this MoU.

During **March 6-8, 2014** the 7th RNA group meet of the Indian RNA biologists was organized at Dr. J.C. Ray auditorium. Several leaders in RNA research in India were present in the meeting. The well known virologist Prof. Sahid Jameel from ICGEB, New Delhi & CEO, DBT-Wellcome Indian Alliance, had also attended this gathering and presented a talk.
On **March 31, 2014** the institute also organized one day meet on Macromolecular Structures, Methods & Mechanisms.

The Institute observed **Hindi Week** during **13th -18th September, 2013** by organizing different competitions like debate in Hindi, noting & drafting competitions and a workshop was conducted on Unicode. The Institute also observed National Hindi Day on 18th September, 2013. The chief guest of the day was Prof Shoma Bandyopadhyay, Professor of Hindi Department, Calcutta University, Kolkata.

During the reporting period a number of scientists of our institute received different national **honors and awards** among which Fellow of The World Academy of Sciences (TWAS), Fellow of the Indian National Science Academy, Delhi (FNA), Fellow of National Academy of Sciences, Allahabad (FNASc), Fellow of National Academy of Sciences, Bangalore (FASc), Fellow of the National Academy of Medical Sciences, India (FNAMSc), Fellow of West Bengal Academy of Science and Technology (WAST), National Bioscience Award, Jagdish Chandra Bose Medal from Indian National Science Academy, Fulbright Fellow (2013-2014) in Science and Technology from United States Indian Education Foundation and DAAD Fellowship are important.

A large number of scientists and technologists of national and international repute **visited our**

institute, delivered lectures and held discussions with different research groups in CSIR-IICB during this reporting year. Among which a lecture on "Role of Semaphorin3D in Cardiovascular Development and Disease" by Dr. Manavendra Singh, Dept. of Cell & Dev. Biology, Perelman School of Medicine, University of Pennsylvania, USA; visit by Dr. Prabhat Mandal, Johns Hopkins University School of Medicine Baltimore, USA for a scientific lecture on "Human L1 retrotransposon and its role in processed pseudogene formation"; visit of Dr. Priyabrata Mukherjee, Professor of Pathology, Peggy and Charles Stephenson Endowed Chair in Cancer Laboratory Research, Oklahoma, USA for his lecture on Nanomedicine : From Discovery to Therapeutics; visit by Dr. Dhruba Chattoraj, Head, Control of DNA Replication Section Centre for Cancer Research NCI, NIH, USA for a lecture on "Transition from a plasmid to chromosomal mode of replication in a bacterium with divided genome, *vibrio cholerae*"; visit of Prof. Tapas K Kundu, Head, Molecular Biology & Genetics Unit, JNCASR, Jakkur, Bangalore for his lecture on "Epigenetic regulations of disease and differentiation : probed by means of Chemical Biology"; visit of Dr Sudipto Roy, Associate Professor, Institute of Molecular & Cell Biology, Singapore for a lecture on "Cilia and Ciliopathies" and visit of Dr. Animesh Dhar, Associate Professor, University of Kansas Medical Centre, USA for his lecture on "Novel epigenetic target in pancreatic cancer" are important. About **119** students from different Universities and Institutes of India participated in summer training and other training programmes. A large number of Scientists of our institute were involved in teaching and training programmes of neighboring universities and institutes.

A steady number of quality publications in journals of high impact factors are the hallmark of the Institute's progress in research. For the year 2013 the total number of scientific publications remained steady at **203.** I am proud in finding that the average impact factor of research publications of CSIR-IICB has increased significantly to **3.69** in this year.

Throughout the reporting period CSIR-IICB has filed four international patents related to synthetic bioactive formulation to combat cancer and a biomarker for heart diseases. Total five patents have been granted among which four in abroad and one in India.

CSIR-IICB has always remained as a centre of choice for promising researchers with ambition to work in biological and chemical fields. This year the institute has attracted a large number of bright, young research fellows and research associates from all over the country to generate adequate and trained human resource in the different fields of Biology and Chemistry and related areas for meeting the requirement of cutting edge research. During 2013-14 around **403** numbers of fellows and Associates are involved with their doctoral & post-doctoral research.

I extend my cordial gratitude to all the staff members of our Institute for their year long sincere activity and cooperation in sustaining the growth and maintaining the reputation of CSIR-IICB. I also believe that the dedication offered by my colleagues will take the Institute to a new height in coming days.

CSIR-IICB, Kolkata Prof. Chitra Mandal

Performance at a Glance

THE LAURELS

Dr. Syamal Roy
elected Fellow of the Indian National Science Academy (FNA), Delhi

Dr. Uday Bandyopadhyay
elected Fellow of the Indian National Science Academy (FNA), Delhi

Dr. Susanta Roy Chowdhury
elected Fellow of National Academy of Sciences (FASC), Bangalore

Dr. Chitra Mandal
elected Fellow of the National Academy of Medical Sciences (NAMS), India

Dr. Subrata Adak
received National Bioscience Award for Career Development by Department of Biotechnology, India

Dr. Pijush Kanti Das
awarded Jagdis Chandra Bose Medal (2013) from Indian National Science Academy (INSA), New Delhi

Dr. Pijush Kanti Das
received Viswanath Memorial Lecture Award by Indian National Science Academy (INSA), New Delhi

Dr. S. Swarnakar
received Fulbright Fellowship (2013-2014) in Science and Technology from United state Indian education foundation (usief).

Dr. P. Jaisankar
received DAAD Fellowship for the year 2013

Performance at a Glance

PUBLICATION

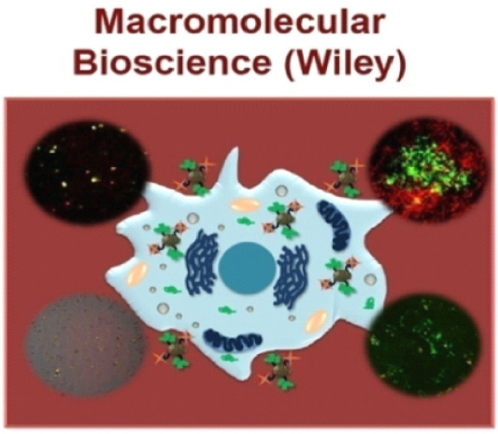
A steady number of quality publications* are the hall mark of the Institutes' progress in research. Year wise publications and average impact factor (IF) for the last five years are shown below:

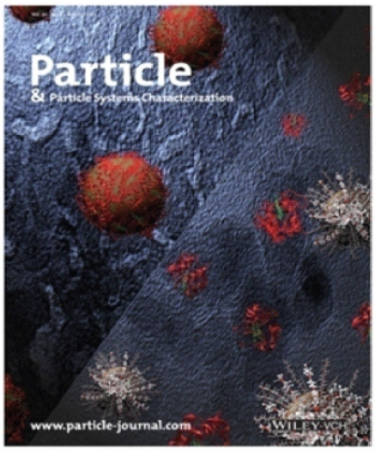
Research Publication – 2013			
Total Publications	...	...	203
Non SCI Publications	...	...	07
Research Publications	...	...	196
No. of Papers with IF ≥ 6			18
No. of Papers with IF ≥ 5 < 6	...	...	15
No. of Papers with IF ≥ 4 < 5	...	...	36
No. of Papers with IF ≥ 3 < 4	...	...	35
No. of Papers with IF ≥ 2 < 3	...	...	63
No. of Papers with IF ≥ 1 < 2	...	...	21
No. of Papers with IF < 1	...	...	08
Total IF (Last 5 yrs. Average)	...	...	724.917
IF per Research Publications	...	...	3.698
IF per Scientist	...	...	11.50
Publications per Scientist	...	...	3.22
Total Scientists			63

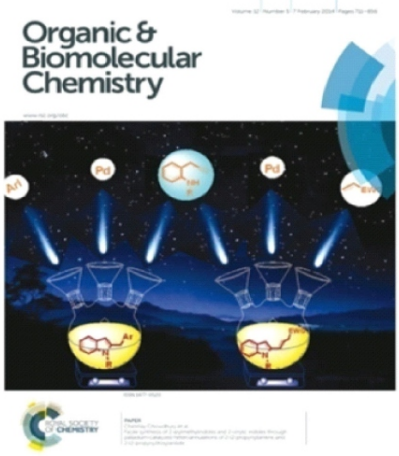
According to Last Five years Average Impact Factor (IF)

*List of publication highlights for 2013 is provided inside separately

Cover Publication in different journals



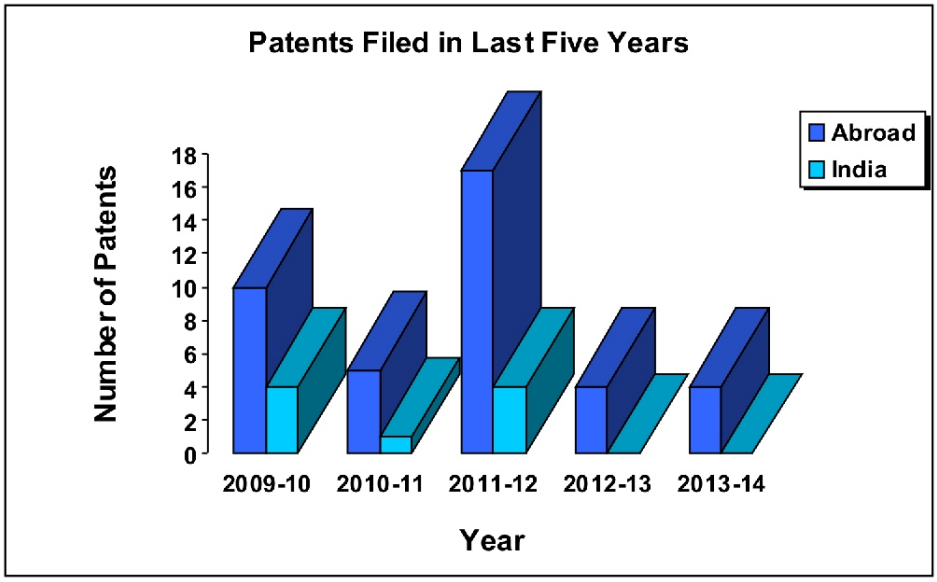


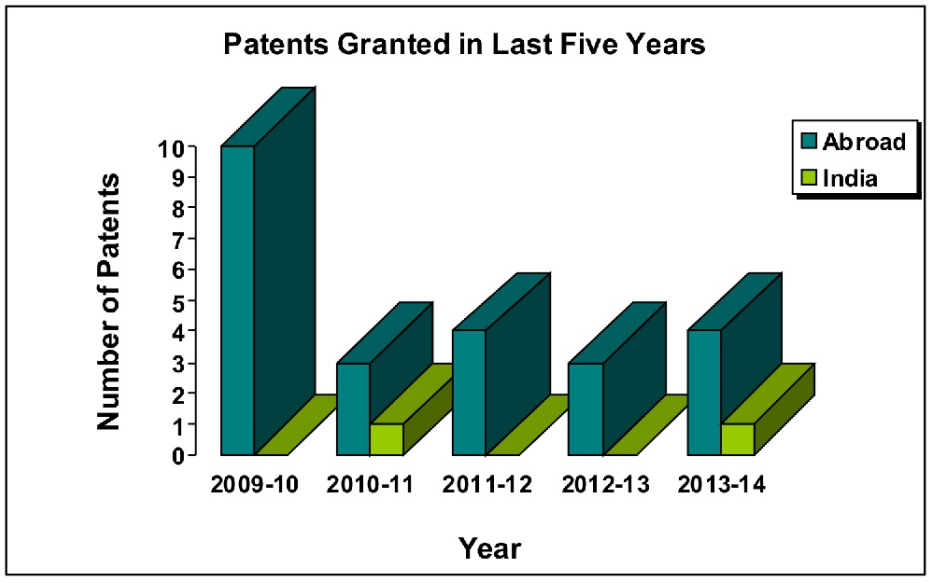


Performance at a Glance

PATENTS

A more or less steady number of patents* are filed every year from the Institute and are granted.



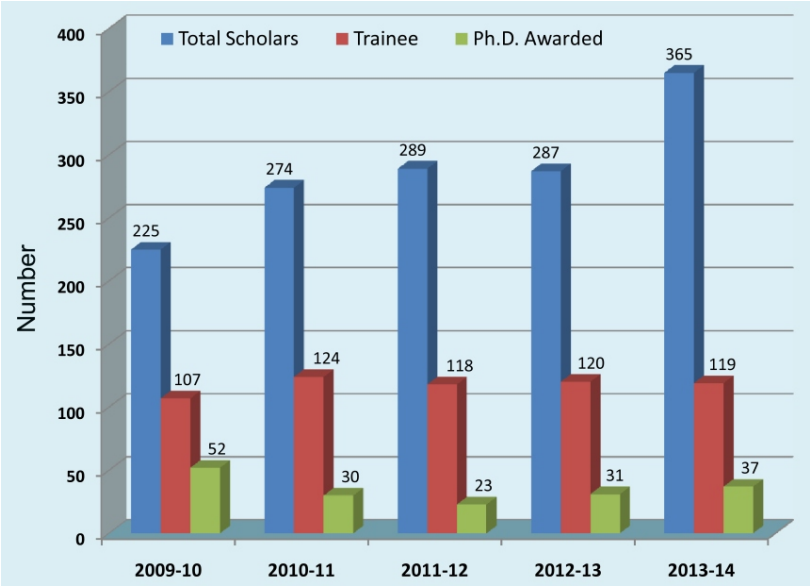


* Detailed list of granted patents in 2013-14 are provided inside separately

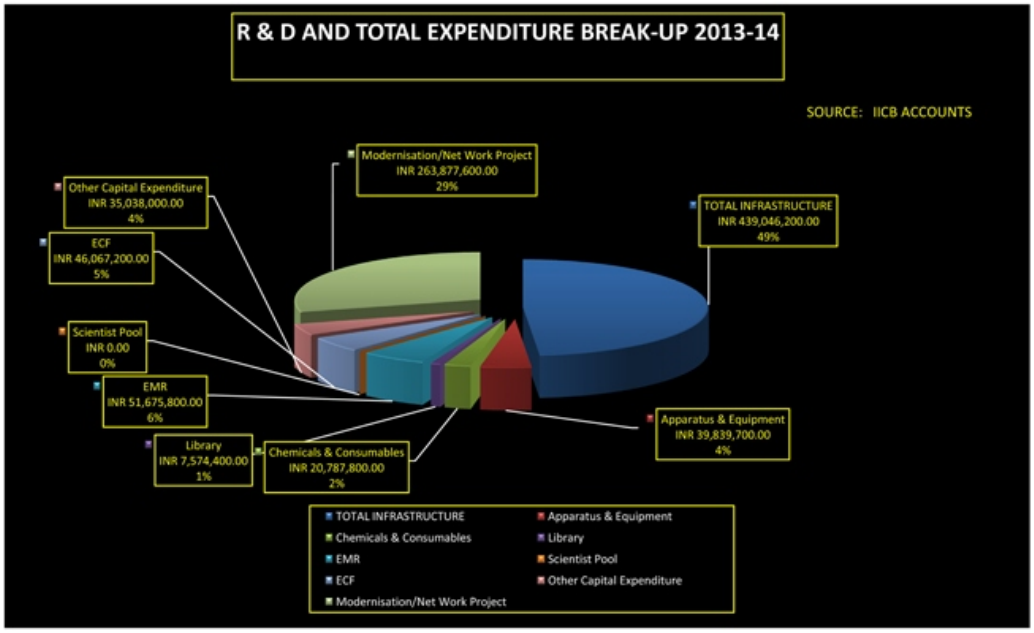
Performance at a Glance

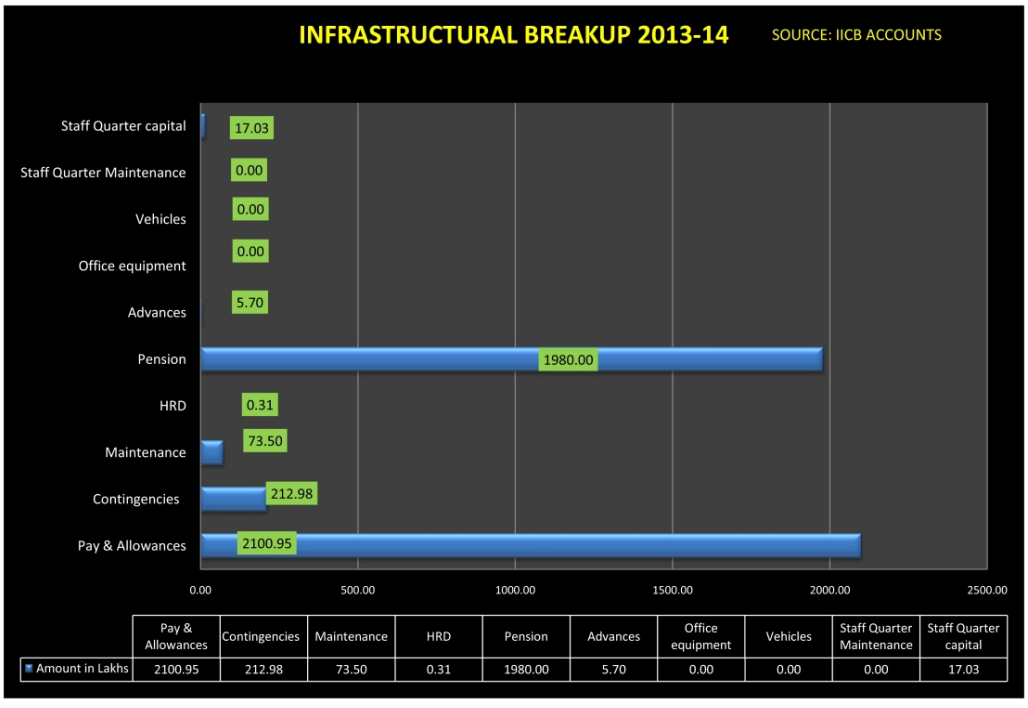
HUMAN RESOURCE DEVELOPMENT

A substantial number of research scholars carry out research at Doctoral and Post-doctoral levels each year. Several students from different universities of our country get short-term training in every year. Data for last five years are given below:



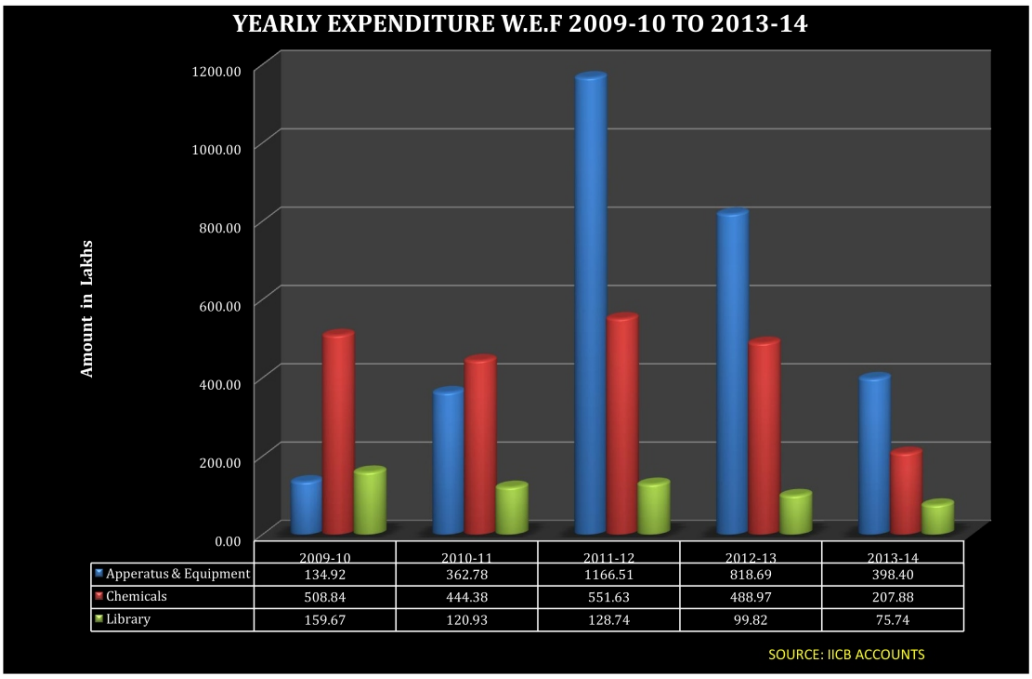
Performance at a Glance



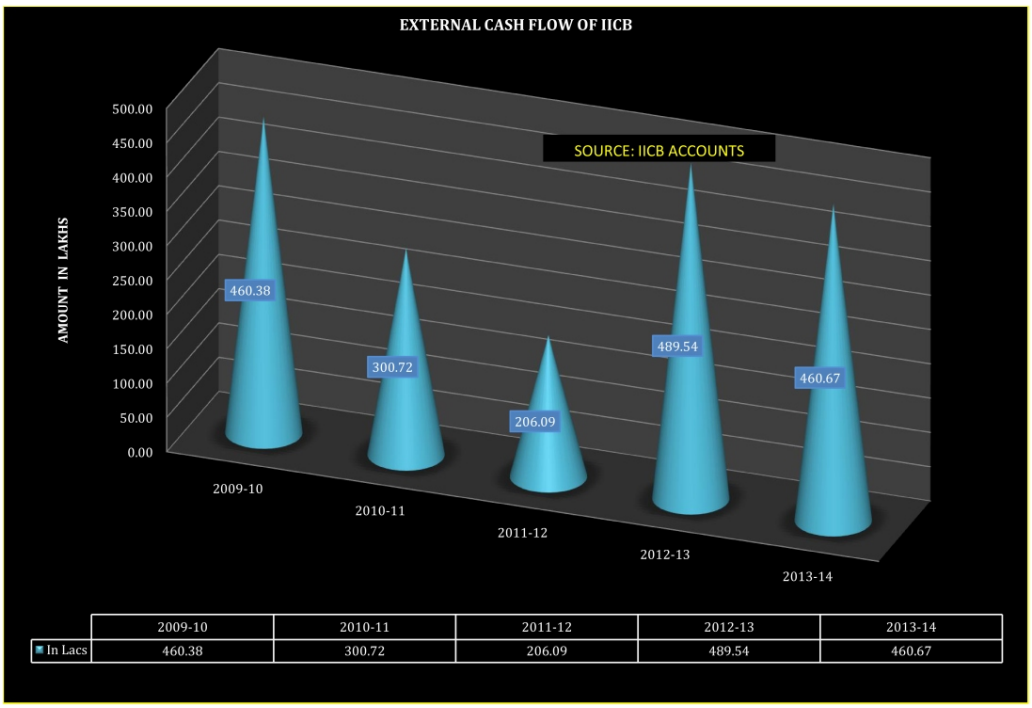


	Pay & Allowances	Contingencies	Maintenance	HRD	Pension	Advances	Office equipment	Vehicles	Staff Quarter Maintenance	Staff Quarter capital
Amount in Lakhs	2100.95	212.98	73.50	0.31	1980.00	5.70	0.00	0.00	0.00	17.03

Performance at a Glance

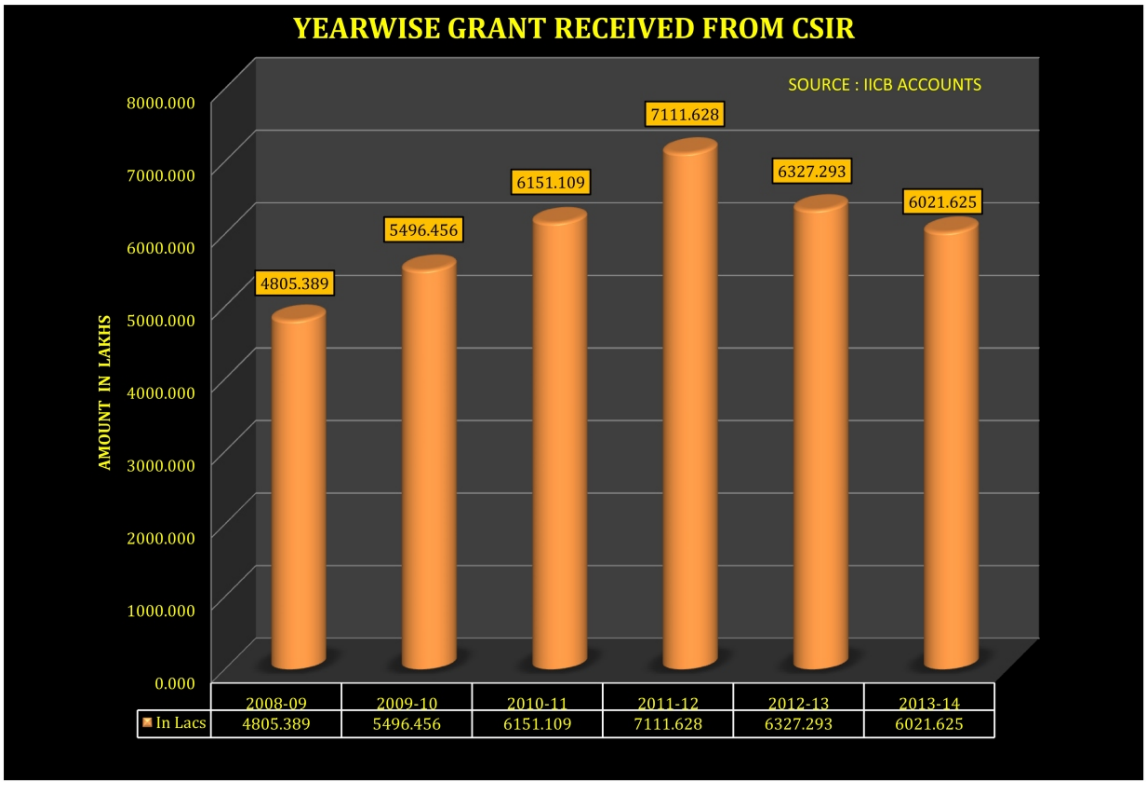


	2009-10	2010-11	2011-12	2012-13	2013-14
Apperatus & Equipment	134.92	362.78	1166.51	818.69	398.40
Chemicals	508.84	444.38	551.63	488.97	207.88
Library	159.67	120.93	128.74	99.82	75.74

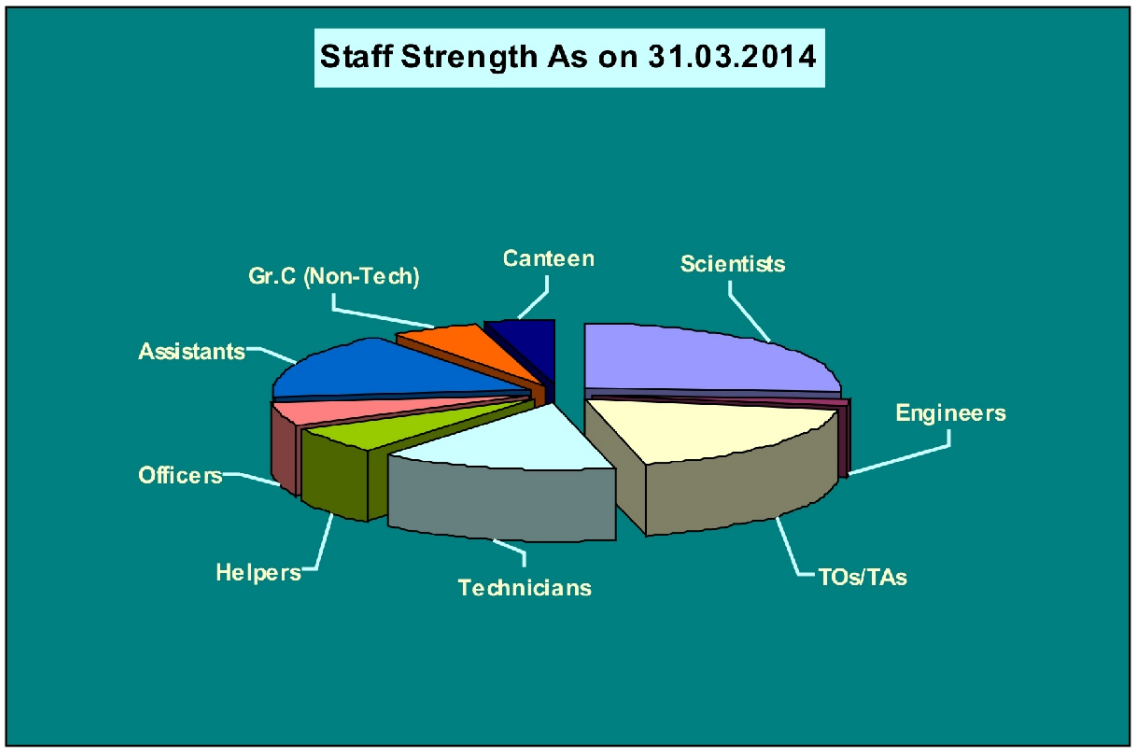


	2009-10	2010-11	2011-12	2012-13	2013-14
In Lacs	460.38	300.72	206.09	489.54	460.67

Performance at a Glance



Performance at a Glance



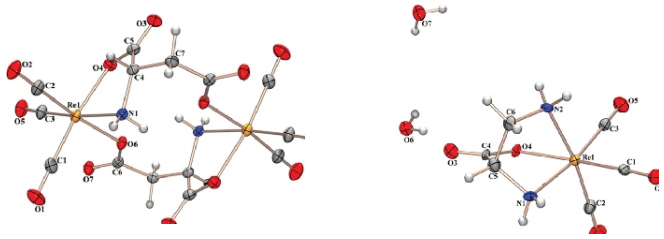
Total Staff-232

S&T Staff **: Scientists-60, Engineers-4, Technical Officers & Assistants-43, Technicians-35, Helpers-16**

Administrative Staff **: Officers-13, Assistants-38, Gr. C-13, Canteen-10**

Scientists : Technical Staff : Administrative Staff :: 1 : 1.6 : 1.2

IDID



Infectious Diseases and Immunology Division

Drs. Pijush K. Das (Head), Syamal Roy, Nahid Ali, Rukhsana Chowdhury, Rupak Bhadra , Uday Bandyopadhyay, Debjani Mandal, Mita Chatterjee Debnath

The major objective of Infectious Diseases and Immunology Division is to understand the molecular pathology of leishmaniasis, cholera, malaria and gastropathy. Work on leishmaniasis is comprised of (i) studies on how Leishmania parasite frustrates macrophage defense, (ii) comprehensive assessment of liposome-encapsulated drugs as therapeutic agentand (iii) studies on the immunobiology of leishmaniasis towards identifying potential vaccine candidates.Work on cholera is comprised of (i) studies on diverse CTX, their role in microgenome diversity of Vibrio cholerae and evolution of new clones, (ii) to explore the integration of pathways sensing environmental cues with virulence regulation and pathogenicityand (iii) to understand stress related and epigenetic gene expressions in V. cholera and Helicobacter pylori. Malaria and gastropathywork is comprised of (i) to study the role of Plasmodium falciparum mitochondria for the parasite growth and survival and liver mitochondrial dysfunction and associated apoptosis during host-malaria interaction and (ii) to study the gastric mucosal apoptosis during H. pylori-mediated and non-mediated gastropathy

Dr. Pijush K. Das
Infectious Diseases and Immunology Division

Macrophages are primary defence cells having well-equipped defensive machineries. Still, *Leishmania* and many other intracellular pathogens neutralize these and successfully survive and replicate within macrophages. Questions are:

i)**How *Leishmania* equip themselves for invasion and survival within macrophages? - *Leishmania Signaling.***

ii)How macrophage signaling processes culminating in production of robust defense molecules are hijacked by *Leishmania*? - *Macrophage signaling*

Regarding *Leishmania signalling, we earlier showed that* increased intracellular cAMP level and cAMP mediated responses are associated with infectivity of *Leishmania* parasites. We identified a unique phosphodiesterase in *L. donovani* which helps in establishment of infection by negatively regulating cAMP dependent PKA signaling through a two way process involving catalytic and non-catalytic sites.

In order to reside and multiply successfully within the host macrophages, *Leishmania* parasites impair the generation of reactive oxygen species (ROS), which is a major host defense mechanism against any invading pathogen. We showed that uncoupling protein 2 (UCP2) of inner mitochondrial membrane is strongly induced in *Leishmania* infection to suppress the mitochondrial ROS generation. The transcriptional activation of UCP2 was mediated by co-ordinated functioning of the transcription factors sterol regulatory element binding protein 2 (SREBP2), specificity protein 1 (Sp1) and upstream stimulatory factor 1 (USF1). *L. donovani* infection resulted in degradation of USF1 thereby facilitating SREBP2 binding which in turn assisted in the association of Sp1 with the promoter ultimately culminating in elevated transcription of UCP2. We further showed that up-regulation of plasma membrane cholesterol for parasite entry and suppression of ROS generation for parasite survival are brought about by the common transcription factor SREBP2 recruited during initial infection stage. The parasite-macrophage interaction led to membrane raft reorientation resulting in Lyn-dependent activation of PI3K/Akt pathway enabling SREBP-cleavage activating (SCAP)-assisted nuclear transport of SREBP2. Increased SREBP2 resulted in transcription of 3-OH-3-methyl glutaryl CoA reductase (HMGCR), key enzyme of cholesterol biosynthesis and UCP2, suppressor of mitochondrial ROS, thereby facilitating both entry and survival of the parasite. Regulation of two distinct yet important ongoing cellular processes in a parasite-conducive manner by a single transcription factor, SREBP2, reveals a case of remarkable economy of host-manipulating strategies employed by the pathogen.

Publication Details:

Viz A, Biswas A, Bhattacharya A and Das PK (2014) A soluble phosphodiesterase in *Leishmaniadonovani* negatively regulates cAMP signaling by inhibiting protein kinase A through a two way process involving catalytic as well as non-catalytic sites. *Int. J. Biochem. Cell Biol.*57, 197-206.

Mukherjee M, Basu Ball W, Srivastav S and Das PK (2014) *Leishmaniadonovani* activates SREBP2 to modulate macrophage membrane cholesterol and mitochondrial oxidants for establishment of infection. *Int. J. Biochem. Cell Biol.*55, 196-208.

Saha A, Biswas A, Srivastav S, Mukherjee M, Das PK and Ukil A (2014) Prostaglandin E_2negatively regulates the production of Th1/Th17 cytokines and proinflammatorychemokines in visceral leishmaniasis. *J. Immunol*. 193, 2330-2339.

Palit S, Kar S, Sharma G and Das PK (2014) Hespiritin induces apoptosis in breast carcinoma by triggering accumulation of ROS and activation of ASK1/JNK pathway. *J. Cell Physiol.* [E-pub ahead of print].

Basu Ball W, Mukherjee M, Srivastav S and Das PK (2014) *Leishmaniadonovani* activates uncoupling protein 2 transcription to suppress mitochondrial oxidative burst through differential modulation of SREBP2, Sp1 and USF1 transcription factors. *Int. J. Biochem. Cell Biol.*48, 66-76.

Gupta P, Giri J, Srivastav S, Chande AG, Mukhopadhyaya R, Das PK and Ukil A (2014) *Leishmaniadonovani*targets tumor necrosis factor receptor associated factor (TRAF) 3 for impairing TLR4-mediated host response. *FASEB, J.*28,1756-1768.

Sharma G, Kar S, Basu Ball W, Ghosh K and Das PK (2014) Curative effect of fucoidan on visceral leishmaniasis is mediated by activation of MAP kinases through specific protein kinase C isoforms. *Cell. Mol. Immunol*. 11, 263-274.

Invited lectures:

Delivered three (**3**) invited talks in India & two (**2**) in abroad which are shown below:

1. **Topic:** How *Leishmania* frustrates macrophage defense
   Venue: Imperial College of London, London, UK
   Date: July 31, 2013

2. **Topic:** Inside Story: Hacking of macrophage defense by *Leishmania*parasites.
   Venue: University of Glasgow, UK
   Date: August 01, 2013

Academic Performance:

Acted as Professor at AcSIR and Guest Professor at Department of Biophysics & Molecular Biology, Calcutta University

Acted as Examiner for Ph.D. thesis at Indian Institute of Science, Bangalore, Jawaharlal Nehru University, New Delhi and Delhi University, New Delhi

Deputation Abroad:

Visited Imperial College, London as Visiting Scientist in the laboratory of Dr. Ingrid Muller during 29-31 July, 2013 and Glasgow University, UK as Visiting Scientist in the laboratory of Prof. Jeremy Mottram during September 1-3, 2013 for developing collaborative programme

Abstracts Presented:

Number of Abstracts in National Conference: **4**
Number of Abstracts in International Conference: **1**

Honours& Awards:

- Awarded Jagdis Chandra Bose Medal by Indian National Science Academy (INSA), recognition of the outstanding contributions in Biochemistry, Biophysics, Molecular Biology and related areas
- Awarded Viswanath Memorial Lecture Award by Indian National Science Academy, recognition for outstanding contributions in Biological Sciences
- Nominated as Member of Sectional Committee (General Biology) by Indian Academy of Sciences, Bangalore
- Nominated as Member of Sectional Committee X (Cell and Bio-molecular Sciences) by Indian National Science Academy
- Nominated as Member of National committee of IUBMB by Indian National Science Academy
- Nominated as Member of the Subject Committee on Biomedical (Life) Sciences by Indian National Science Academy under INSPIRE Faculty scheme of DST.
- Nominated as Member of Animal Sciences & Biotechnology Research Committee, CSIR
- Nominated as Member of Selection Committee for CSIR SRF/RA selection in Medical and Pharmaceutical Sciences (MEDIC/11) of HRDG, CSIR

Human Resource:

Technical/Administrative Staff(s): Mrs. Arti Kheterpaul, Mr. Dipak Kumar Guin

Research Fellow(s): Writoban Basu Ball, Supriya Srivastava, Madhuchhanda Mukherjee, S hreyasiPalit, Amit Viz, Shalini Roy.

DST Inspire Faculty: Dr. Arunima Biswas

Summer Trainee(s): Mr. Sishil Sushanth

Dr. Syamal Roy
Infectious Diseases & Immunology Division

Treatment of drug resistant visceral leishmaniasis: New use of old drug

The drug antimonial was the main stay of treatment of visceral leishmaniasis (VL) or kala-azar in the Indian sub-continent. Because of development of resistance the drug is no longer in use. However resistant to antimonial is still prevailing in the recent clinical isolates. The newer versions of drugs like miltefosine or amphoterecin B have limitations. Therefore there is a need for an effective, affordable and orally active drug for the treatment of VL. Previously we showed that infection with antimony resistant *Leishmania donovani* (SB^R-LD) gives rise aggressive infection with higher organ parasites as compared to sensitive counterpart (SB^S-LD). Infection of macrophages with SB^R-LD but not SB^S-LD induces IL-10 production which in turn upregulates multidrug resistant protein-1 (MDR-1) leading to efflux of antimonial. Imipramine, a commonly used drug for the treatment of depression and nocturnal enuresis in children kills LD parasites directly and inhibits upregulation of MDR-1 by modulation translocation of c-Fos/c-Jun. The drug upregulates histone deacetylase 11, which inhibits acetylation of IL-10 promoter leading to decreased IL-10 production. Imipramine mediated decrease IL-10 production favored IL-12 production leading to increase in IL-12/IL-10 ratio and development of protective antileishmanial immune repertoire. Oral treatment of SB^R-LD infected mice with imipramine together sub-optimal dose of antimonials cleared organ SB^R-LD where antimonial alone is not effective. Thus imipramine may be used for treatment of drug resistant leishmaniasis as a combination therapy.

Interaction of host cell and antimony resistant *Leishmania donovani*: a model to understand mechanism of aggressive pathology in kala-azar

Kala-azar patients harboring antimony resistant *Leishmania donovani*(SB^R-LD) but not antimony sensitive *Leishmania donovani*(SB^S-LD) display aggressive pathology which can be reproduced in the animal model. The SB^R-LD infected Balb/c mice show much higher organ parasites as compared to infection with SB^S-LD parasites, the mechanism of which is far from clear. Here we show that preexisting autophagy in the host cells favors growth of SB^R-LD but not SB^S-LD and upregulates of beclin-1 which forms the platform for autophagy induction. The transcription factor Nrf-2 controls beclin-1 expression and knock-down of Nrf-2 in Balb/c mice and subsequent infection with SB^R-LD show significantly lower organ parasites as compared to infected wild type mice. We have also noted a switch from autophagy to apoptosis due to miR30a driven post-transcriptional modification of beclin-1 mRNA. SB^R-LD infected cells favored parasite egression from apoptotic cells leading amplification of cell to cell transmission of SB^R-LD may contribute to higher organ parasite load in infected mice. There is an important implication of this study. Kala-azar patients in the Indian sub-continent are malnourished and presence of rampant antimony resistant parasites in the field may contribute to aggressive pathology displayed by the patients in Bihar state of India.

Vaccine development against visceral leishmaniasis:

Vaccines are one of the key pillars to improve public health. Our laboratory has focused on the development of prophylactic vaccines against leishmaniasis in the last few years. With spread of drug resistance in the endemic areas it is now imperative to formulate a vaccine against the parasite *Leishmania donovani* to control the disease incidence. We have utilized the method of DNA vaccination, which is very potent in activating cellular immunity, in our aim to test different parasite antigens as suitable vaccine candidate.

Kinetoplastid membrane protein-11 (KMP-11) is a conserved antigen in many *Leishmania* species and has a very high density of T-cell activating epitopes. We tested a heterologous prime-boost vaccination method where we primed animals with KMP-11 encoding plasmid DNA and boosted with KMP-11 expressing recombinant vaccinia virus followed by parasite challenge at a later time point. This vaccination method provided long term protection to the disease in both mouse and hamster model of experimental infection. Protection was correlated with effective CD4+ T-cells and also cytotoxic CD8+ T-cells activation in immunized animals.

We have also established *Leishmania* hemoglobin receptor (Hb-R) as a new antigen that is suitable for inclusion in anti-*Leishmania* vaccine development efforts. Hb-R encoding DNA immunized animals are able to resist *L. donovani* mediated disease pathogenesis, by the expansion of parasite specific T-cells (CD4+ and CD8+) that destroy infected cells.

Our lab was also involved as part of an international consortium in developing a novel multi-antigen containing DNA vaccine against leishmaniasis. Five conserved antigens were carefully analyzed for T-cell stimulating epitopes in their sequence. These rationally chosen antigens were delivered via a next generation DNA vector system that is optimized for expression in humans and also with improved safety profile. This multi-component was tested in mouse model of visceral leishmaniasis and found to be highly efficacious. All these studies have yielded knowledge that we hope may contribute to the development of a successful vaccine against visceral leishmaniasis in future.

Publications:

Moumita Ghosh, Koushik Roy, Syamal Roy. (2013) Immunomodulatory effects of antileishmanial drugs. *The Journal of antimicrobial chemotherapy*, 68, 2834-8.

Moumita Ghosh, Ashish KSolanki, Koushik Roy, ReemaR Dhoke, Ashish, Syamal Roy. (2013) Carrier protein influences immunodominance of a known epitope: implication in peptide vaccine design. *Vaccine,* 31, 4682-8.

Maya Berg, Manu Vanaerschot, Andris Jankevics, Bart Cuypers,Ilse Maes, SandipMukherjee, Basudha Khanal,Suman Rijal, Syamal Roy, Fred Opperdoes,RainerBreitling, Jean-Claude Dujardin. (2013) Metabolic adaptations of Leishmania donovani in relation to differentiation, drug resistance, and drug pressure. *Molecular microbiology,* 90, 428-42.

Rajan Guha, Deepika Gupta,Ruchir Rastogi, Rajagopal Vikram,Ganga Krishnamurthy, Sanjiva Bimal,Syamal Roy,Amitabha Mukhopadhyay. (2013) Vaccination with leishmania hemoglobin

receptor-encoding DNA protects against visceral leishmaniasis. *Science translational medicine* 5, 202ra121.

Koushik Roy, Moumita Ghosh, Tuhin Kumar Pal, Saikat Chakrabarti, Syamal Roy. (2013) Cholesterol lowering drug may influence cellular immune response by altering MHC II function. *Journal of lipid research,* 54, 3106-15.

Sunny Sharma, Suparna Sarkar, Simanta Sarani Paul, Syamal Roy,Krishnananda Chattopadhyay. (2013) A small molecule chemical chaperone optimizes its unfolded state contraction and denaturant like properties. *Scientific reports*, 3, 3525.

June Ghosh, Rajan Guha, Shantanabha Das, Syamal Roy. (2014) Liposomal cholesterol delivery activates the macrophage innate immune arm to facilitate intracellular Leishmania donovani killing. *Infection and immunity*, 82, 607-17.

Human Resource:

Technical/Administrative Staff(s): Mr. Kshudiram Naskar, Mr. Gopal Mondal

Research Fellow(s): Ms. June Ghosh, Mr. Rajan Guha, Mr. Koushik Roy, Ms. Moumita Ghosh, Mr. Shantanabha Das, Ms. Rupkatha Mukhopadhyay, Mr. Budhaditya Mukherjee, Mr. Sandip Mukherjee

Dr. Nahid Ali
Infectious Diseases and Immunology Division

IL-4 contributes to failure, and colludes with IL-10 to exacerbate Leishmania donovani infection following administration of a subcutaneous leishmanial antigen vaccine

One of the key interests of our lab is to devise a successful control strategy against the deadly parasitic disease, kala-azar. Since most of the available treatment options against kala-azar have limitations of toxicity, high cost, relapse or unresponsiveness, combative strategies against this disease demand the development of a safe and efficacious vaccine. Our lab previously reported that leishmanial antigen (LAg) entrapped liposomes could provide protection against experimental *L. donovani* infection when administered through intraperitoneal route. However, the same combination failed to provide any protection when injected subcutaneously. This formulation (LAg+ liposome) was even unsuccessful in clearing parasites from both hepatic and splenic compartments when subcutaneously used with adjuvants, alum and saponin. On further investigation failure of alum+ LAg was found to

be associated with elevation of IL-10 whereas both IL-4 and IL-10 levels were increased in saponin+ LAg immunized mice suggesting their roles in vaccine failure and/or exacerbation of disease. In contrast, a robust IFNγ response, in the absence of IL-4 and IL-10 production, was associated with protective immunity following LAg+ liposome vaccine. Thus a detailed investigation of the immunomodulatory effects involving IL-4, IL-10 and IFNγ production of prospective vaccine candidates could be helpful in increasing their efficacy as well as management of this disease.

Publication Details:

Bhattacharya P and Ali N (2013) Involvement and interactions of different immune cells and their cytokines in human visceral leishmaniasis. *Rev Soc Bras Med Trop*, **46(2)**, 128-134.

Ali N and Bhattacharya P (2013) Translating immune call cross-talk into a treatment opportunity for visceral leishmaniasis. *Immunotherapy,* **5(10)**, 1025-1027.

Bhowmick S, Ravindran R, Ali N (2014) IL-4 contributes to failure, and colludes with IL-10 to exacerbate Leishmania donovani infection following administration of a subcutaneous leishmanial antigen vaccine. *BMC Microbiology,* **14(8)**, 1-12.

Md Asad and Ali N (2014) Dynamicity of immune regulation during visceral leishmaniasis. *Proc Indian Natn Sci Acad,* **80(2)**, 1-21.

Invited Lectures:

Delivered three (**3**) invited talks in India

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Acted as Examiner for Ph.D. Thesis at University of Delhi, New Delhi and Jawaharlal Nehru University, New Delhi

Deputation Abroad:

Delivered an invited talk entitled "Liposomal Leishmanial antigens with adjuvant confers long term protection against experimental visceral leishmaniasis" at the 5th World Congress on Leishmaniasis-Worldleish 5 held at Porto De Galinhas, Prenambuco, Brazil from May 13-17, 2013.

Abstracts Presented:

No. of Abstracts in National Conference is **1**

Honors and Awards:

Hosted a research topic entitled "Control of visceral leishmaniasis through immunotherapeutic and prophylactic strategies" in Frontiers in Immunology as a Guest Associate Editor

Reviewer of several papers and projects submitted to national and international journals and funding agencies

Human Resource:

Research Fellow(s): Roma Sinha, Manjarika De, Pradyot Bhattacharya, Md. Asad, Md. Shadab, Sarfaraz Ahmad Ejazi, Somsubhra Thakur Chowdhury, Rudra Chhajer, Abdus Sabur and Nicky Didwania.

Project Fellow(s): Amrita Das and Anirban Bhattacharyya.

Summer Trainee(s): Sneha Ghosh, Arifa Akbar, Bhagyashree Mitra, Deepthi Makaraju, Sreyashi Dev, Debosruti Nath, Rahul Chatterjee, T S Balaji and Asheeta Bose.

Dr. Rukhsana Chowdhury
Infectious Diseases & Immunology Division

Role of the flagellar hook length control protein FliK and sigma-28 in cagA expression in gastric cell adhered Helicobacter pylori :

Adherence of Helicobacter pylori to the gastric epithelial cell line AGS strongly induces expression of fliK encoding a flagellar hook-length control protein. FliK has a role in triggering dissociation of the alternate sigma factor, σ^{28} from a non functional σ^{28}-FlgM complex, releasing free, functional σ^{28}. The σ^{28}-RNAP initiates transcription of cagA, the major virulence gene, from a promoter identified in this study. Consequently, significant upregulation of cagA was observed in AGS-adhered H. pylori.

Novel role of LeuO in HNS mediated silencing of the Vibrio cholerae virulence regulatory gene toxT:

LeuO is a LysR-type transcriptional regulator that is required to overcome gene silencing mediated by the histone like nucleoid-structuring protein H-NS. We demonstrate a novel function of LeuO. Rather than acting as an H-NS antagonist, LeuO facilitates binding of H-NS to the promoter of the virulence regulatory gene *toxT* of the enteric pathogen *Vibrio cholerae* and is required for H-NS mediated repression of *toxT* expression.

Role of the oral microbiota in precancer and cancer:

To understand the correlation between oral microbiota and oral habits with special reference to tobacco chewing, the microbiota was analysed in saliva samples from healthy individuals or precancer/cancer patients with or without tobacco chewing habits. Significant differences have been observed between the groups.

Publication Details:

Raghwan, Chowdhury R. (2014) Host Cell Contact Induces Fur-dependent Expression of Virulence Factors CagA and VacA in *Helicobacter pylori. Helicobacter*; 19, 17-25

Sinha S, Giri AK, Chowdhury R and Ray K. (2014) Mitochondrial genome variations among arsenic exposed individuals and potential correlation with apoptotic parameters. *Environ Mol Mutagen*; **55**, 70-76

Chakraborti S, Bhattacharya S, Chowdhury R, Chakrabarti P (2013) The molecular basis of inactivation of metronidazole-resistant *Helicobacter pylori* using polyethyleneimine functionalized zinc oxide nanoparticles. *PLoS One*; **8(8):**e70776

Chatterjee E, Chowdhury R (2013) Reduced Virulence of the *Vibrio cholerae fadD* Mutant Is Due to Induction of the Extracytoplasmic Stress Response. *Infect Immun*; **81**, 3935-3941

Academic Performance:

Sectional Committee Member, West Bengal Academy of Science & Technology
Member, Expert committee for 'Capacity Building' programme & Departmental Technical Committee (R&D), DBT, Govt. of West Bengal.
Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata
Examiner, Department of Genetics & Department of Biotechnology, Calcutta University

Abstracts Presented:

Number of Abstracts in National Conference: **2**
Number of Abstracts in International Conference: **2**

Human Resource:

Technical/Staff: Dr. Kalidas Paul , Mr. Sandip Chakraborty
Research Fellows: Ms. Sreejana Ray, Mr. Saurabh Bhattacharya, Ms. Chirantana Sengupta, Ms. Sharmistha Sinha
Research Associate: Dr. Maitreyee Mandal
Project Assistants: Mr. Amit K. Dey, Ms. Subhra Pradhan , Mr. Raghwan , Mr. Amit K. Baidya
Summer Trainees: Moutrisha Ray , Sayan Baidya, Debanjana Maji, Arka Mitra, Koyeli Das

Dr. Rupak K. Bhadra
Infectious Diseases and Immunology Division

Our group is working for a long time to elucidate the molecular basis of nutritional starvation response in bacterial pathogens particularly in *Vibrio cholerae, the causative agent of the severe diarrheal disease cholera.* Functional characterizations of several genes, e.g., *relA, spot, dksA, cgtA* and *relV* involved in intracellular metabolism of two small molecules, ppGpp and pppGpp, together called (p)ppGpp, have been done. In fact, we have discovered the novel (p)ppGpp synthetase-coding gene *relV* of *V. cholerae*. RelV is a small protein and it may play a critical role under various stress conditions including glucose and fat starvations. It has been reported that RelV is needed for causing the disease. Recently, we have determined the minimal functional region carrying the synthetase domain of the RelV protein by deletion and mutational approaches. We have also determined the minimal functional region of the bi-functional (p)ppGpp synthetase protein Rel of *Mycobacterium tuberculosis*, the causative agent of tubercolosis. Currently further comparative analysis on (p)ppGpp synthetase domains is in progress. Apart from this, our group is also trying to understand the role of an important regulator of stringent response, called DksA. We found that DksA has dual functions, one in regulation of stringent response and another one in fine-regulation of various pathogenesis related processes of *V. cholerae*.

Publication Details:

Banerjee, M. Kumar, S. Ghosh, S. Bhadra, R.K. Mondal, N.B. (2014) Amberlite IRA 402(OH)-mediated synthesis and evaluation of fused tricyclic quinolinium salts as potent non-detergent type microbicidal spermicides. *Med Chem Res*, 132, 695-706.

Invited Lectures:

Delivered 2 numbers of invited talks in India & 3 numbers in abroad which are shown below:

Topic: Infectious diseases and *Vibrio cholerae*
Venue: Osaka Prefecture University, Osaka, Japan
Date: November 12, 2013

Topic: Molecular basis of stringent response in *Vibrio cholerae*
Venue: Osaka Prefecture University, Osaka, Japan
Date: November 15, 2013

Topic: Identification of essential amino acid residues and minimal functional domain of the novel (p)ppGpp synthetase RelV of *Vibrio cholerae*
Venue: 48th US-Japan Conference on Cholera and other enteric Diseases, ICDDR,B, Dhaka, Bangladesh
Date: February 12, 2014

Session Chaired:

Chaired one scientific session in India

Academic Performance:

Acted as a Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata
Acted as an external examiner of Ph.D. viva voce examination of Jadavpur University, Kolkata
Acted as a moderator for M.Sc. examination of Department of Microbiology, Bijoygarh College
Acted as an external reviewer for research proposals submitted to DST, DBT, CSIR etc.
Acted as a reviewer for ASM
Acted as an External Examiner for M.Sc (Physiology) project evaluation at Serampur College, Serampur, West Bengal, India
Acted as an External Examiner for M.Sc (Physiology) project evaluation at Presidency University, Kolkata, India

Deputation Abroad:

Foreign Guest Professor at Osaka Prefecture University (OPU), Osaka, Japan, from November 01-22, 2013
Attended the 48th US-Japan Conference on Cholera and other enteric Diseases, ICDDR,B, Dhaka, Bangladesh, from February 10-13, 2014

Abstracts Presented:

Number of Abstracts in National Conference: **2**
Number of Abstracts in International Conference: **1**

Dr. Uday Bandyopadhyay
Infectious Diseases and Immunology Division

Nonsteroidal anti-inflammatory drug induces proinflammatory damage in gastric mucosa through NF-κB activation and neutrophil infiltration: Anti-inflammatory role of heme oxygenase-1 against nonsteroidal anti-inflammatory drug

Nonsteroidal anti-inflammatory drug (NSAID)-induced mitochondrial oxidative stress (MOS) is an important prostaglandin (PG)-independent pathway of the induction of gastric mucosal injury. However, the molecular mechanism behind MOS-mediated gastric pathology is still obscure. In various pathological conditions of tissue injury oxidative stress is often linked with inflammation. Here we report that MOS induced by indomethacin (an NSAID) induces gastric mucosal inflammation leading to proinflammatory damage. Indomethacin, time dependently stimulated the expression of proinflammatory molecules such as intercellular adhesion molecule 1(ICAM-1), vascular cell adhesion molecule 1(VCAM-1), interleukin1β (IL-1β), and monocyte chemotactic protein-1 (MCP-1) in gastric mucosa in parallel with the increase of neutrophil infiltration and injury of gastric mucosa in rat. Western immunoblotting and confocal microscopic studies revealed that indomethacin induced nuclear translocation of nuclear factor kappa-B (NF-κB) in gastric mucosal cells, which resulted in proinflammatory signaling. The prevention of MOS by antioxidant tryptamine-gallic acid hybrid (SEGA) inhibited indomethacin-induced expression of ICAM-1, VCAM-1, IL-1β, and MCP-1. SEGA also prevented indomethacin-induced NF-κB activation and neutrophil infiltration as documented by chromatin immunoprecipitation studies and neutrophil migration assay, respectively. Heme oxygenase-1 (HO-1), a cytoprotective enzyme associated with tissue repair mechanisms is stimulated in response to oxidative stress. We have investigated the role of HO-1 against MOS and MOS-mediated inflammation in recovering from gastropathy. Indomethacin stimulated the expression of HO-1 and indomethacin-stimulated HO-1 expression was reduced by SEGA, an antioxidant, which could prevent MOS. Thus, the data suggested that the induction of HO-1 was a protective response against MOS developed by indomethacin. Moreover, the induction of HO-1 by cobalt protoporphyrin inhibited inflammation and chemical silencing of HO-1 by zinc protoporphyrin aggravated the inflammation by indomethacin. Thus, NSAID by promoting MOS-induced proinflammatory response damaged gastric mucosa and HO-1 protected NSAID-induced gastric mucosal damage by preventing NF-κB activation and proinflammatory activity.

Synthesis and biological evaluation of primaquinechloroquine twin drug: a novel heme-interacting molecule prevents free heme and hydroxyl radical-mediated protein degradation.

Accumulations of oxidized and degraded proteins are the markers for oxidative stress. Degradation of hemoprotein e.g. hemoglobin during different pathological conditions produces heme, which induces oxidative stress and inflammation through its pro-oxidant nature and leads to protein degradation. Moreover, reduced transition-metal ions Fe^{2+} can generate toxic hydroxyl radicals ($^{\cdot}OH$) and leads to protein degradation. Therefore, synthesis of a compound that will detoxify free heme, chelate Fe^{+2} and show antioxidant activity by scavenging $^{\cdot}OH$ would be beneficial against protein degradation. Here, we report the synthesis of a novel heme-interacting primaquinechloroquine twin drug (PQCL) that could chelate free iron and showed excellent antioxidant activity as evident from ferric reducing antioxidant power. PQCL prevented $^{\cdot}OH$ and heme-mediated protein degradation. PQCL also could scavenge nitrogen-centered free radical (2,2-diphenyl-1-picrylhydrazyl). Thus, we have synthesized PQCL, a hemeinteracting molecule, which is capable to prevent free heme and $^{\cdot}OH$ -mediated protein degradation.

Publication Details:

Bindu S, Mazumder S, Dey S, Pal C, Goyal M, Alam A, Iqbal MS, Sarkar S, Azhar Siddiqui A, Banerjee C, Bandyopadhyay U (2013) Nonsteroidal anti-inflammatory drug induces proinflammatory damage in gastric mucosa through NF-κB activation and neutrophil infiltration: Anti-inflammatory role of heme oxygenase-1 against nonsteroidal anti-inflammatory drug. *Free. Radic. Biol. Med*, 65C:456-467.

Chinmay Pal, Souvik Sarkar , Somnath Mazumder , Susanta Adhikari and Uday Bandyopadhyay (2013) Synthesis and biological evaluation of primaquine-chloroquine twin drug: a novel heme-interacting molecule prevents free heme and hydroxyl radical-mediated protein degradation. *Med. Chem. Commun.* 4, 731736.

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata

Honors & Awards:

Elected as a Fellow of Indian National Science Academy (**FNA**), 2014

Human Resource:

Research Fellow(s): Mohd. Shameel Iqbal , Souvik Sarkar , Chinmoy Banerjee, Somnath Mazumder, Asim Azhar Siddiqui, Rudranil De, Shubhra J Saha

Project Assistant(s): Sumanta Dey

Summer Trainee(s): Subhadip Das, Sourav Sarkar

Dr. Mita Chatterjee Debnath
Infectious Diseases and Immunology Division

Tricarbonyl technetium(I) and tricarbonyl rhenium(I) complexes of amino-carboxy ligands; crystal and molecular structure

We have been interested in developing small peptides that have several advantages over proteins and antibodies particularly in respect of immunogenicity and size. Radiolabeled amino acids can also be used to understand the mechanism of membrane transport of amino acids in various disease conditions, e.g. tumor, CNS dysfunction, etc. The fac-[^{99m}Tc $(CO)_3(H_2O)_3]^{+1}$ core can be bound directly to the peptide chain or the amino acid unit. The donor atoms that play a vital role in anchoring the technetium (^{99m}Tc) core are S, N, and O. These donor atoms represent potential technetium binding sites within the coordinating peptides. Such knowledge about the preferred donor atoms arrangement is of great importance in the design of synthetic technetium-binding peptides with high bioactivity.Considering the importance of amino carboxy ligands radiolabeled complexes of monoamino polycarboxylic, polyamino monocarboxylic and thiol containing amino acid ligands were prepared from a fac-[^{99m}Tc$(CO)_3(H_2O)_3]^{+1}$ precursor. The overall radiochemical yield was 9498%, the complexes exhibited substantial in vitro and in vivo stability and showed good and fast clearance from all organs and tissues. The corresponding Re(I) complexes of the ligands DAPA, Asp and CysH were prepared and characterized by means of IR, NMR, and MS spectroscopic studies, as well as X-ray crystallography. The rhenium complexes have

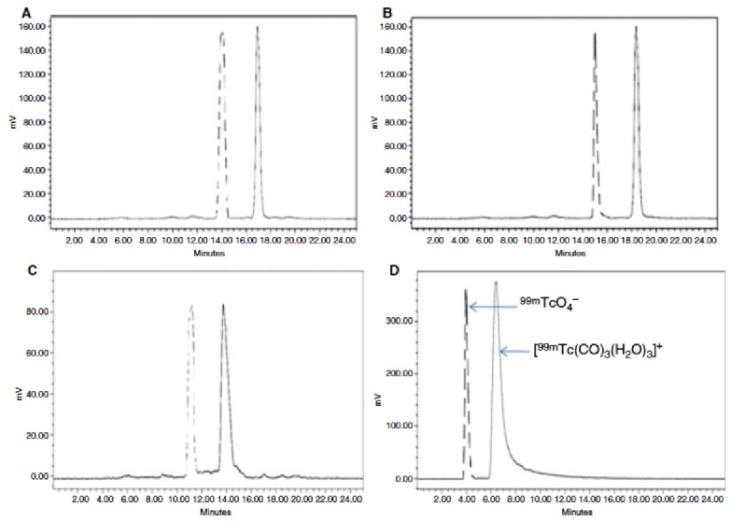


Fig. 1 Radiochromatograms of $M(CO)_3$- labeled peptides. (----) Unlabeled ligand in UV detector, (-) labeled ligand in radioactive detector.

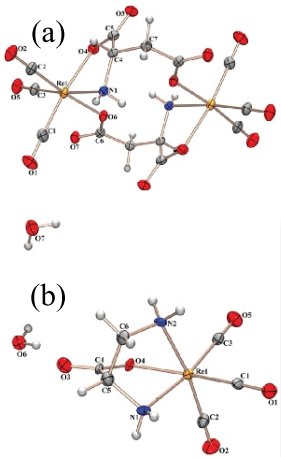


Fig. 2 Molecular structure of $M(CO)_3$-Asp (a) and $M(CO)_3$-DAPA (b) showing 30% probability displacement ellipsoids (M=^{99m}Tc/Re)

been structurally correlated with the technetium complexes by means of HPLC studies. Syntheses of various RGD-peptides which can serve as vectors for integrin targeted delivery of cytotoxic drugs are in progress in our laboratory.

It is expected that the above study will provide necessary information for the design of $^{99m}Tc(CO)_3$-labeled small peptides attached to drug molecules that can act as potential radiopharmaceuticals for tumor imaging.

Publication Details:

Dipak Kumar Nayak, Kamal Krishna Halder, Rinku Baishya, Tuhinadri Sen, Partha Mitra, Mita Chatterjee Debnath: Tricarbonyltechnetium(I) and tricarbonylrhenium(I) complexes of amino acids: crystal and molecular structure of a novel cyclic dimeric Re(CO)3-amino acid complex comprised of the OON donor atom set of the tridentate ligand. Dalton Transactions 2013, 42 (37), 13565-13575.

Rinku Baishya, Dipak Kumar Nayak, Nabanita Chatterjee, Kamal Krishna Halder, Sanmoy Karmakar, Mita Chatterjee Debnath: Synthesis, characterisation and biological evaluation of $^{99m}Tc(CO)_3$ labeled peptides for potential use as tumor targeted radiopharmaceuticals. Chemical Biology & Drug Design 2014, 83(1), 58-70.

Abstracts Presented:

Number of Abstracts in International Conference: 1

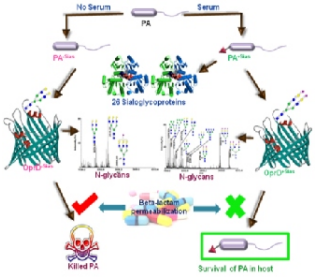
Conference/Workshop/Symposia Organized:

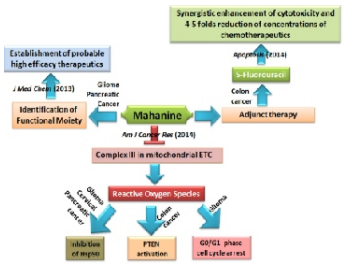
Organised a Training Programme on Laboratory Safety : Biosafety, Chemical Safety & Radiation Safety on 16th Sept 2013, at CSIR-India Institute of Chemical Biology.

Human Resource:

Research Fellow(s): Raghuvir Gaonkar, Dipak Kumar Nayak, Rinku Baishya and Soumya Ganguly
Summer Trainee(s): Kazi Julekha

CBID





Cancer Biology & Inflammatory Disorder Division

Drs. Chitra Mandal, Santu Bandyopadhyay (Head), Susanta Roy Chowdhury, Padma Das, Mrinal K. Ghosh, Malini Sen, Dipyaman Ganguly, Amitava Sengupta, Krishna Das Saha

The division of Cancer Biology & Inflammatory Disorders (CBID) is a more recent addition in the intra-institution research groups in CSIR-IICB, comprising of a unique combination of senior and young scientists, and aims at taking a very futuristic approach to address relevant and inter-related questions in cancer and chronic inflammation. Cancer is one of the most asking areas of modern biomedical research. Beyond the unique biology of cancer cells, the relationship of cancer and chronic inflammation has gained immense importance. Moreover, cancer immunosurveillance (the interaction between cancer and the host immune system) and cancer immunotherapy are issues engaging lot of research effort all over the world in the past decade or so. IICB scientists affiliated to CBID are taking into consideration all these different aspect of the relevant areas and conducting their coordinated research programs.

- CBID scientists are studying cancer cells from different tissue origins at molecular and cellular levels by different approaches, viz. transcriptomic, proteomic, glycoproteomic and bioinformatic techniques.
- Identification of cellular signaling, probable target proteins and signal cross-talk are being undertaken to understand the disease biology and pathogenesis, with the realization that it could serve the critical role for development of new generation chemotherapeutics as well.
- Biology of cancer initiating stem cells, both in solid tumors and in hematologic malignancies are being investigated by multiple CBID laboratories.
- In terms of elucidating specific pathways involved in cancer growth and survival, efforts are on to investigate RNA helicases, EGFR and Wnt signaling, autophagy pathway and molecular regulation of chromosomal instability.
- Role of specific signaling pathways (e.g. Wnt signaling) and particular immune cells (dendritic cells) and cytokines (e.g. type I interferons) in chronic inflammation is being investigated which can provide unique insight in specific clinical contexts of inflammatory disorders as well as in the overlapping areas with cancer biology.
- Cancer immunosurveillance mechanisms and evolution of tumor immunome is being explored to gain insights into the key regulatory pathways that may point out to key immunotherapeutic targets.
- An integrated approach for identifying lead molecules (novel molecules from natural sources as well as library molecules with target-specific activities), with anti-cancer and anti-inflammatory properties, is also actively pursued.
- Intense logistic and knowledge-based collaborations are ongoing with different clinical institutions in the city and beyond, to nurture an atmosphere of translational research.

Dr. (Mrs.) Chitra Mandal
Cancer Biology & Inflammatory Disorder Division

Mahanine: a potential chemotherapeutic agent -

We have identified mahanine, a carbazole alkaloid, from herbal source which showed anti-proliferative efficacy either as single or combined agents. It is also nontoxic towards normal cells/tissue. Mahanine targeted complex-III of mitochondrial electron transport chain and increased reactive oxygen species (ROS) production possibly mediated by C-7-OH and 9-NH functional groups. Enhanced ROS mediated Hsp90 inhibition in pancreatic cancer, PTEN activation in colon cancer and G0/G1 cell cycle arrest in glioblastoma. More importantly, this potent molecule synergistically enhanced the cytotoxic effect of 5-FU by ~4-5 folds and thereby reducing effective concentration of this toxic chemotherapeutic. Altogether, our results established the therapeutic potency of mahanine (Fig 1).

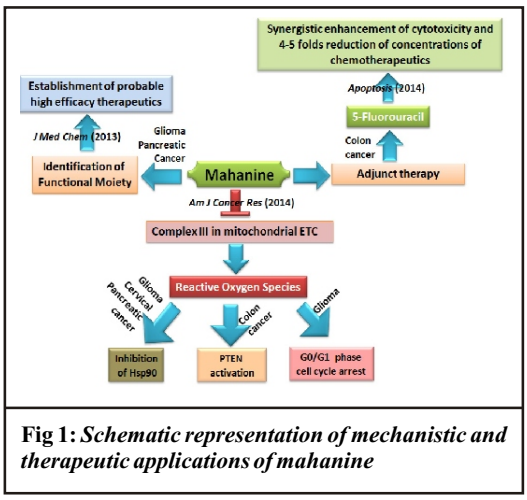


Fig 1: ***Schematic representation of mechanistic and therapeutic applications of mahanine***

Sialylation of OprD: A mechanistic aspect of antibiotic resistance in *Pseudomonas aeruginosa (PA)* -

PA is a Gram-negative bacterium mainly infects immune-compromised host. We demonstrated the presence of both α2,3- and α2,6-linked sialic acids (Sias) on PA (PA^{+Sias}) and normal human serum is their source of Sias. To identify the responsible molecule, affinity purification followed MALDI-TOF/TOF-MS indicated the presence of twenty six α2,6- and α2,3-linked sialylated proteins in PA^{+Sias}. One such sialoglycoprotein, OprD ($OprD^{+Sias}$) was purified. Sialylation was confirmed and Glycan structures revealed three sialylated *N*-glycans. β-lactam antibiotics (piperacillin and ceftazidime) showed decreased capability to penetrate through $OprD^{+Sias}$. An array of clinical isolates (PA^{+Sias}) also showed more resistant to these antibiotics. This might be one of the new mechanisms of PA for antibiotic resistance (Fig 2).

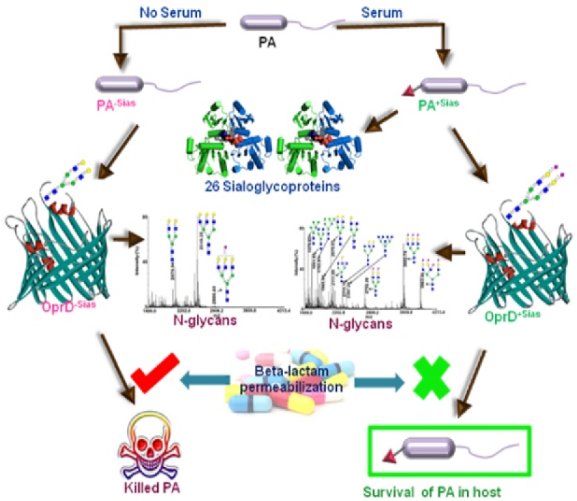


Fig 2: ***Role of sialic acids in hindrance of antibiotic permeabilization***

Publication Details:

Biswajit Khatua, Jeremy Van Vleetb, Biswa Pronab Choudhuryb, Chitra Mandal (2014) Sialylation of OprD protein: A mechanistic basis of antibiotic uptake in Pseudomonas aeruginosa. *Mol Cell Proteomics* 13(6):1412-28.

Sayantani Sarkar, Chandan Mandal, Rajender Sangwan and Chitra Mandal (2014) Chk1/Chk2 couples with G2/M cell cycle arrest and perturbed canonical Wnt/β-catenin pathway to elicit apoptosis in pancreatic adenocarcinoma. *Endrocine Related Cancer* 21, 113-125.

Ranjita Das, Kaushik Bhattacharya, Sayantani Sarkar, Suman K Samanta, Bikas C Pal and Chitra Mandal (2014) Mahanine synergistically enhances cytotoxicity of 5-fluorouracil through ROS-mediated activation of PTEN and p53/p73 in colon carcinoma. *Apoptosis 19:149-164.*

Bhattacharya Kaushik, Chandra Sarmila, Mandal Chitra (2014) Critical Stoichiometric ratio of CD4+CD25+FoxP3+ Treg and CD4+CD25- Tresp persuades immunosuppression in patient with B-cell Acute Lymphoblastic Leukemia. *Immunology* 142 (1):124-39

R.K Mehta, S Verma, S Mohanty, P. Jena, B. Khatua, R. Jena, S. Sethy, Chitra Mandal, K.H. Roehm, and A. Sonawane (2014) Mutations in subunit interface and B-cell epitopes improve antileukemic activities of Escherichia coli asparaginase-II: Evaluation of immunogenicity in mice. *J. Biol. Chem* 289(6), 35555-70.

C. D. P. Tripathi, R. Gupta, P. K. Kushawaha, Chitra Mandal, S. Misra Bhatracharya & A. Dube (2014) Efficacy of Withania somnifera chemotypes NMITLI101R, 118R and Withaferin A against experimental visceral leishmaniasis *Parasite Immunology* 1-13.

Das M, Bhattacharya K, Dittrick SA, Mandal Chitra, Balla VK, Sampath Kumar TS, Bandyopadhyay A, Manna I (2014). In situ synthesized TiB-TiN reinforced Ti6Al4V alloy composite coatings: Microstructure, tribological and in-vitro biocompatibility. *J Mech Behav Biomed Mater* 29:259-271.

Sarita Roy, Kaushik Bhattacharya, Chitra Mandal and Anjan K. Dasgupta (2013) Cellular response to chirality and amplified chirality. *Journal of Materials Chemistry B. 1:6634-43.*

Suman K. Samanta, Devawati Dutta, Sarita Roy, Kaushik Bhattacharya, Sayantani Sarkar, Bikas C. Pal, Chhabinath Mandal, Anjan K. Dasgupta and Chitra Mandal (2013) Mahanine, a DNA minor grove binding agent exerts cellular cytotoxicity with involvement of C-7-OH and -NH functional groups. *Journal of Medicinal Chemistry,* 56(14):5709-21.

Biswajit Khatua, Saptarshi Roy and Chitra Mandal (2013) Sialic acids siglec interaction: A unique strategy to circumvent innate immune response by pathogens. An invited review *Indian Journal of Medical Research* 138(5):648-62

Invited Lectures:

Delivered **11** invited talks in India & **one** in abroad which are shown below:

Topic: *Molecular interplay between sialic acids and siglecs in subversion of host innate Immune response by Pseudomonas aeruginosa*
Venue: The 15th International Congress of Immunology (ICI 2013) at Milano, Italy
Date: August 22-27, 2013

Session Chaired:

Chaired one scientific session in the Indian Immunology Society (IMMUNOCON-2013) at University of Delhi during November 16-17, 2013

Chaired one scientific session in the "Frontiers in Cancer Research: Prevention to Therapeutics" at Amity University, New Delhi during 15th Nov, 2013

Chaired one scientific session in the 24th General Meeting of The World Academy of Science (TWAS) at Buenos Aires, Argentina during Oct 1-4, 2013

Chaired one scientific session in the 15th International Congress of Immunology (ICI 2013) at Milano, Italy during August 22-27, 2013

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata, NIPER, Kolkata and JBNSTS students
Acted as External examiner for thesis examination and viva voce at Jadavpur University; Kolkata, J.N.U, New Delhi; National Institute of Immunology, New Delhi; PGIMER, Chandigarh; Banaras Hindu University, Varanasi; CSIR-CDRI, Lucknow; Calcutta University, Kolkata

Deputation Abroad:

Visit to Prof. Peter Walden's laboratory (Germany) in the context of the joint research and exchange project: Glycoproteomics network: Biomarkers for human diseases, funded through the IB-BMBF-CSIR Programme during August 2013.
Delivered and chaired a session at The 15th International Congress of Immunology (ICI 2013) at Milano, Italy August 22-27, 2013 Funded through J.C. Bose Fellowship.

Abstracts Presented:

Number of Abstracts in National Conference: **10**
Number of Abstracts in International Conference: **1**

Honors & Awards:

Fellow of National Academy of Medical Sciences, by *National Academy of Medical Sciences*, Recognition of the outstanding contribution to medical science (FAMS), 2013

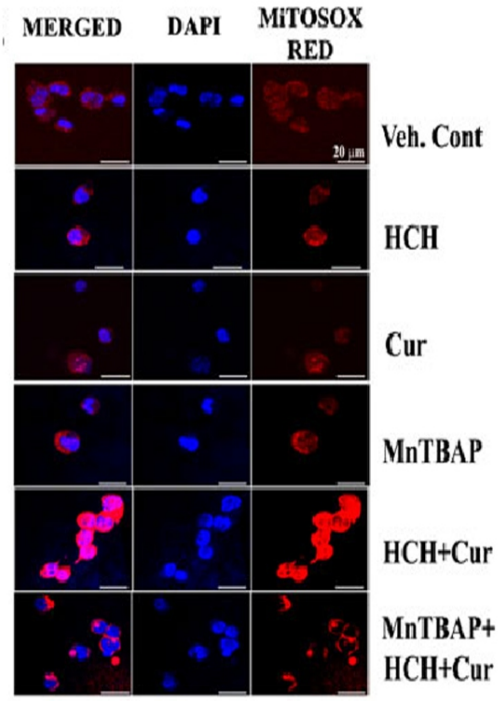
Human Resource:

Technical/Administrative Staff(s): Mr. Asish Mullick
Research Fellow(s): Mr. Biswajit Khatua, Mr. Kaushik Bhattacharya, Mr. Suman Kr. Samanta, Mr. Saptarshi Roy, Ms. Arup Kr. Bag, Ms. Ranjita Das, Ms. Sayatani Sarkar, Ms. Devawati Dutta, Mr. Samarpan Maiti
Research Associate(s): Dr. Chandan Mandal, Dr. Manjusha Chakrobarty
Project Assistant(s): Ms. Rita Maity

Dr. Santu Bandyopadhyay
Cancer Biology & Inflammatory Disorder Division

New insight for mTOR activation in apoptosis

Mammalian target of Rapamycin (mTOR) regulates multiple biological functions. Usually, mTOR activation is linked to cell survival. Here we report that two reactive oxygen species (ROS) generating phytochemicals namely hydroxychavicol and curcumin synergize in inducing apoptosis of leukemic cells. This combined treatment independently activates both mitogen activated protein kinases MAPKs (JNK and p38) and mTOR pathways. Our data indicate that mTOR and MAPK pathways converge at eukaryotic translation initiation factor 4E (eIF4E) that lead to preferential translation of pro-apoptotic proteins. Our data, for the first time, provide mechanistic insight to correlate mTOR activation and apoptosis.



Publication Details:

Chaudhuri J, Chowdhury AA, Biswas N, Manna A, Chatterjee S, Mukherjee T, Chaudhuri U, Jaisankar P and Bandyopadhyay S (2014) Superoxide activates mTOR-eIF4E-Bax route to induce enhanced apoptosis in leukemic cells. *Apoptosis*, 19, 135-148.

Students Awarded Ph.D.:

Avik Acharya Chowdhury , University of Calcutta.

Human Resource:

Technical/Administrative Staff(s):
Anirban Manna
Research Fellow(s):
Avik Acharya Chowdhury

Dr. Susanta Roychoudhury

Cancer Biology & Inflammatory Disorder Division

Killing cancer cells by targeting Mitotic Checkpoint Complex

Recent studies have underscored the importance of targeting mitotic apparatus for killing cancer cells. Targeting mitotic exit has been proposed as a better therapeutic strategy than targeting spindle assembly and spindle regulators. The successful mitotic exit is ensured by the proper function of the spindle assembly checkpoint (SAC) proteins. We provide evidence that abrogation of the function of SAC proteins as well as that of Cdc20 may result severe aneuploidy which is detrimental for the cell viability. A consistent feature of such abrogation is mitotic delay as indicated by the slow degradation of Cyclin B1 followed by chromosomal abnormality (Biochem Pharmacol; 2014; 19: 31-39).

Deciphering the host-susceptibility to *Helicobacter pylor* associated human diseases

Helicobacter pylori is a major pathogen associated with the development of different gastroduodenal diseases. It has been reported that *H. pylori* infection induced alteration in IL1B expression causes modulation in the gastric acid secretion in the gut. We reported that IL1B down regulates gastrin expression by activating NFkB pathway. In the present study we elucidated the probable pathway by which IL1B induces NFkB and affects gastrin expression.

We observed activation of MyD88 followed by phosphorylation of TAK1 upon IL1B treatment of AGS cells. The activated TAK1 subsequently induces NFkB p50-p65 heterodimer. The NFkB heterodimer in turn recruits on to gastrin promoter together with HDAC1 and NCoR bringing the repression of the gastrin expression (PLoS ONE August 2013, 8(8) e73409).

Publication details:

Ghosh A, Maiti GP, Bandopadhyay MN, Chakraborty J, Biswas J, Roychoudhury S, Panda CK. Inactivation of 9q22.3 tumor suppressor genes predict outcome for patients with head and neck squamous cell carcinoma. Anticancer Res. 33:1215-1220 (2013)

Maiti GP, Mondal P, Mukherjee N, Ghosh A, Ghosh S, Dey S, Chakrabarty J, Roy A, Biswas J, Roychoudhury S, Panda CK. Overexpression of EGFR in Head and Neck Squamous Cell Carcinoma Is Associated with Inactivation of SH3GL2 and CDC25A Genes. PLoS One 2013 May 10;8(5):e63440. doi: 10.1371/journal.pone.0063440

Datta De D., Datta A., Bhattacharjya S. and Roychoudhury S. NF-kappaB Mediated Transcriptional Repression of Acid Modifying Hormone Gastrin. PLoS ONE August 2013, 8(8) e73409; doi:10.1371/journal.pone.0073409

Sarkar S., Maiti G P, Jha J., Biswas J., Roy A., Roychoudhury S., Sharp T., Panda C K. Reduction of Proliferation and Induction of Apoptosis are Associated with Shrinkage of Head and Neck Squamous Cell Carcinoma due to Neoadjuvant Chemotherapy. Asian Pac J Cancer Prev, 14: 6419-6425 (2013)

Tania Das, Kumar Singha Roy, Tulika Chakraborty, Sibabrata Mukhopadhyay, Roychoudhury S. Withaferin A modulates the Spindle Assembly Checkpoint by degradation of Mad2-Cdc20 complex in colorectal cancer cell lines. Biochem Pharmacol 19: 31-39 (2014)

Invited Lectures:

Delivered 4 numbers of invited talks in India

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata, NIPER, Kolkata, West Bengal University of Technology, Kolkata and Calcutta University

Abstract Presented:
No. of abstract in National Conference is: **3**
No. of abstract in International Conference is: **2**

Honors and Awards: Fellow, Indian Academy of Sciences 2014

PhD thesis Awarded: Sumana Bhattacharjya, Calcutta University

Human Resources:
Technical staff: Mr. Bhaskar Basu
Research Fellow(s): Ms. Sumana Bhattacharya, Ms. Tania Das, Mr. Debrup Sen, Mr. Arindam Datta, Mr. Kayum Alam, Ms. Sangeeta Ghuwalewala, Mr.Chetan Kr. Jain, Mr. Abhishek Chowdhury, Mr. Kumar Singha Roy and Ms.Dishari Ghatak.
Project Assistants: Mr. Pijush Das, Mr. Arnab Choudhury
Research Associates: Dr. Sanjib Dey , Dr. (Mrs) Ruma Dey Ghosh
Summer trainees: Shreyoshi Sengupta , Snigdha Bhowmick, Vignesh Amalraj, Joshua mark David, Suvoshree Ghosh.

Dr. (Mrs.) Padma Das
Cancer Biology & Inflammatory Disorder Division

Novel herbal compound induce apoptosis and autophagy associated cell death in colon carcinoma cells.

We have investigated that herbal extract initiates both autophagic and apoptotic cell death in human colon carcinoma cells suggests that it has potential for anti cancer therapy. A novel family of betulinic acid analogues were synthesized and initially screened for their anticancer activity against different cancer cell lines and normal human PBMC by MTT assay. The role of Betulinic acid analogue, **2c** as an inducer of apoptosis were investigated on HT-29 cell line by measuring its ROS generation capability, Annexin-V/ PI binding assay, depolarization of mitochondrial transmembrane potential, activation of caspases, PARP cleavage, nuclear degradation and expression of pro- and anti-apoptotic proteins. As there is a functional relationship between apoptosis and autophagy we checked whether **2c** was capable to induce autophagy or act antagonistically for autophagic pathway. Analogue **2c** exhibited much higher cytotoxicity than standard drug 5-fluorouracil on HT-29 cells but interestingly, it showed negligible cytotoxicity towards normal PBMC. Elevated level of ROS generation, activation of caspase 3 and caspase 9, DNA fragmentation, higher expression of proapoptotic protein, Bax, Bad whereas lower expression of anti apoptotic protein Bcl_2, Bcl-xl, increased level of Bax/Bcl-xl ratio represents **2c** as a promising inducer of apoptosis and suggests that **2c** follows

mitochondrial dependent pathway of apoptosis. Biophysical studies reveal that compound 2c binds to a minor groove of DNA as determined by Molecular Docking. Altogether our studies suggest that **2c** follows mitochondrial dependent pathway of apoptosis. Interestingly, even with these molecular features of apoptosis, **2c** was able to alter different autophagic protein levels like Beclin-1, Atg 5, Atg 7, LC3B which were checked by Immuno Cyto Chemistry, Western Blotting and Real Time PCR.These was accompanied by formation of autophagic vacuoles as revealed by FACS, fluorescence microscopy and transmission electron microscopy confirming the occurrence of autophagy. Lastly, the hallmark of autophagy i.e. the presence of LC3B on the autophagolysozome was determined by confocal microscopy.

Publication Details:

Rajneeta Roy, Deepak Kumar, Biswajit Chakraborty, Chinmay Chowdhury, Padma Das (2013), Apoptotic and Autophagic Effects of Sesbania grandiflora Flowers in Human LeukemicCells. PLoS ONE 8(8): e71672,

Abstract presented:

No. of Abstracts in National Conference is **1**
No. of Abstracts in International Conference is **1**

Human Resource:

Research Fellow(s): Deepak Kumar, Rajneeta Roy, Debasmita Dutta
Summar Trainee (s): Upasana Banerjee

Dr. Mrinal K Ghosh
Cancer Biology & Inflammatory Disorder Division

Role of deubiquitinase HAUSP in protein turnover and oncogenic signalling

The process of ubiquitination is extremely dynamic and regulated by deubiquitinating enzymes which remove ubiquitin tags from proteins, exerting strict control on protein turnover and cell signaling. Deubiquitinase HAUSP (Herpes-virus associated ubiquitin-specific protease) has varied roles in a number of biological processes ranging from genome stability, epigenetic regulation, cell cycle and apoptosis to viral infection, immunity and even stem cell maintenance and hence, emerges to be a very important candidate with implications in cancer. The significance and mode of action of HAUSP in oncogenesis was investigated. Tumor suppressor Rb is an important cell cycle regulator, arresting cell cycle in early G1. Several E3 ligases including protooncogene MDM2 promote the degradation of Rb. HAUSP was found to colocalize and interact with Rb to save it from proteasomal degradation by removal of ubiquitin chains, in normal cells. Hence, HAUSP is a novel deubiquitinase for Rb.

Besides, HAUSP was overexpressed in glioma and contributed towards glioma progression. However, the saving mechanism of Rb by HAUSP was abolished in glioma (cancer), where HAUSP and Rb showed an inverse relationship. MDM2 (a known substrate of HAUSP) served as a better target for HAUSP mediated protection in cancer cells, facilitating degradation of Rb and oncogenic progression. This is speculative of a new possibility to distinguish cancer cells from normal cells at the molecular level, which may be investigated for therapeutic intervention in future.

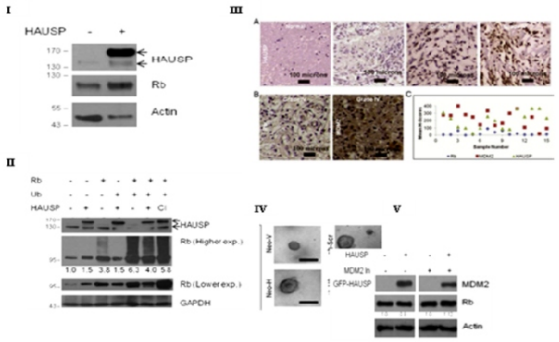


Figure: HAUSP plays a role in glioma progression via differential regulation of Rb and MDM2

I. GFP-HAUSP was overexpressed in COS-7 cells and Rb protein levels were determined by WB.

II.WB of Rb cotransfected with wild type (WT) or catalytically inactive (CI) HAUSP in the presence or absence of Ubiquitin .

III. (A) Representative IHC images of each grade of human glioma patient samples (n=38) for HAUSP expression. (B) IHC of a subset of the above glioma samples for Rb and MDM2 expression (n=15) (C) Dot plot representation of the mean H-scores calculated for each sample to estimate the overall levels of expression of HAUSP, MDM2 and Rb (n=15).

IV. Representative images of C6 glioma-stable cell lines showing reduced colony size and number in HAUSP knockdown cells (sh-H2) compared to the control cells (sh-Scr).

V. WB of Rb upon HAUSP overexpression in U87MG glioma cells either with or without MDM2 inhibitor.

Publication Details:

Bhattacharya S, Ghosh MK*. HAUSP, a novel deubiquitinase for Rb - MDM2 the critical regulator. *FEBS J* 2014; 281: 3061-3078.

Paul I and Ghosh MK* (2014). The E3 ligase CHIP: insights into its structure and regulation. *BioMed Research International*, Article ID 918183, 12 pages. doi.org/10.1155/2014/918183.

Dhar A, Mallick S, Ghosh P, Maiti A, Ahmed I, Bhattacharya S et al. Simultaneous Inhibition of Key Growth Pathways in Melanoma Cells and Tumor Regression by a Designed Bidentate Constrained

Helical Peptide. *Biopolymers 2014*; 101: 344-58.

Mandal T, Bhowmik A, Chatterjee A, Chatterjee U, Chatterjee S and Ghosh MK*. Reduced phosphorylation of Stat3 at Ser-727 mediated by Casein Kinase 2 - Protein Phosphatase 2A enhances Stat3 Tyr-705 induced tumorigenic potential of glioma cells. *Cellular Signaling* 2014; 26: 172534.

Paul I†, Bhattacharya S†, Chatterjee A and Ghosh MK*. Current Understanding on EGFR and Wnt/β-Catenin Signaling in Glioma and Their Possible Crosstalk. *Genes & Cancer* 2013; 4: 427-446.

Invited Lecture:
Delivered 2 numbers of invited talks in India

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB

Abstracts Presented (Oral/Poster)
No. of Abstracts in National Conference is seven **7**.

No. of Abstracts in International Conference is nine **9**.

PhD Thesis Awarded
Two **(2)**

Human Resources
Research Fellow(s): Tapashi Mandal; Seemana Bhattacharya; Nilanjana Das; Moumita Sarkar; Syed Feroj Ahmed; Arijit Bhowmik; Rajni Khan; Neerajana Datta; Veenita Khare; Aroni Chatterjee.

Dr. Malini Sen

Cancer Biology & Inflammatory Disorder Division

Evaluating WNT and WISP in Health and Disease.

We are interested in understanding the molecular basis of WNT5A and WISP3 mediated regulatory networks in health and disease. WNT5A, a member of the WNT family of growth factors has previously been shown to be associated with proinflammatory cytokine secretion. WISP3, a chaperone like protein is linked to a cartilage disorder termed progressive pseudorheumatoid dysplasia. We are carrying out a detailed investigation on (i) the role of WNT5A in immune response and inflammation and (ii) the role of WISP3 in the preservation of mitochondrial metabolism and chondrocyte integrity.

Our experimental results suggest that WNT5A signaling contributes to macrophage growth / differentiation, phagocytosis and maintenance of immune homeostasis. While WNT5A signaling is beneficial for innate immunity, it may also support context dependent chronic inflammation. We also propose that WISP3 sustains chondrocyte / cartilage integrity by modulating IGF1 mediated effects and mitochondrial metabolism.

Publication Details:

Repudi S, Patra M and Sen M. 2013. WISP3-IGF1 interaction regulates chondrocyte hypertrophy. J Cell Sci 126: 1650 1658.

Naskar D, Maiti G, Chakraborty A, Roy A, Chattopadhyay DJ and Sen M. 2014 Wnt5a Rac1 NFκB homeotsatic. circuitry sustains innate immune functions in macrophages. J Immunol 192: 4386-4397.

Invited Lectures:

Delivered **1** of invited talk in India

Human Resource:

Research Fellows: Mr. Debdut Naskar, Mr. Milan Patra, Mr. Arijit Chakraborty, Ms. Indira Guha, Ms. Debosruti Nath, Mr. Suborno Jati.
Research Associates: Dr. Srinivasarao Repudi, Dr. Suman Kundu
Visiting Scholar from Lagos, Nigeria (TWAS program): Mr. Oyesola Ojewunmi

Dr. Dipyaman Ganguly

Cancer Biology & Inflammatory Disorder Division

Role of plasmacytoid dendritic cells in metaflammation:

Infiltrating immune cells in the adipose tissue (metaflammation), in addition to deregulated lipogenesis and adipokine expression, has been linked to metabolic syndrome in obesity. We now discover that adipokine deregulation in obesity is linked to initiation of this inflammatory milieu.

Crosstalk between plasmacytoid dendritic cells and B regulatory cells in systemic lupus erythematosus:

In Systemic lupus erythematosus (SLE) autoreactivity is attributed to antibody producing B cells with aberrant specificity to self molecules. Another population of B cells, which produces the anti-inflammatory cytokine interleukin-10 (IL10) and dampens immune response, called the IL-10 producing regulatory B cells (Bregs) or B10 cells, is less abundant and dysfunctional in SLE. A critical role of type I interferons and plasmacytoid dendritic cells (pDCs), the major IFN-I producing cells, in several autoimmune diseases including SLE is already established. We discovered a mechanistic link between the pDC-driven IFN-I-dominant autoreactive inflammation and B10 cell dysregulation in SLE.

Publication Details:
Ganguly D, Haak S, Sisirak V, Reizis B. Role of dendritic cells in autoimmunity. Nature Reviews Immunology. 2013 Aug;13(8):566-77.

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Conference/Workshop/Symposia Organized:
Organized the World Immunology Day Celebration in CSIR-IICB

Human Resource:
Research Fellow(s): Amrit Raj Ghosh, Roopkatha Bhattacharya, Oindrila Rahaman, Deblina Raychoudhuri, Dr. Pritam Duttagupta,
Research Associate(s): Dr. Shamik Bhattacharya
Summer Trainee(s): Chinky Shiu Chen Liu, Oindrila Mukherjee, Shounak Roy

Dr Amitava Sengupta
Cancer Biology & Inflammatory Disorder Division

Regulation of hematopoietic stem cells

Stem cells possess two fundamental properties; self-renewal and differentiation. Bone marrow-resident adult hematopoietic stem cells (HSC) respond to physiological stimuli and regenerate hematopoiesis. Dysregulated self-renewal and arrest in differentiation of HSC and progenitors induce leukemic transformation. From a translational perspective HSCs draw attention because of their potential use in stem cell and gene therapy. We are interested at understanding the cell-autonomous and non-cell-autonomous molecular determinants that regulate HSC self-renewal, differentiation and interaction with hematopoietic microenvironment or niche.

1. Cell-autonomous mechanisms of hematopoietic stem cell transformation.
2. Epigenetic regulation of leukemia stem cell heterogeneity.
3. Microenvironment regulation in hematopoiesis

Publication Details:

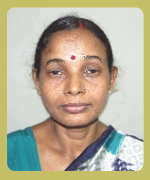
Chang KH*, Sengupta A*, Nayak R, Duran A, Lee SJ, Pratt R, Wellendorf AM, Watkins M, Gonzalez-Nieto D, Aronow BJ, Starczynowski DT, Civitelli R, Diaz-Meco MT, Moscat J, Cancelas JA. (2014) p62 is required to retain short-term repopulating and myeloid progenitor cells through inhibition of IKK/NF-κB/Ccl4 signaling at the bone marrow macrophage-osteoblast niche. *Cell Reports;* 9: 2084-2097

Invited Lectures:
Delivered **2** numbers of invited talks in India

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Abstracts Presented:
Number of Abstracts in National Conference: **2**

Human Resource:
Research Fellow(s): Mr. Shankha Subhra Chatterjee,Mr. Mayukh Biswas, Mr. Sayan Chakraborty, Mr. Liberalis Debraj Boila, Ms. Sayantani Sinha
Project Assistant(s): Mr. Subha Saha



Dr. Krishna Das Saha

Cancer Biology & Inflammatory Disorder Division

Anti Cancer and Anti-Inflammatory activity of microbial lipid natural, synthetic & nano formulated compounds

Lipids isolated from attenuated *Leishmania donovani* is found to improve the lung injury and protect mice against gram-negative bacterial sepsis by modulating the inflammatory condition via TLR4-CD14 expression. Sphingolipid fraction separated from attenuated *Leishmania donovani* inhibits the growth of Sarcoma 180 cells in vitro and in vivo via apoptosis and angiogenic switchover. Lipids isolated from pathogenic *L. donovani* improve the endotoxin-associated liver damage and disbalance of the inflammatory factors, vascular permeability factors, such as VEGF, cell adhesion molecules ICAM-1, VCAM-1, PECAM-1, P-selectin, and E-selectin. This lipid from pathogenic Leishmania effectively prevents CCl_4 induced liver injury by preventing the histopathological changes, alteration of the level of antioxidant enzymes, and growth factors like TGF-β, HGF, and EGF with consequent suppression of apoptosis as revealed from normalization in the caspase activities and expressions of Bad, Bax, p53, and NF-κBp65 activation.

Anticancer activity of the gold (I) and gold (III) N-heterocyclic carbene complexes through regulation of ROS, PARP, p53, p21, NF-κB, VEGF, MMP-9 has been established both in vitro and in-vivo model. Anticancer activity of an anthracene-bisphosphonate based novel fluorescent organic nanoparticle has been explored in U937 cancer cells. Inhibitors of p53-

HDM2 as antiproliferative agents have been designed from molecular modeling study. PARP-1 inhibitors have been developed through stepwise structure-activity relationship studies and have been validated from in-silico modeling studies. Porus polyurea network is found to act as biosensor and scaffold for drug delivery. Magnetic coreshell nanoprobe was designed and targeted for cancer cells death.

Publications

Nabanita Chatterjee, Subhadip Das, Dipayan Bose, Somenath Banerjee, Sujata Das, Tarun Jha, Krishna Das Saha. Leishmanial lipid suppresses bacterial endotoxin induced inflammatory response with attenuation of tissue injury in sepsis. Journal of Leukocyte Biology 2014, 96(2):325-336.

Subhadip Das, Nabanita Chatterjee, Dipayan Bose, Somenath Banerjee, Prajnamoy Pal, Tarun Jha, Krishna Das Saha. Lipid isolated from a Leishmania donovani strain reduces Escherichia coli induced sepsis in mice through inhibition of inflammatory responses. Mediator of Inflammation 2014;409694

Nandy A, Dey SK, Das S, Munda RN, Dinda J, Saha KD. Gold (I) N-heterocyclic carbene complex inhibits mouse melanoma growth by p53 upregulation. Mol Cancer. 2014, 13;13:57

Manna K, Khan A, Kr Das D, Bandhu Kesh S, Das U, Ghosh S, Sharma Dey R, Das Saha K, Chakraborty A, Chattopadhyay S, Dey S, Chattopadhyay D. J. Protective effect of coconut water concentrate and its active component shikimic acid against hydroperoxide mediated oxidative stress through suppression of NF-κB and activation of Nrf2 pathway. Ethnopharmacol. 2014,8;155(1):132-46.

Das U, Manna K, Sinha M, Datta S, Das DK, Chakraborty A, Ghosh M, Saha KD, Dey S. Role of ferulic acid in the amelioration of ionizing radiation induced inflammation: a murine model. PLoS One. 2014 , 22;9(5):e97599.

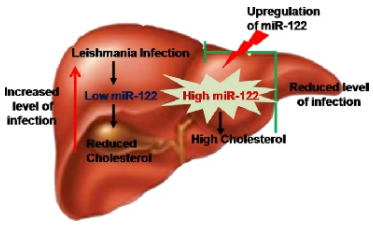
Halder AK, Saha A, Saha KD, Jha T. Stepwise development of structure-activity relationship of diverse PARP-1 inhibitors through comparative and validated in silico modeling techniques and molecular dynamics simulation. J Biomol Struct Dyn. 2014 28:1-24.

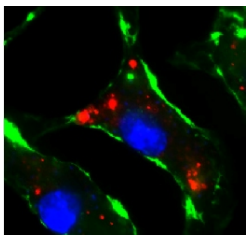
Samir Mandal, Nabanita Chatterjee, Subhadip Das, Krishna Das Saha and Keya Chaudhuri. Magnetic coreshell nanoprobe for sensitive killing of cancer cells via induction with a strong external magnetic field.RSC Advances 2014, 4, 20077-20085.

Joydev Dinda, Abhishek Nandy, Bidyut Kumar Rana, Valerio Bertolasi, Krishna Das Saha and Christopher W. Bielawski Cytotoxicity of silver(I), gold(I) and gold(III) complexes of a pyridine wingtip substituted annelated N-heterocyclic carbine. RSC Adv., 2014,4, 60776-60784

Research Fellow: Abhisek Nandy, Subhadip Das, Dipayan Bose , Somnath Banerjee, Nabanita Chatterjee, Sujata Das

MHG





Molecular and Human Genetics Division

Drs. Samit Adhya, Keya Chaudhury, Suvendra Nath Bhattacharyya (Head), Debabrata Biswas

This department has mandates to identify the role of pathogens in modulating small RNAs in the host; to find whether telomere length or senescence factors are responsible for the carcinogenic effects of arsenic; to determine the molecular basis of gene delivery to mitochondria, and to understand the eukaryotic transcriptional regulatory mechanisms and their role in human diseases.

Previous work led to the development of a novel carrier-based protocol for mitochondrial RNA therapy; in the following years we propose to explore the mechanism of uptake and intracellular targeting of the carrier complex and RNA to mitochondria in animal model. Emphasis will be placed on determination of the function of microRNAs in parasitic disease (leishmaniasis) and also in cancer. Mechanistic understanding and regulation transcription process at molecular level is also under investigation. Using a combination of basic and applied approaches we will study the molecular basis of genetic disease and its therapy.

Dr. Samit Adhya
Molecular and Human Genetics Division

Very little is known about how nucleic acids are translocated across membranes. The multi-subunit RNA Import Complex (RIC) from mitochondria of the kinetoplastid protozoon Leishmania tropica induces translocation of tRNAs across artificial or natural membranes, but the nature of the translocation pore remains unknown. We have reconstituted the minimal import pore rom recombinant subunits and examined its structural and functional properties.

A voltage-gated pore for translocation of tRNA

We show that subunits RIC6 and RIC9 assemble on the membrane in presence of subunit RIC4A to form complex R3. Atomic Force Microscopy of R3 revealed particles with an asymmetric surface groove of ~20 nm rim diameter and ~1 nm depth. R3 induced translocation of tRNA into liposomes when the pH of the medium was lowered to ~6 in the absence of ATP. R3-mediated tRNA translocation could also be induced at neutral pH by a K+ diffusion potential with an optimum of 6070 mV. Point mutations in the Cys2His2 Fe-binding motif of RIC6, which is homologous to the respiratory Complex III FeS protein, abrogated import induced by low pH but not by K+ diffusion potential. These results indicate that the R3 complex forms a pore that is gated by a protongenerated membrane potential and that the FeS binding region of RIC6 has a role in proton translocation. The tRNA import complex of L. tropica thus contains a novel macromolecular channel distinct from the mitochondrial protein import pore that is apparently involved in tRNA import in some species.

Publication Details:

Koley, S. and Adhya, S. (2013) A voltage-gated pore for translocation of tRNA; *Biochem. Biophys. Res. Comm.* ; 439, 2329

Invited Lectures:

Delivered **one (1)** numbers of invited talks in India

Chairing Sessions:

Chaired the Plenary talk session at the Third Annual Conference of the Society for Mitochondrial Research and Medicine, NIMHANS, Bangalore, 20 December, 2013

Academic Performance:

Lectures to CSIR-IICB course work students on Eukaryotic Gene Regulatory Mechanisms

Awarded Ph.D:
Sukanta Jash, Calcutta University

Human Resource:
Technical staff: Tapas Chaudhury
Research Fellow(s): Sandip Koley, Sukanta Jash, Utpalendu Ghosh, Joyita Mukherjee
Research Associate(s): Dr. Gunjan Dhar

Dr. Keya Chaudhuri
Molecular and Human Genetics Division

Biology of Oral Cancer and precancer:

Early detection and quantification of DNA damage in oral premalignant lesions and conditions or malignancy may help in management of the disease and improve survival rates. The comet assay has been successfully used to detect DNA damage in oral premalignancy or malignancy. However, due to the invasive nature of collecting blood, it may be painful for many unwilling patients. Our study probed into developing some noninvasive methods. A comparison of the micronucleus (MN) assay in oral buccal mucosa cells with the comet assay in peripheral blood cells in a subset of oral habit induced precancer and cancer patients was conducted. MN assay of exfoliated epithelial cells was compared with comet assay of peripheral blood leucocytes among 260 participants, including those with oral lichen planus (OLP; $n = 52$), leukoplakia (LPK; $n = 51$), oral submucous fibrosis (OSF; $n = 51$), oral squamous cell carcinoma (OSCC; $n = 54$) and normal volunteers ($n = 52$). The DNA damage pattern in precancer and cancer patients was OLP < OSF < LPK < OSCC, and with respective oral habits, it was multiple habits > cigarette + khaini > cigarette smokers > areca + khaini > areca. There was no significant difference in the comet length and Mni frequency between males and females who had oral chewing habits. An overall significant correlation was observed between MNi frequency and comet tail length with $r = 0.844$ and $P < 0.0001$. Thus, the extent of DNA damage evaluation by the comet assay in peripheral blood cells is perfectly reflected by the MN assay on oral exfoliated epithelial cells, and MNi frequency can be used with the same effectiveness and greater efficiency in early detection of oral premalignant conditions.

Herbal remedy for *Vibrio cholerae*

Vibrio cholerae is one of the major bacterial pathogens responsible for the devastating diarrheal disease called cholera. Chemotherapy is sometimes used against *V. cholerae* infections; however, the emergence of *V. cholerae* with multidrug resistance (MDR) toward the

chemotherapeutic agents is a serious clinical problem. This scenario has provided us with the impetus to look into herbal remediation, if any. Our studies were undertaken to determine the antidiarrheal potential of several compounds of herbal origin. Among the screened compounds 6-gingerol (6G) was found to be a potential candidate due to its effect on CT, the virulence factor secreted by *V. cholerae*. Our results showed that 6G binds to CT, hindering its interaction with the GM1 receptor present on the intestinal epithelial cells. The detailed mechanistic study was conducted by enzyme-linked immunosorbent assay (ELISA), fluorescence spectroscopy, and isoelectric focusing. These results were validated with *in vitro* studies performed with the CHO, HeLa, and HT-29 cell lines, whereas a rabbit ileal loop assay was done to estimate the *in vivo* action, which confirms the efficacy of 6G in remediation of the choleragenic effects of CT. Thus, 6G can be an effective adjunctive therapy with oral rehydration solution for severe CT-mediated diarrhea.

Arsenic toxicity and its remediation by components of garlic:

Chronic exposure to high concentrations of arsenic in drinking water poses severe health problems. Despite arsenic being a severe health hazard, a safe and effective remedy against arsenic poisoning remains elusive. Previously, studies from our group showed that aqueous garlic extract (AGE) could be a potential protective substance against arsenic toxicity. Further, we aimed to identify the bioactive component of garlic that participates in the remediation of arsenic toxicity. Previously, we found that AGE formed a precipitate when incubated with $NaAsO_2$ overnight. Mass spectral analysis showed arginine to be one component of AGE responsible for forming the precipitate with $NaAsO_2$. Incubation of A375 cells with $NaAsO_2$ (10 µM) for 24 h caused a reduction in cell viability, enhanced reactive oxygen species (ROS) production, a reduction of the activities of the intracellular enzymatic as well as non-enzymatic antioxidants and also an enhancement of lipid peroxidation. Arginine (60 µM) along with $NaAsO_2$ almost normalized the altered cell viability, modulated ROS level and activities of antioxidant indices. Arginine also blunted arsenic induced genotoxicity and elevated the expression of poly-ADP ribose polymerase.

Further, we studied the interaction between diallyl disulphide (DADS), a stable antioxidant present in garlic, with NaAsO2 by UV spectrophotometry. The UV spectral data revealed the chemical interactions between DADS and As(III) in a 3 : 1 molar ratio. The potency of DADS in combating arsenic toxicity in human hepatocellular carcinoma cell line (HepG2) was investigated by MTT assay. The results showed that 50 mM DADS along with 10 mM $NaAsO_2$ could effectively attenuate the arsenite-induced cytotoxicity, production of reactive oxygen species (ROS), lipid peroxidation and DNA damage. Application of DADS along with $NaAsO_2$ in HepG2 cells resulted in the modulation of arsenite-induced activities of antioxidant enzymes like superoxide dismutase (SOD) and catalase (CAT) to near normal levels. Finally, we attempted to trace the chemical interaction between As(III) and DADS in the HepG2 cellular environment. High-performance liquid chromatography (HPLC) analysis of the $NaAsO_2$ and DADS treated cell lysate revealed similar interactions between $NaAsO_2$ and DADS to those observed in vitro.

Publication details:

Atul Katarkar, Sanjit Mukherjee, Masood H Khan, Jay G Ray, Keya Chaudhuri; Comparative evaluation of genotoxicity by micronucleus assay in the buccal mucosa over comet assay in peripheral blood in oral precancer and cancer patients; Mutagenesis. 2014 Sep;29(5):325-34.

Mahammad, A., Bhowmick, R., Dolai, M., Alam, R., Mistri, T., Katarkar, A., & Chaudhuri, K. (2014). A novel pyrene-2-(pyridin-2-ylmethylsulfanyl) ethylamine based turn-on dual sensor for Al3+: experimental and computational studies.RSC Advances. 4 (79), 41784-41792

Alam R, Mistri T, Katarkar A, Chaudhuri K, Mandal SK, Khuda-Bukhsh AR, Das KK, Ali M.; A novel chromo-and fluorogenic dual sensor for Mg2+ and Zn2+ with cell imaging possibilities and DFT studies; Analyst. 2014 Aug 21;139(16):4022-30.

Samir Mandal, Nabanita Chatterjee, Subhadip Das, Krishna Das Saha and Keya Chaudhuri. Magnetic coreshell nanoprobe for sensitive killing of cancer cells via induction with a strong external magnetic field. RSC Adv., 4 (39), 20077-20085.

Bornita Das and Keya Chaudhuri. Amelioration of sodium arsenite induced toxicity by diallyl disulfide, a bioactive component of garlic: the involvement of antioxidants and the chelate effect; RSC Adv., 2014, 4, 20964-20973.

Bornita Das, Samir Mandal and Keya Chaudhuri. Role of arginine, a component of aqueous garlic extract, in remediation of sodium arsenite induced toxicity in A375 cells; Toxicol. Res., 3(3), 191-196.

Dutta A, Chatterjee R, Chaudhuri K. Identification of C. elegans & C. briggsae miRNAs by modified miRsearch..(2014). Frontiers in Bioscience 19 : 504-514. Front Biosci (Landmark Ed). 2014 Jan 1;19:504-14. PMID:24389198.

Mandal S, Hossain M, T. Muruganandan, Kumar GS and Chaudhuri K*. Gold nanoparticles alter Taq DNA polymerase activity during polymerase chain reaction.(2013). RSC Advances 3:20793-20799.

Saha P, Das B, Chaudhuri K. Role of 6-Gingerol in the reduction of cholera toxin activity in vitro and in vivo. (2013).Antimicrobial Agents Chemotherapy 57(9):4373-4380. Antimicrob Agents Chemother. 2013 Sep;57(9):4373-80.

Awarded PhD:

Avirup Dutta, Vidyasagar University, Midnapore
Sanjit Mukherjee, Jadavpur University
Samir Mandal, Jadavpur University

Human Resource:

Technical/Administrative staff: Ms Mahua Bhattacharya
Pool Officers/ RA : Dr. Tapasi Das (DST Woman Scientist)
Research Fellows: Pallashri Saha, Debashree Chatterjee , Samir Mondal, Bornita Das, Avirup Dutta, Sanjit Mukherjee, Atul K Katarkar

Dr. Suvendra N. Bhattacharyya
Molecular and Human Genetics Division

The power of small RNA: Identification of mi-RNA as a potential therapeutic molecule against Kala-azar

Visceral Leishmaniasis (Kala-azar) caused by the pathogenic parasite *Leishmania donovani* is a deadly disease affecting a large portion of Bihar and adjoining areas. In patients, with progress of infection, downregulation of serum cholesterol was noted. Investigating the mechanism of this change, CSIR-IICB scientists have discovered the role of a host micro-RNA regulating the infection process. This tiny RNA, miR-122 is a liver specific micro-RNA that gets reduced in the liver of infected animals. Restoration of miR-122 level in infected animals reverted serum cholesterol level and cleared parasite load from infected subjects. From this study, a therapeutic potential of miR-122-the tiny RNA wonder- in curing this parasitic diseases is evident. This is important particularly when other drugs are failing due to increased drug resistivity of the pathogen that has emerged recently.

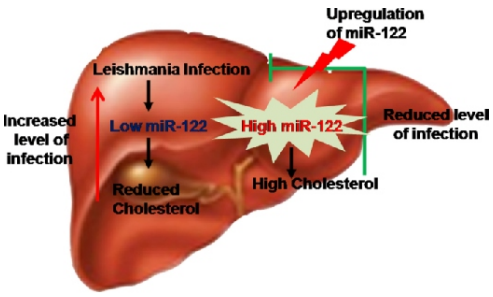


Fig.: Leishmania donovani lowers cholesterol by reducing liver specific miR-122

Macrophage activation ensured by miRNP deactivation

How the miRNA targeted proinflammatory genes escape miRNA-mediated repression during macrophage activation is a long-standing unresolved issue in immunology. CSIR-IICB Scientists have recently shown how a transient reversal on miRNA-mediated gene repression during macrophage activation ensures inflammatory response in mammalian macrophage cells. Dr Suvendra Bhattacharyya and his colleagues from CSIR-IICB have identified that phosphorylation of AGO2, happening in stimulated macrophage, is necessary for miRNA unbinding and thus also for derepression of miRNA-targeted proinflammatory genes in activated macrophages. They have shown it a study, published in EMBO Rep in November 2013, the importance of transient reversal of miRNA-activity in macrophage activation and pathogen invasion. Cells defective for AGO2 phosphorylation that could ensures derepression of miRNA activity upon stimulation become more vulnerable for pathogen infection.

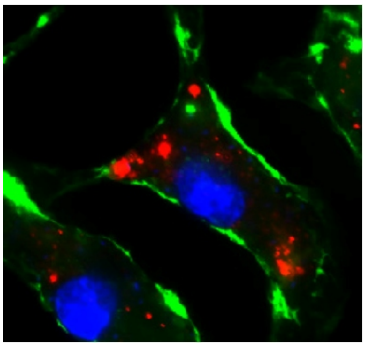


Fig.: Pathogen Leishmania donovani evades macrophages defective for AGO2

Publication Details:
Mazumder, A., Bose, M., Chakraborti, A., Chakrabarti, S. and Bhattacharyya, S.N., (2013). A transient reversal of miRNA-mediated repression controls macrophage activation. *EMBO Rep.,* 14, 1008-1016.

Ghosh J., Bose M., Roy S., Bhattacharyya S.N., (2013). Leishmania donovani targets Dicer1to downregulate miR-122, lower serum cholesterol, and facilitate murine liver infection. *Cell Host Microbe,* 13, 277-288.

Invited Lectures:
Delivered **one (1)** numbers of invited talks in India

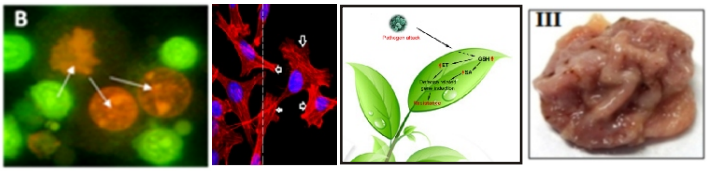
Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata
Acted as Examiner at B C Guha Center at University of Calcutta, MSc Bitechnology.

Deputation Abroad:
EMBO|EMBL Symposium: The Non-Coding Genome starting tomorrow at EMBL Heidelberg from 9-12 October 2013

Abstracts Presented:
Number of Abstracts in National Conference: **1**
Number of Abstracts in International Conference: **2**

Conference/Workshop/Symposia Organized:
Co-convener of the 7th RNA Meeting at CSIR-IICB, 6-8th March 2014

Human Resource:
Research Fellow(s): Anup Mazumder, Souvik Ghosh, Banhisikha Barman, Kamalika Mukherjee, Somi Patranabis, Yogaditya Chakraborty, Mainak Bose, Bartika Ghoshal, Avijit Goswami and Dipayan De
Research Associate(s): Sudarshana Basu, Rishikesh Sil
Summer Trainee(s): Ankit Kushwaha



DDDB

Drug Development Diagnostics and Biotechnology Division

Drs. Suman Khowala (Head), Samir K Dutta, Sharmila Chattopadhya, Snehasikta Swarnakar, Shila Elizabeth Besra

Research activities in DDDB division is driven by multi-disciplinary approach with a vision to conduct targeted basic research with applied potentials to improve health and quality of life, and to promote future economic growth through innovation in biotechnology relevant to needs of our country. The broad aim of the division involves basic and applied research covering areas of health, agriculture and process biotechnology with focus on development of new products, processes and technologies of commercial and industrial importance.

The specific objectives are: Studying regulatory mechanisms for production and secretion of hydrolytic enzymes and use of biomass from Termitomyces clypeatus for biotechnological and biomedical applications in the area of biofuel, bioremediation in tannery sector, food industries and for anticancer activities; Functional polymorphism of matrix metalloproteinases and the risk of gastric cancer, to establish the mechanism of gastric ulceration; tissue targeted drug delivery; unravelling the crosstalk of glutathione with other established signaling molecules like SA, JA and ET to combat biotic stress in planta; cloning and characterization of podophyllotoxin biosynthetic pathway gene/s; plant gene manipulation for improved production of pharmaceutical/ nutraceuticals/ biopesticidal molecules.

Dr. Suman Khowala
Drug Development Diagnostics and Biotechnology Division

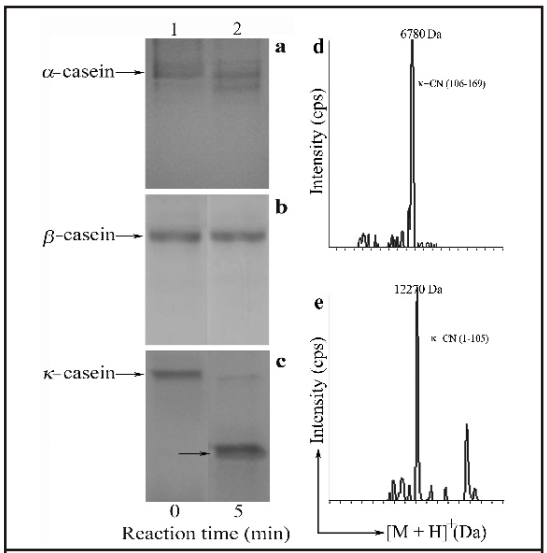
Uncovering the novel application potentials of the filamentous fungus Termitomyces clypeatus MTCC 5091

The fungus *T. clypeatus* can be used as a nutritional food ingredient, produced many secondary metabolites (enzymes of commercial importance). Biotechnology to produce biofuel was studied by using low cost mustard waste for production of lignocellulosic enzymes, food processing enzyme acid protease was purified and characterized to be used for cheese processing in dairy industry. Bioremediation by adsorption of trivalent Chromium in tannery industry was studied using fungal mycelia of T. clypeatus.

The aqueous extract of the fungal mycelia possessed significant activity in inducing cancer cell death against a wide range of cancer cell lines (used in the study) and also possesses high antioxidant activity measured by different in vitro assay methods

In-vitro antioxidant and free radical scavenging potential and Effect of Alocasia indica tuber extract on reducing hepatotoxicity and liver apoptosis in alcohol intoxicated rats

Overproduction of reactive oxygen species (e.g. superoxide, hydroxyl, peroxyl, and alkoxy radicals) and other free radicals by numerous physiological and biochemical processes is commonly referred to as 'oxidative stress'. The deleterious effects of ROS inside the body are responsible for serious ailments like cancer, atherosclerosis, cardiovascular diseases, ageing and inflammatory diseases. In this respect the hepatoprotective effects of ethanol extracted *A. indica* tuber extract was assessed on alcohol-induced liver damage rat model. This study also aimed to establish the correlation between antioxidative activity and antiapoptotic activity of the extract. Ethanolic (ETE) and aqueous (AQE) extracts of *A. indica* tubers showed presence of potential for scavenging of hydroxyl radicals, superoxide anions, nitric oxide, reducing power, phenolic and flavonoid contents. The results strongly imply the potential use of Ethanolic Extract of *Alocasia indica* tuber in future application for treatment in reducing oxidative stress, alcoholic liver disease and apoptotic cell death of vital organs such as liver which can create a lot of possibilities in therapeutic aspects.



Susceptibility of the T.clypeatus acid protease on milk casein fractions with preferential activity towards K-casein> α-casein > β-casein

Publication Details:

Pal S, Bhattacharjee A, Mukherjee S., Bhattacharya K, Khowala S (2014) Antioxidant and Hepatoprotective Activity of Ethanolic Extract of Alocasia indica Tuber, *American Journal of Phytomedicine and Clinical Therapeutics*, **2**, 191-208.

Pal S, Bhattacharjee A, Mukherjee S., Bhattacharya K, Mukherjee S, Khowala S (2014) Effect of *Alocasia indica* tuber extract on reducing hepatotoxicity and liver apoptosis in alcohol intoxicated rats, *Bio Med Research International,* Article ID 349074, http://dx.doi.org/10.1155/2014/349074

Chapter(s) Details:

Banik SP, Khowala S, Pal, C, Mukherjee S (2014) Proteomic approaches to identify novel therapeutics and nutraceuticals from filamentous fungi: Prospects and Challenges. In: Genomics, proteomics and metabolomics in nutraceuticals & functional foods (2nd Edition). Wiley Blackwell (USA/UK) (*Ed.* Bagchi D, Swaroop A, Bagchi M, pg.314-338

Invited Lectures:

Delivered **two** numbers of invited talks in India

Academic Performance:

Teaching, examining and training
Delivered invited lecture at Dept. of Food Technology & Biochemical Engineering, Jadavpur University at Kolkata under aegis of Refresher Course (UGC-ASC).

Abstracts Presented:

Number of Abstracts in National Conference: 1
Number of Abstracts in International Conference: **3**

Honors & Awards:

Member of Executive Committee of Society of Biological Chemists (India), Kolkata Chapter
General Secretary of The Biotech Research Society, India, Kolkata Chapter of IICB-Jadavpur University
Reviewer of Reputed International and National Biotechnology Journals
Reviewer of national projects for Funding by DBT, DST and CSIR

Human Resource:

Research Fellow(s): Soumya Mukherjee, Rajib Majumder, Sanjeeta Tamang
Research Associate(s): Dr Swagata Pal, Dr Debopam Banerjee, Dr Sangita Mazumdar, Dr Arijit Mondol
Project Assistant(s): Siddthartha Mukherjee
Summer Trainee(s): Kavita Chandra

Dr. Samir K Dutta
Drug Development Diagnostics and Biotechnology Division

Potentiation of tumoricidal plant secondary metabolite through 'co-drug' development

The 'co-drug' Bet-CA, developed was an ester derivative formed through C-3-OH of betulinic acid (BA) and dichloroacetic acid (DCA). we decided to scrutinize the merits of Bet-CA as a potent anti-angiogenic and anti-metastatic mediator and establish it as a strategic tool that would simultaneously interferes with cancer development at multiple points.

Themes emerging from the present studies imply that Bet-CA might target the pivotal signalling hubs that acts as convergent nodes for tumor progression and provides durable approach that is less prone to toxicity. Mitochondria targeting metabolic modulator-Bet-CA at pertinently scalar doses serve to provide inhospitable environment disabling and restricting cell proliferation and climax the angiogenic and metastatic phenomenology of the malignant variety. This study is expected to broaden the potential of Bet-CA in the emerging and rapidly evolving fields of drug development and cancer therapeutics.

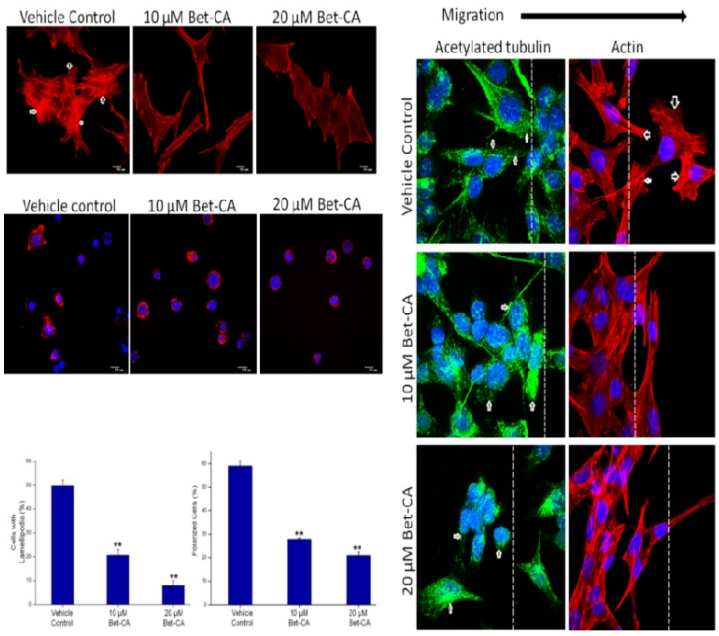


Fig. Bet-CA inhibits lamellipodia formation and cell polarisation

Development of a multi-enzyme inhibitor construct for stress tolerance

Earlier we have cloned and characterized a chymotrypsin/ trypsin inhibitor from winged bean (WbTI-1A). Presently we have joined a peptide (part of a bi-functional protein) having amylase inhibitory activity, through PCR amplification with this WbTI-1A to make it a multi-functional inhibitor. The PCR product indicated addition of 30 residue base with WbTI-1A. The construct has been expressed in *E. coli* and peptide-protein hybrid is undergoing purification using immune-affinity column for further characterization. It is expected that a protein having amylase and protease inhibitory activity will come out soon.

Publication Details:

Bera, S., Ghosh, M., Pal, M., Das, N., Saha, S., Dutta, S. K. and Jana, S. (**2014**) Synthesis, characterization and cytotoxicity of europium incorporated ZnO-graphene nano-composites on human MCF7 breast cancer cells. *RSC Adv.*, (DOI: 10.1039/C4RA06243D).

Bhattacharya, N., Banerjee, S. and Dutta, S. K. (2014) Cloning, expression and mutational studies of a trypsin inhibitor that retains activity even after cyanogen bromide digestion. *Protein Expression and purification*,**96**, 26-31.

Academic Performance:

Acted as Teacher at NIPER, Kolkata and Calcutta University

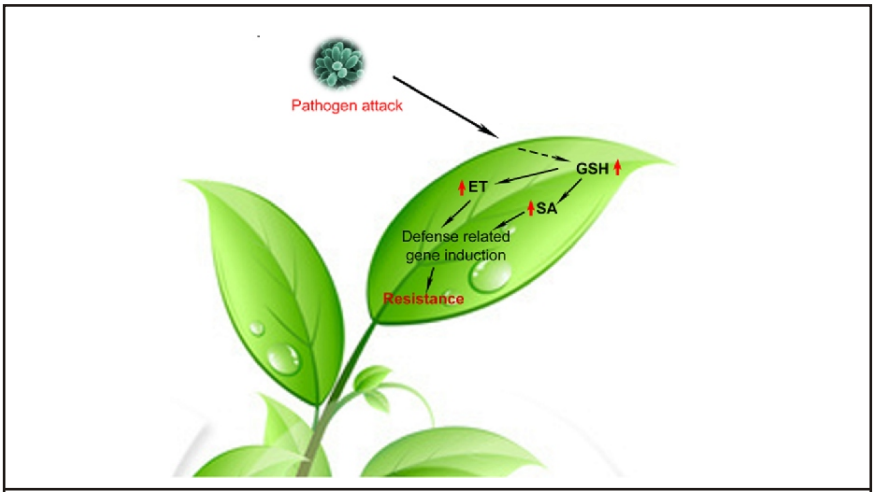
Human Resource:

Research Fellow(s): Suchandrima Saha, Monisankar Ghosh and Mrs. Sayanika Banerjee
Research Associate(s): Dr. Saswati Sen

Dr. Sharmila Chattopadhyay
Drug Development Diagnostics and Biotechnology Division

The intricate role of GSH in plant defense

The role of glutathione (GSH) in plant defense is an established fact. However, the association of GSH with other established signaling molecules within the defense signaling network remains to be evaluated. Previously we have shown that GSH is involved in defense signaling network likely through NPR1-dependent SA-mediated pathway. To gain further insight, we developed chloroplast-targeted γ-ECS overexpressed transgenic *Nicotiana tabacum* (*NtGp* line) and constructed a forward subtracted cDNA library using *NtGp* line as a tester. Interestingly, in addition to SA-related transcripts like PR1a and SAR8.2 m/2l, ACC oxidase, a key enzyme of ET biosynthesis, was identified in the SSH library. Besides, transcription factors like WRKY3, WRKY1 and ERF4, associated with SA and ET respectively, were also identified thus suggesting an interplay of GSH with ET and SA. Proteomic profiling of *NtGp* line, performed by employing 2-DE, corroborated with the transcriptomic profile and several defense-related proteins like serine/threonine protein kinase, HSP70 etc. were identified with increased accumulation. Fascinatingly, ACC synthase, was also noted thus demonstrating the active involvement of GSH with ET. The protein gel blot analysis confirmed the enhanced accumulation of ACC oxidase in *NtGp* line. Together, the present study demonstrated the synergistic multiple steps crosstalk of GSH with ET and SA to combat environmental stress.



Medicinal plant & metabolic engineering: Characterization of podophyllotoxin pathway gene/s from Himalayan Mayapple, *Podophyllum hexandrum Royle*.

Publication Details:

Ghanta S, Datta R, Bhattacharyya D, Sinha R, Kumar D, Hazra S, Bose Mazumdar A and Chattopadhyay S (2014) Multistep involvement of glutathione with salicylic acid and ethylene to combat environmental stress. *J. Plant Physiol.*, 171, 940-950.

Kumar D, Datta R, Sinha R, Ghosh A and Chattopadhyay S (2014) Proteomic profiling of γ-ECS overexpressed transgenic *Nicotiana* in response to drought stress. *Plant Sign. & Behaviour*, 9, e29246.

Bhattacharyya D, Sinha R, Hazra S, Datta R and Chattopadhyay S (2013) De novo transcriptome analysis using 454 pyrosequencing of the Himalayan Mayapple, *Podophyllum hexandrum*. *BMC Genomics*, 4: 748.

Chapter(s) Details:

Invited to contribute to the book entitled, "Mechanism of Plant Hormone Signaling under Stress", which will be published by Wiley by the editor, Dr. Giridhar Pandey, Univ. of Delhi, South Campus entitled "The interaction of glutathione with salicylic acid and ethylene to combat drought stress".

Invited Lectures:

Delivered **two(2)** invited talks in India

Session Chaired:

Chaired one scientific session in the International conference and Exhibition on Traditional & Alternative Medicine, Hyderabad, India, December 10, 2013.

Academic Performance:

Acted as expert in the Ph.D course work (2013-14) of CSIR-IICB, Kolkata.
Acted as reviewer of the journals like Plant Science, Plant Cell Tissue & Organ Culture, Journal of Agricultural Food Chemistry,BMC Proteome Science, PLANTA, Food & Chemical Toxicology, Natural Product Radiance, Indian Journal of Exp. Biology, Acta Physiologiae Plantarum, Jr. Plant Physiology, etc.

Abstracts Presented:

Number of Abstracts in National Conference: **5**
Number of Abstracts in International Conference: **4**

Students Awarded Ph.D.:

Ragini Sinha, University of Calcutta.

Human Resource:

Research Fellow(s): Saptarshi Hazra , Riddhi Datta , Deepak Kumar, Aparupa Ghosh, Mehar Kalim , Asma Sultana, Ria Mukhopadhyay , Dr. Dipto Bhattacharya
Summer Trainee(s): Madhurima Chatterjee, Miss. Nikita Ingale, Rajat Pandey

Dr. Snehasikta Swarnakar
Drug Development Diagnostics and Biotechnology Division

Omeprazole prevents restraint cold stress-induced gastric inflammation and related cell death.

In seeking to define the novel gastroprotection mechanism of omeprazole, we generated rodent model of restraint cold stress ulcer. Rats were immobilized and kept under cold condition (4 ± 1 °C) at different time periods and sacrificed after 30, 60, 120, 180 mins, respectively. Ulcer indices (UI) in each stomach were measured. Gastric lesions became severe at 120 mins and further increased at 180 mins. For the protection study, omeprazole at a dose of 15 mg/kg body weight was administered orally 30 min prior to stress induction, whereas the control rats (**Fig 1)**

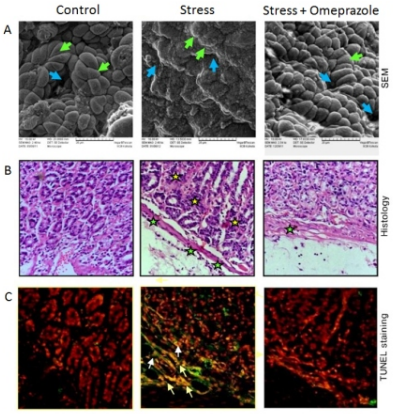


Fig 1: Effect of Omeprazole in restraint cold stress-induced gastropathy

Gastroprotective action of black tea via matrix metalloproteinase-9 mediated pathway on ethanol treated AGS cells.

The pathogenesis of gastric ulcer is a complex process and known to be associated with extracellular matrix (ECM) turnover wherein matrix metalloproteinases (MMPs) exhibit pivotal role. However, the mechanism of action in gastric ulcer due to ethanol is poorly understood. The aqueous extract of tea (*Camelia sinensis)* is the most popular beverage all over the globe. Several studies suggest that black tea reduces the risk of variety of illnesses, including cancer, atherosclerosis, hypertension and coronary heart disease. The present study was designed to assess the action of black tea extract on MMP-9 activity during gastric injury and its prevention.The major finding in this study is that black tea extract protected ethanolic damage of AGS cells. The antioxidant property of black tea extract has been re-established in this study. We found that black tea extract decreased the MMP9 level during protection against cell death by ethanol.Thus offered a greater influence on matrix remodeling.

MMP7 promoter polymorphism is associated with gastric cancer risk and expression of MMP7 increased in cancer tissues.

Cancer progression is associated to changes in susceptible genes, including matrix metalloproteinase (MMP). MMP7, a matrilysin is the smallest known member of MMP family and possesses potent ECM degradative activity. Accumulated evidences showed a positive

correlation between MMP7 expression and invasive potential of cancer. However, the molecular basis of MMP7 upregulation in gastric cancer remains unclear. To understand the involvement of MMP7 in gastric cancer progression we compared the abundance of MMP7 protein between gastric cancer patients and non-cancer control subjects. MMP7 expression was measured by Western blot and immunofluorescence (**Fig 2)**.

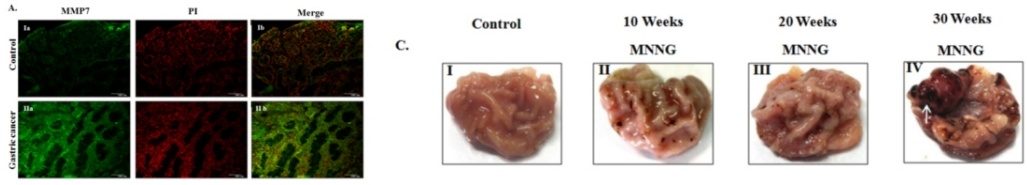


Fig 2: Upregulation of MMP7 expression in gastric cancer patient serum and rat gastric tumor tissues: Immunofluorescent labeling of MMP7 for control and gastric cancer patient tissue Representative macroscopic appearance of MNNG tumor formation with duration of MNNG treatment of rat.

Publication Details:

Roy Goswami M, Banerjee P, Swarnakar S and Mukhopadhyay A. (2013). Carbaryl mediated biochemical alterations in Eggplant. *International Journal of Research in Environmental Science and Technology.***3**(2):51-57.

Dey S, Ghosh N, Saha D, Kesh K, Gupta A and Swarnakar S. (2014) Matrix Metalloproteinase 1 (MMP1) Transcriptional Polymorphisms are Well Linked with Lower Stomach Tumor Formation in Eastern Indian Population. *PLoS One*; **5**; 9(2):e88040.

Mandal AK, Ghosh D, Sarkar S, Ghosh A, Swarnakar S, Das N. (2014). Nanocapsulated quercetin downregulates rat hepatic MMP-13 and controls diethylnitrosamine-inducedcarcinoma. *Nanomedicine*; DOI: 10.2217/nnm.14.11.

Bhattacharya P, Ghosh S, Swarnakar S and Mukhopadhyay A. (2014). Reuse of textile effluent for dyeing using combined technology of ceramic microfiltration and surface treated sugarcane bagasse: toxicity evaluation using Channa punctatus as model. *Desalination and Water Treatment*; DOI: 10.1080/19443994.2014.887035.

Chapter(s) Details:

Sarkar, S; Chatterjee, S and Swarnakar, S. Chapter: Matrix Metalloproteinases in Ischemia-Reperfusion Injury in Brain: Antioxidants as Rescuer in the Book Proteases in Health and Disease. Springer pub (2013)

Roychoudhury, S., Roy, A., Chatterjii,I., Ghosh, N., Roychowdhury, R and Swarnakar, S. Chapter: Landscape of HPV in human cancers: prevention and therapeutic avenues Book: Cancer causing Viruses and Their Inhibitors . CRC Press, Taylor and Francis Group, Boca Raton, USA (2014)

Invited Lectures:

Delivered **one (1)** invited talk in India and **three(3)** invited talks in abroad which are shown below:

1. Topic: Melatonin and Metalloproteinases
Venue: Galveston, TX.
Date: Jan'2014.

2. Topic: Alcohol induced lung and gastric injury: Regulation of matrix metalloproteinases
Venue: Emory University, Atlanta, Georgia.
Date: Feb'2014.

3. Topic: Growing the Network: Fulbright, Friendships, and Academic success 2nd Fulbright Academic Symposium
Venue: Clemson University, South Carolina
Date: 7th, March 2014.

Academic Performance:

Examined a thesis entitled "Endometriosis as an inflammatory, angiogenic and proliferative disease" from Nizam's Institute of Medical Sciences.

Examined a thesis entitled "Understanding advanced glycation end product (AGE)-mediated cell signalling and its regulation" from Central Drug Research Institute.

Acted as the examiner for viva voce of M.Sc. in Calcutta University.

Deputation Abroad:

Acted as a Fullbright Research Fellow at Emory University, Atlanta from Aug'13 to Apr'14

Abstracts Presented:

Number of Abstracts in National Conference: **4**
Number of Abstracts in International Conference: **3**

Honors & Awards:

Selected for Fullbright-Nehru Fellowship at Emory University, USA, 2012-2013.

Human Resource:

Technical/Administrative staff (S): Dr. Ardhendu Kumar Mandal
Woman Scientist: Dr. Sibani Sarkar
Research Fellow(s): Kousik Kumar Kesh, Nillu Ghosh, Nilanjan Ganguly, Dharmendra Kumar Yadav, Sugreev Verma
Research Associate(s): Dr. Susri Ray Chaudhuri (Guha)
Project Assistant(s): Sayantan Jana, Deep Sankar Rudra, Anirban Roy, Kasturi Chatterjee
Summer Trainee(s): Dr. Papita Ghosh

Dr. Shila Elizabeth Besra
Drug Development Diagnostics and Biotechnology Division

Anti-carcinogenic effects against human leukemia and hepatoma cell line by natural sources via mitochondrial mediated caspase cascade.

Secretion extract of *Bellamya bengalensis* f. annandalei have been traditionally used for many ailments. The anti-leukemic activity of secretion extract of *Bellamya bengalensis* f. annandalei (SEBB) has been established against three human leukemic cell lines U937, K562 and HL-60. Cell shrinkage, membrane blebbing, chromatin condensation, nuclear fragmentation and formation of apoptotic bodies are characteristic features of apoptosis. Gel electrophoresis study shows fragmented DNA in the form of ladder and Flow cytometric analysis showed appreciable number of cells in early & late apoptotic stages. The cells are getting arrested in the sub-G_1 & G_1 phases of cell cycle. The apoptosis is mediated through activation of caspase-9 & Caspase-3. Leaves *Ruellia tuberosa* L. (MERTL) was also studied for anti-oxidant property on Hep-G2 & RAW 264.7 cell line. Anti-oxidant property of MERTL & its fractions has been confirmed by increased Super oxide dismutase activity.

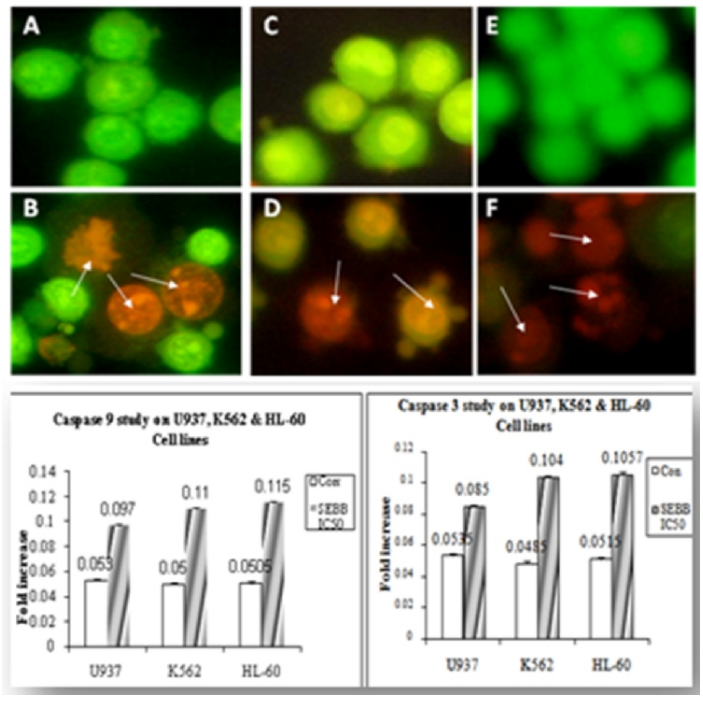


Figure: Fluorescence microscopic images of untreated control U937 (**A**), K562 (**C**) and HL-60 (**E**) and SEBB treated U937 (**B**), K562 (**D**) and HL-60 (**F**) cells. The control cells were with intact nuclei and gave bright green fluorescence whereas treated cells showed intense orange- red fluorescence with membrane blabbing, condensed chromatin and fragmented nuclei, showing signs of apoptosis and histogram showing the fold increase in Caspase 9 & 3 productions in U937, K562 & HL-60 cell lines after SEBB treatment for 24 h at IC_{50} dose with respect to control

Publication Details:

Shila Elizabeth Besra, Moumita Ray, Sayantan Dey, Subhadeep Roy and Nilanjana Deb (2013) Apoptogenic activity of secretion extract of *Bellamya bengalensis* f. Annandalei via mitochondrial mediated caspase cascade on human leukemic cell line. *Int. J. Pharm. Sci. Rev. Res.,* 20(1), 146-152.

Sayantan Dey, Subhadeep Roy, Nilanjana Deb, Kalyan Kumar Sen and Shila Elizabeth Besra (2013) Anti-carcinogenic activity of *Ruellia tuberosa* l. (acanthaceae) leaf extract on hepatoma cell line & increased superoxide dismutase activity on macrophage cell lysates. *Int. J. Pharmacy and Pharmaceutical Sci.,* 5(3), 854-861

Subhadeep Roy, Sayantan Dey and Shila Elizabeth Besra (2013) Anti-leukemic activity of Moringa oleifera root bark on human leukemic cell lines, Proceedings of ICHEIB (BioSangam2013). page 1-7.

Session chaired:

Chaired one scientific session in AICTE sponsored National Conference on "Complex Diseases, Novel Therapeutics & Delivery Challenges" At Gupta College of Technological Sciences, Asansol, West Bengal, India on 23rd January, 2014.

Abstract Presented:

Number of abstracts in National conferences: 8
Number of abstracts in International conferences: 3

Honors and Awards:

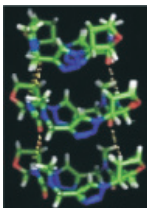
Two, 1ST prize awarded for the *best* poster presentation in Medical Biotechnology Session *on "Anti-leukemic activity of Moringa oleifera root bark on human leukemic cell lines"* and Pharmaceutical Biotechnology Session on "Depressant Activity of β Carboline Alkaloid (BNW-8) Isolated from *Neanotis wightiana"* in International Conference on Health, Environment & Industrial Biotechnology at Motilal Nehru National Institute of Technology (MNNIT) Allahabad, India on 23rd November 2013.

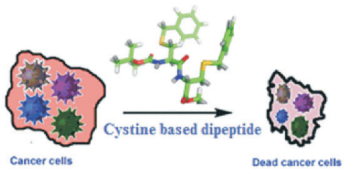
Human Resource:

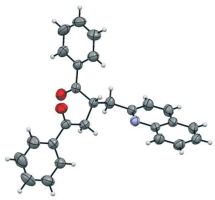
Summer trainees / Short term trainees: Mr. Sayantan Dey, Mr. Subhadeep Roy, Mr. Krishnendu Pal, Ms. Subarta Pal, Ms. Sreyashi Majumdar, Mr. Prashanta Kumar Deb, Ms. Sudipta Chanda, Priya Rani, Sangeeta Kumari.

Students visit at CSIR-IICB

CD







Chemistry Division

Drs. P. Chattopadhyay(Head), G. Suresh Kumar, Asish K. Banerjee, P. Jaisankar, Chinmay Chowdhury, Biswadip Banerji, Surajit.Ghosh, Indrajit Das, Sanjay Dutta, Ranjan Jana, Arindam Talukdar, Indubhusan Dev, R. Natarajan, S. Ghorai

The Chemistry department intensively pursues interdisciplinary research activities in the fields of synthetic and natural product chemistry, carbohydrate chemistry, biophysical chemistry and chemical biology. The division is engaged in active collaboration with biologists of this institute and other CSIR laboratories in utilizing the synthetic and isolated natural products for studying their efficacy and potential application in biology and medicine.

The division is fully equipped with MS facility (LCMS, HRMS and MALDI-TOF), NMR facility, X-ray crystallographic facility, CD spectrometer, micro-calorimeter etc. The major research activities of the division focus on the following areas:

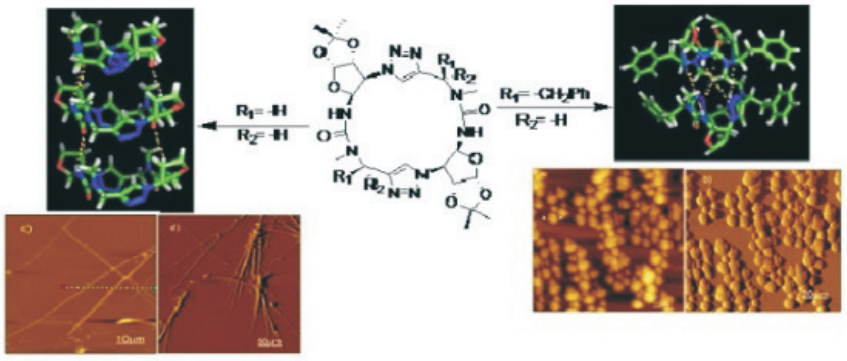
- Development of synthetic methodologies
- Synthesis of bioactive natural products or natural product like molecules, which include chiral/achiral heterocycles and dipeptides
- Development of chiral ligands and their transition metal complexes for asymmetric organic transformations
- Synthesis of peptidomimetic macrocycles with special attention to conformation and self assembly studies
- Isolation of bioactive natural products from medicinal plants and determining their efficacies for the treatment of some major ailments
- Studies on biomolecular assembly process in solution, and on activity of biological molecules in solution and in immobilized condition on the surface
- Discovery of small molecules binding Hepatitis C virus RNA internal ribosome entry site (IRES), which can be developed for RNA targeting therapy and used as inhibitor of Hepatitis C virus RNA
- Nucleic acid binding properties of natural products
- Teaching and providing guidance to research scholars

Dr. Partha Chattopadhyay
Chemistry Division

Design and Synthesis of Regioisomeric Triazole / urea Based Peptidomimetic Macrocycles and their chirality controlled self-assembly

A tandem macro-dimmerization reaction via Cu(I) catalyzed azide/alkyne cycloaddition reaction has been employed to construct triazole/urea based peptidomimetic macrocycle behaving as a pseudo-cyclo-β-peptide. Introduction of one particular chirality in the peptide backbone can alter the conformation as well as nature of self-assembly from cyclic D-,L-,-peptide to cyclo-β-peptide. One of them forms antiparallel dimmers while the other undergoes higher order aggregation to form nanorod structure.

We have designed and synthesized two novel class of (1,4)-linked triazole/urea based pseudo cyclic peptides (peptidomimetic macrocycles) by applying Cu(I) catalyzed tandem di-merization-click chemistry on linear N-methylated ureido-(azido/alkyne) precursors. One of them, which is built up of all chiral units, appears conformationally homologous to N-methylated cyclic D-,L-α-peptides in terms of functional group while retaining the backbone chirality. In solution phase self-assembly behavior, it exactly resembles cyclic D-,L-α-peptides as well as cyclic α,γ-peptides. **It** was dissolved to a concentration of 50 μM in a nonpolar solvent such as (2:3) $CDCl_3$:CCl_4. The nonpolar solvent was chosen because the dipole moment of the ensemble is not expected to be large as the triazole moiety and the urea linkage are oriented in opposite directions. Interestingly this showed several ball-like composites (reflecting several numbers of dimers in solution phase) stacking together instead of any nanotube formation (via β-L and pseudo β-D H-bonding). The cyclic urea/triazole oligomer was therefore concluded to self-assemble in an antiparallel manner to form H-bonded dimers as discussed above, by analogy with partially N-methylated cyclic D-,L-α-peptides and cyclic-(α,γ)-



Energy minimized structures of peptidomimetic macrocycles with SAME images 2:3 $CDCl_3$:CCl_4 and CH_3CN:H_2O(4:1)

peptides.
The other compound, constructed from prochiral alkyne units, displays a typical cyclo-β-peptide conformation testifying the urea-triazole backbone should be perpendicular to the mean plane of the peptide ring where N2/N3 (equivalent to a carbonyl group) and a urea carbonyl (or urea-NH and triazole CH) are oriented along the same face of the pseudo peptide backbone and hierarchical organization conducive for nanotube formation which undergoes higher order aggregation. NMR, ESI-MS, FT-IR, TEM, AFM studies have been employed to characterize the hierarchical organization of these new classes of peptidomimetic macrocycles. The anion binding properties of these novel macrocycles will be a subject of future studies.

Publication Details:
Bhattacharya, D.; Ghorai, A.; Pal, U.; Maity, N. C. and Chattopadhyay, P. (2014) Stereoselective domino azidation and [3+2]Cycloaddition: A facile route to chiral heterocycle scaffolds from carbohydrate derived synthones: , *RSC Advance*, *4*, 4155-4162.

Invited Lecturers
Deliver one (1) number of invited talk in NIT, Durgapur, WB, India

Session Chaired:
Chaired one Scientific Session on Recent Development of Chemistry, (RDC-2013), Dept of Chemistry, NIT, Durgapur-713209, WB, India on October, 3-5, 2013

Academic Performance:
Acted as Guest Faculty at Scottish Church College, Kolkata ,Niper-Kolkata and as teacher of CSIR-IICB.

Acted as Project Reviewer, *Organic Chemistry Section*, DST, SERC, Govt. of India and also for *Journal of Organic Chemistry*, *Tetrahedron Letter*, *Bioorganic Medicinal Chemistry letter.*

Acted as PhD Thesis Examinar of Natural Product Chemistry Division, Osmania University, Hyderbad and Acharya Nagarjuna University, Guntur, AP, India.

Abstracts Presented:
Number of Abstracts in National Conference: **1**
Human Resources:
Technical/ Administrative staff(s): Dr Tapas Sarkar; Mr Sandip Kundu
Senior Research Fellow: Avijit Ghorai, Deboleena Bhattacharya, Gautam Kulsi

Dr. G. Suresh Kumar
Chemistry Division

Nucleic acid and protein interaction of plant alkaloids and small molecules

Our work focuses on understanding the biophysical and biochemical aspects, at the molecular level, of some small molecule natural products that are prospective anticancer agents with promising for futuristic clinical applications in the persuit of develping new class of antibiotics. We studied the interaction of a number of natural alkaloids, their synthetic analogs, several planar dyes, food colorants and biogenic polyamines with biomacromolecules viz. DNA, RNA and proteins through a number of biophysical techniques. It has been revealed that the **13-diphenyl alkyl** and 9-O-ω-amino alkyl ether berberines were better DNAduplex and triplexe binders compared to berberine. These compounds also easily induced self-structure in polyadenylic acid. These results highlighted the importance of substitution at the 13- and 9-position of the isoquinoline chromophore for enhanced binding. The base and sequence specificity of DNA bdining of the natural benzophenanthridine alkaloid and pitative anticancer agent chelerythrine has been elucidated for the first time. The charged iminium form and neutral alkanlamine form of sanguinarine binding to hemoglobin was investigated, structurally and thermodynamically characterized and the binding sites located. Similarly, structural and thermodynamic characterization of the interaction of a number of phenazinium and phenathaizinium dyes, biogenic polyamines and food colorants with various DNA sequences and protein structures have been performed. The sugar binding natural alkaloid aristololactam-β-D-glucoside was found to stabilize single stranded RNAs but was a weaker binder compared to structurally similar daunomycin. The interaction of a number of biogenic polyamines and some analogs with natural DNAs and synthetic polynucleotides have deciphered their base and sequence specificity and energetics of interaction. Overall, these biophysical studies highlight the utility of these small molecules for development as potential therapeutic agents.

Publication Details:

Hazra, S. & Suresh Kumar, G*., Structural and thermodynamic studies on the interaction of iminium and alkanolamine forms of sanguinarine with hemoglobin. *J. Phys. Chem. B,* 118(14), 3771-3784 (2014).

Patra, A, Hazra, S. & Suresh Kumar, G* & Mitra, R., Entropy contribution towards micelle driven de-intercalation of drug-DNA complex. *J. Phys. Chem. B,* 118(4), 901908 (2014).

Kabir, A. & Suresh Kumar G*., Probing the interaction of spermine and 1-naphthyl acetyl spermine with DNA polynucleotides: A comparative biophysical and thermodynamic investigation. *Mol. BioSyst.,* 10, 1172-1183 (2014).

Jash, C & Suresh Kumar G*., Binding of alkaloids berberine, palmatine and coralyne to lysozyme: a combined structural and thermodynamic study. *RSC Adv*., 4, 1251412525 (2014) .

Khan, A.Y, Saha, B & Suresh Kumar, G*., Phenazinium dyes safranine O and phenosafanine induces self-structure in single stranded polyadenylic acid: structural and thermodynamic studies. *J. Photochem. Photobiol. B Biol.,* 132, 1726 (2014).

Bhowmik, D, Buzzetti, F, Fiorillo, G, Orzi, F, Syeda, T.M, Lombardi, P. & Suresh Kumar, G*., Synthesis of new 13-diphenylaljklyl analogues of berberine and elucidation of their base pair specificity and energetics of DNA binding. *Med. Chem. Com*., 5, 226-231 (2014).

Hazra, S. Hossain M. & Suresh Kumar, G*., Studies on α-, β-, and γ-cyclodextrin inclusion complexes of isoquinoline alkaloids berberine, palmatine and coralyne. *J. Incl. Phenom. Macrocycl. Chem*., 78, 311-323 (2014) .

Basu, A. & Suresh Kumar, G* Minor groove binding of the food colorant carmoisine to DNA: Spectoscopic and calorimetric characterization studies. *J. Agricultural Food Chem*., 62, 317-326 (2014).

Basu, A. & Suresh Kumar, G*., Elucidating the energetics of the interaction of non-toxic dietary pigment curcumin with human serum albumin: A calorimetric study. *J. Chem. Thermodyn.,* 70,176-181 (2014).

Bhaumik, D, Buzzetti, F, Fiorillo, G, Lombardi, P. & Suresh Kumar, G*., Spectrroscopic studies onthebinding interaction of novel 13-phenylalklyl analogs of the natural alkaloid berberine to nucleic acid triplexes. *Spectrochim. Acta A: Mol. Biomol. Spectroscopy,* 120, 257-264 (2014).

Paul, P. & Suresh Kumar, G*., Targeting ribonucleic acids by toxic small molecules: Structural perturbation and energetics of interaction of phenothiazinium dyes thionine and toluidine blue O to $tRNA^{phe}$. *J. Hazard. Mater*., 263, 735 745 (2014).

Biswas, B, Mitra, M, Pal, A, Basu, A, Rajalakshmi, S, Mitra P, Aliaga-Alcalde N, Suresh Kumar, G, Nair, B.U. & Ghosh, R., DNA binding and cleavage activity of a structurally characterized an oxobridged diiron (III) complex. *Indian J. Chem*., 52A, 1576-1583 (2013).

Basu, P, Bhowmik, D. & Suresh Kumar, G*., The benzophenanthridine alkaloid chelerythrine binds to DNA by intercalation: Photophysical aspects and thermodynamic results of iminium versus alkanolamine interaction. *J. Photochem. Photobiol. B Biology,* 129, 57-68 (2013).

Basu, A & Suresh Kumar, G*., Biophysical studies on curcumin-deoxyribonucleic acid interactions: spectroscopic and calorimetric approach. *Int. J. Biol. Macromol.* 62, 257-264 (2013).

Pal, A, Biswas,B, Mitra, M, Rajalakshmi, S, Purohit, C.s, Hazra, S, Suresh Kumar, G, Nair, B.U. & Ghosh R., DNA binding and cleavage activity by a mononuclear iron (II) Schiff base complex: Synthesis and structual characterization *J. Chem. Sci.,* 125(5), 11611168 (2013).

Mandal, S, Hossain, M, Muruganandan, T, Suresh Kumar, G. and Chaudhuri, K., Gold nanoparticles alter Taq DNA polymerase activity during polymerase chain reaction. *RSC Adv.,* 3(43), 20793-20799 (2013).

Kabir, A. & Suresh Kumar, G*., Binding of the biogenic polyamines to deoxyribonucleic acids of varying base composition: base specificity and associated energetics of the interaction. *PloS ONE,* 8(7), e70510 (2013).

Das A and Suresh Kumar, G*., Binding of the plant alkaloid aristololactam-β-D-glucoside and antitumor antibiotic daunomycin to single stranded polyribonucleotides. *Biochim. Biophys. Acta*,1830, 4708-4718 (2013).

Das, S, Banerjee B, Hossain, M, Muriganandan,T, Dasgupta, S., Chongdar, N, Suresh Kumar, G .& Basu, G., Characterization of DNA binding property of the HIV-1 host factor and tumor suppressor protein integrase interactor 1 (INI1/hSNF5). *PLoS ONE,* 8 (7), e66581 (2013).

Basu, A, Jaisankar, P & Suresh Kumar, G*., Photophysical and calorimetric studies on the binding of the 9-O-substituted analogs of the plant alkaloid berberine to double stranded poly(A). *J. Photochem. Photobiol. B Biology,* 125,*105-114* (2013).

Bhaumik, D. & Suresh Kumar, G*., Interaction of 9-O-ω-amino alkyl ether berberine analogs with poly(dT)*poly(dA)*poly(dT) triplex and poly(dA)*poly(dT) duplex: a comparative study. *Mol. Biol., Rep,*. 40, 54395450 (2013).

Paul, P. & Suresh Kumar G*., Thermodynamics of the DNA binding of phenothiazinium dyes toluidine blue O, azure A and azure B. *J. Chem. Thermodyn.,* 64, 5057 (2013).

Mandal, S., Hossain, M., Devi, P.S., Suresh Kumar, G. & Chaudhuri, K., Interaction of carbon nanoparticles to serum albumins: elucidation of the extent of perturbation of serum albumin

Invited lectures:

Delivered **2** numbers of invited talks in India

Session Chaired:

Chaired one scientific session in the International Conference on Chemical Biology: Disease Mechanisms and Therapeutics (ICCB-2014) at CSIR- Indian Institute of Chemical Biology, Hyderabad 500 007 during 6-8, February 2014.

Abstracts presented:

No. of abstracts in National conference: **24**
No. of abstracts in International conference: **6**

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata
Acted and Ph.D thesis adjudicator for Cochin University of Science and Technology, University of Delhi and Jadavpur University and Indian Institute of Technology, Kharagpur
Acted as reviewer for a number of manuscripts of ACS, RSC, Elsevier, Springer and Bentham journals
Acted as reviewer for projects submitted for funding to CSIR and DST
Acted as editorial advisory board member: Recent Patents on Drug Delivery & Formulation and The Open Natural Products Journal (Bentham Science Publishers)
Acted as Member of the Research Advisory Council of RK Mission Residential College, Narendrapur, Kolkata 700103
Acted as Council Member and Editor, West Bengal Academy of Science and Technolgy (2013-2017)
Acted as Member, National Executive Committe, Indian Photobiology Society (2013-2015)
Acted as the Secretary, DNA Society of India (2009-2014)

Human Resource:

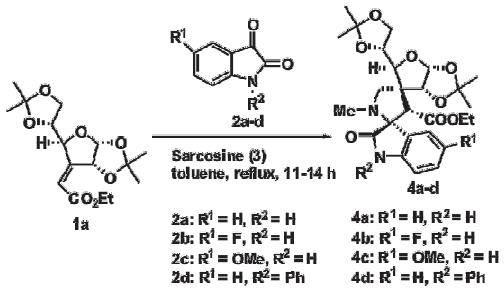
Research Fellow(s): **8**
Research Associate(s): **2**

Dr. Asish Kr. Banerjee
Chemistry Division

A simple entry to sugar derived bisspiropyrrolidines through non-stabilized azomethineylides

The presence of bisspiropyrrolidinyl-oxindole scaffolds in natural products, to the best of our knowledge, is hitherto unknown in the literature. Nevertheless, they have received a great deal of attention among synthetic chemists due to their immense activity against diabetes, bacteria, fungi, microbes and mycobacteria. A numerous reports for the synthesis of bisspiropyrrolo-/ pyrrolizino-/ pyrrolothiazolo- oxindoles by addition of azomethineylides to a variety of non-sugar-based olefins have been documented. However, much synthetic research work on sugar-based bisspiro compounds has not been initiated.To this end, we report an expeditious approach to target a new kind of sugar-fusedbisspiropyrrolidinyloxindoles/-acenaphthylenone/-cycloalkanes derivatives using a secondary α-amino acid (sarcosine), 1,2-diketones (isatin and acenaphthoquinone), cycloalkanones, and the sugar-derived olefin precursor through the application of 1,3-dipolar azomethineylide cycloaddition reaction.

In our initial attempt (**Scheme 1**), reaction of the sugar-derived exocyclic olefin, the required dipolarophile**1a** with the non-stabilized azomethineylide, generated in situ by the condensation of isatin**2a** with the amino acid sarcosine (**3**) in toluene at refluxtemperature for 12h furnished the bisspiropyrrolidinyl-oxindole derivative **4a** in 83% yield. Similar reactions of the substituted isatins**2b-d** afforded **4b-d** in 78%, 85% and 81% yields respectively. The structure of **4a-d** was elucidated from the 1H and 13C NMR spectroscopic data. Finally, the structural confirmation of **4a** was obtained from a single crystal X-ray crystallographic study (the ORTEP diagram is given in the **Figure 1**).



Scheme1. Synthesis of sugar-based bisspiroheterocycles via azomethineylides

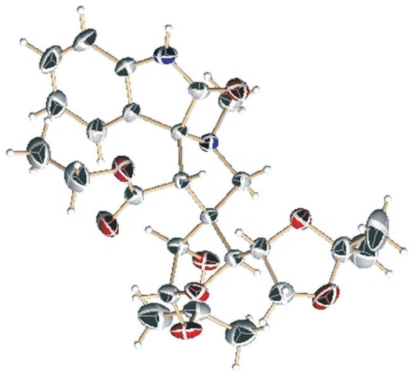
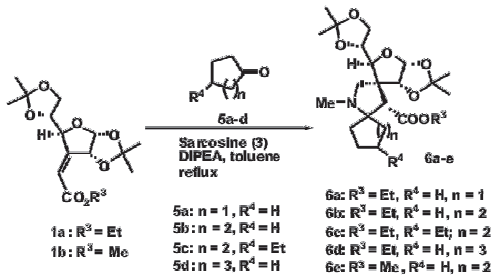


Figure1. ORTEP diagram of **4a**

Next, our attention was to generalize the methodology employing non-aromatic cycloalkanones, instead of isatins, for generation of azomethineylide (1,3-dipoles) by the reaction with sarcosine, although a very few reports exist in the literature on this method. Thus, at the outset, we choose cyclopentanone

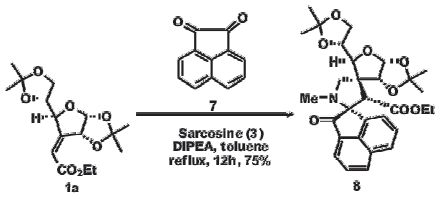
(5a) and sarcosine (3) as the ylide generator and reacted with 1a (Scheme 2) under the previously optimized reaction condition. This although produced the desired product 6a, the yield was too low (22%). A careful modification of the reaction condition was, therefore, needed.



***Scheme 2**. Synthesis of sugar-fused bisspiroheterocycles using cycloalkanones*

We first decided to screen solvents of the reaction. Attempts employing methanol, o-xylene, DMF, DMSO etc. under the conventional solution-phase protocols were frustrating, yieldingthe product 6a to the extent of 10-22%. Thus, in a modified approach, addition of Et3N into the reaction mixture to facilitate the decarboxylation of sarcosine-iminium ion in forming an ylide improved the yield up to 51%. The coupling was then further reinvestigated by replacing Et3N by DBU. This, however, failed to show any substantial improvement in the outcome and had to be discarded. Finally, we tested DIPEA as the base to condense 1a with 5a, which led to maximization of the product yield (92%) in 10 h under reflux condition in toluene.

Once these bisspiropyrrolidines with cycloalkane rings were constructed, we moved towards attempting the synthesis of analogous bisspiropyrrolidine using sterically hindered ketone acenaphthoquinone7, which also led to the cycloadduct 8 (Scheme3) in 75% yield upon reaction with the azomethineylide, generated from 7 and 3, the structure of which was deduced by spectral analyses.



***Scheme 3**. Synthesis of bisspiroheterocycles using acenaphthaquinone*

Publication Details

IshitaSanyal, Brajesh Shukla, Piyali Deb Barman, Asish Kumar Banerjee; "Stereoselective synthesis of (S)-oxiracetam and (S)-GABOB from (R)-glyceraldehyde acetonide", Tetrahedron Letters, 2013, ***54***, 26372640

Piyali Deb Barman, DivyaGoyal, Upendra Kumar Daravath, IshitaSanyal, Sukhendu B. Mandal,Asish Kumar Banerjee "A simple entry to sugar derived bispiropyrrolidines through non-stabilized azomethineylides" Tetrahedron Letters 2013, ***54***, 38013804

Academic Performance/Teaching:

Acted as a Reviewer of *Organic Letters* and *Journal of Organic Chemistry*, American Chemical Society. Tetrahedron, Tetrahedron Letters, Synthesis.

Acted as Project Director of NIPER-Kolkata

Honours & Awards:

Member, Steering Committee of NIPERs, Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India.

Member, Joint Counselling Committee, NIPER-Mohali, SAS Nagar, Punjab.

Member, Committee constituted to formulate rules, service conditions, etc. of NIPER staff, constituted by Dept. of Pharmaceuticals, Govt. of India.

Member Secretary of State Level Co-ordination Committee, Govt. of West Bengal, constituted by Dept. of Pharmaceuticals, Govt. of India

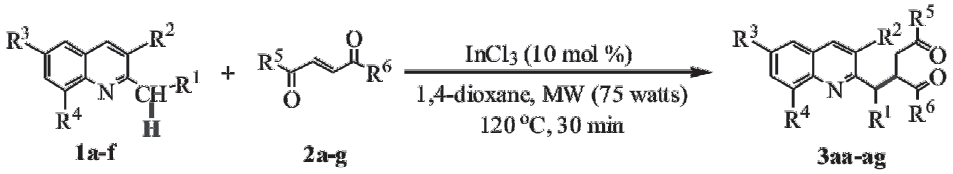
Human Resource:

Senior Research fellow: Ms. Piyali Deb Barman
Technical/Administrative Staff(s): Mr. Shekhar Ghosh, Mr. Santu Paul

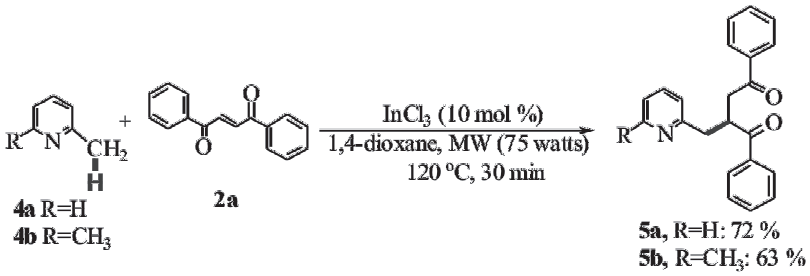
Dr. P. Jaisankar
Chemistry Division

Indium trichloride catalyzed sp^3 CH bond functionalization of 2-alkyl azaarenes under microwave irradiation[1]

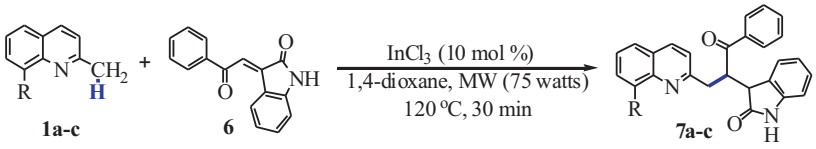
Microwave promoted indium trichloride (10 mol %) catalyzed sp^3 CH bond functionalization of 2- alkyl azaarenes **1** and substituted pyridines **4** has been observed to construct C-C bond with but-2-ene-1,4-diones **2** giving access to 2-((quinolin-2-yl)methyl)butane-1,4-diones **3** (scheme 1) and 2-((pyridin-2-yl)methyl)butane-1,4-diones **5** (scheme 2). In a similar fashion substituted quinaldenes **1** reacted with (*E*)-3-(2-oxo-2-phenylethylidene)indolin-2-one (**6**) to yield 3-(quinolin-2-yl)propan-2-yl)indolin-2-ones **7** in good yields using 1,4-dioxane as solvent (Scheme 3).



Scheme 1: synthesis of 2-((pyridin-2-yl)methyl)butane-1,4-diones



Scheme 2: synthesis of 2-((pyridin-2-yl)methyl)butane-1,4-diones



Scheme 3: synthesis of 3-(quinolin-2-yl)propan-2-yl)indolin-2-ones

The structures of the compounds have been confirmed by single X-ray crystallography technique. Crystal structure of a representative compound **3aa** has been given in figure 1.

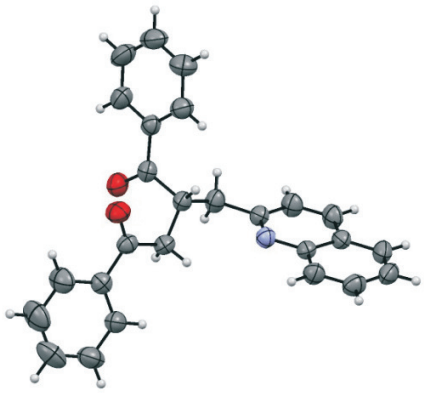


Figure 1: ORTEP diagram of 3aa

Study of antibacterial properties of 3,3'-diindolylmethane derivatives[2]

Various 3,3' -diindolylmethane (DIM) derivatives **8** and **9** (figure 1) were synthesized and the antibacterial activity of these compounds were tested against ten bacterial strains and their minimum inhibitory concentration (MIC) values were determined. The MIC values of derivatives **8ad** were ranging from 125 to 500 µg /mL. Other DIM derivatives, 2-(di(1H-indol-3-yl)methyl)phenol (**9a**) and 3-((1H-indol-3-yl)(pyridin-3-yl)methyl)-1H-indole (**9d**) exhibited potent activity, showing MIC values 6.562.5 µg/ mL against Gram positive and Gram negative bacteria. Hemolytic assay of these active DIM derivatives did not show considerable toxic effect on the normal human erythrocytes.

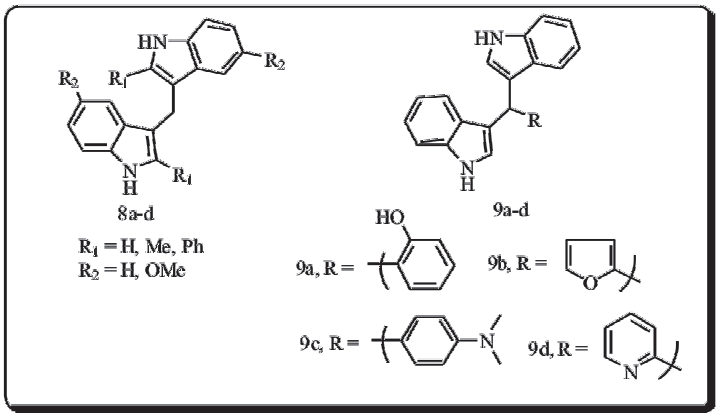


Figure 1: Structure of 3,3'-diindolylmethane derivatives having antibacterial activities .

Publication Details:

Chatterjee S, Bhattacharjee P, Temburu J, Nandi D and Jaisankar P (2014) Indium trichloride catalyzed sp3 C-H bond functionalization of 2-alkyl azaarenes under microwave irradiation. *Tetrahedron Lett*. **55**, 6680-6683.

Roy S, Gajbhiye R, Mandal M, Pal C, Meyyapan A, Mukherjee J and Jaisankar P (2014) Synthesis and antibacterial evaluation of 3,3'-diindolylmethane derivatives. *Med Chem Res*, 23, 1371-1377.

Chowdhury S, Mukherjee T, Chowdhury S, Sengupta S, Mukhopadhyay S, Jaisankar P, and Majumder H K (2014) Disuccinyl betulin triggers metacaspase-dependent endonuclease G-mediated cell death in unicellular protozoan parasite *Leishmania donovani*. *Antimicrob Agents Chemother.* **58**, 2186-2201.

Basu A, Jaisankar P and Kumar G S (2014) Interaction of 9-O-N-aryl/arylalkyl amino carbonyl methyl berberine analogs with single stranded ribonucleotides. *J. Photochem. Photobiol. B: Biology* **134**, 64-74.

Gorain B, Choudhury H, Kundu A, Sarkar L, Karmakar S, Jaisankar P and Pal T K (2014) Nanoemulsion strategy for olmesartan medoxomil improves oral absorption and extended antihypertensive activity in hypertensive rats. *Colloids and Surfaces, B: Biointerfaces* **115**, 286-294.

Chaudhuri J, Chowdhury A, Biswas N, Manna A, Chatterjee S, Mukherjee T, Chaudhuri U, Jaisankar P and Bandyopadhyay S (2013) Superoxide activates mTOR-eIF4E-Bax route to induce enhanced apoptosis in leukemic cells. *Apoptosis* **19**, 135-148.

Saha S, Mukherjee T, Chowdhury S, Mishra A, Chowdhury S, Jaisankar P, Mukhopadhyay S and Majumder H K (2013) *Biochem. Pharmacol.* (Amsterdam, Netherlands) **86**, 1673-1687.

Avik A, Chaudhuri J, Biswas N, Manna A, Chatterjee S, Mahato S K, Chaudhuri U, Jaisankar P and Bandyopadhyay S (2013) Synergistic apoptosis of CML cells by buthionine sulfoximine and hydroxychavicol correlates with activation of AIF and GSH-ROS-JNK-ERK-iNOS pathway. *PLoS One* **8**, e73672.

Basu A, Jaisankar P and Kumar G S (2013) Photophysical and calorimetric studies on the binding of 9-O-substituted analogs of the plant alkaloid berberine to double stranded poly(A). *J. Photochem. Photobiol. B: Biology* **125**, 105-114

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Gorain B, Choudhury H, Biswas E, Barik A, Jaisankar P and Pal T K (2013) A novel approach for nanoemulsion components screening and nanoemulsion assay of olmesartan medoxomil through a developed and validated HPLC method. *RSC Advances* **3**, 10887-10893.

Bhowmik A, Das N, Pal U, Mandal M, Bhattacharya S, Sarkar M, Jaisankar P, Maiti N C and Ghosh Mrinal K (2013) 2,2'-diphenyl-3,3'-diindolylmethane: a potent compound induces apoptosis in breast cancer cells by inhibiting EGFR pathway. *PLoS One* **8**, e59798.

Basu A, Jaisankar P and Kumar G S (2013) Binding of the 9-O-N-aryl/arylalkyl amino carbonyl methyl substituted berberine analogs to tRNAphe. *PLoS One* **8**, e58279.

Invited Lectures:

Delivered **one (1)** number of invited talk in India & **one (1)** number in abroad which is shown below:

Topic:	3,3'-Diindolylmethane (DIM) as potent anti-leishmanial agent targeting DNA topoisomerase 1B of Leishmania Donovani
Venue:	International Chemical Biology Society (ICBS2013), Kyoto University, Japan
Date:	October 7-9, 2013

Session Chaired:

Chaired one scientific session in the INTERNATIONAL CONFERENCE ON CHEMICAL BIOLOGY at CSIR-IICT, Hyderabad, India, on February 5, 2014

Chaired one Technical session in the National Workshop on Registration of Bio-ehtics Committee for Chemical Research- its practice and prospects at Jadavpur University, Kolkata, India on 18th April, 2013

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata

Deputation Abroad:

DAAD Fellowship at Technische Universität München, with Prof. Lukas Hinterman in the field of asymmetric catalysis on 15th October to 14th December, 2013.

Abstracts Presented:

Number of Abstracts in National Conference: **1**
Number of Abstracts in International Conference: **1**

Ph.D. Awarded:

Mrs. Madhumita Mandal

Honors & Awards:

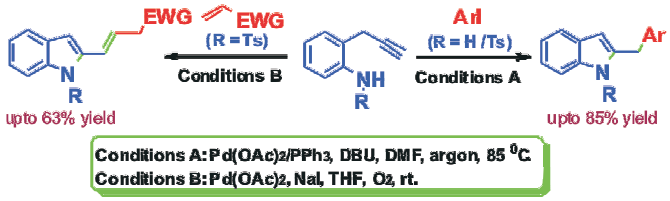
DAAD (German Academic Exchange Service) Fellowship for the year 2013 (under re-invitation programme).

Human Resource:

Technical/Administrative Staff(s): 2
Research Fellow(s): 3
Research Associate(s): 2
Project Assistant(s): 2

Dr. Chinmay Chowdhury
Chemistry Division

A facile method for the general synthesis of 2-arylmethylindoles has been developed through the reaction of 2-(2-propynyl)aniline or 2-(2-propynyl)tosylanilide with aryl iodides in the presence of Pd(OAc)2, PPh3, and DBU. 2-(2-Propynyl)tosylanilide is found to be reactive also towards electron deficient alkenes in the presence of Pd(OAc)2 and sodium iodide under oxygen atmosphere, providing an easy access to 2-vinylic indoles which possess exclusive E-stereochemistry in the side chain double bond. Operational simplicity, compatibility of the various functional groups, and ease of product formation are the hallmarks of these methods. A mechanism has been proposed to explain the product formation.



Publication Details:

Das B, Kundu P and Chowdhury C (2014) Facile synthesis of 2-arylmethylindoles and 2-vinylic indoles through palladium-catalyzed heteroannulations of 2-(2-propynyl)aniline and 2-(2-propynyl)tosylanilide. Org. Biomol. Chem., 12, 741-748.

Roy R, Kumar D, Chakraborty B, Chowdhury C and Das P (2013) Apoptotic and autophagic effects of Sesbania grandiflora flowers in human leukemic cells. PLoS One, 8, e71672.

Academic Performance:

Acted as Teacher of the course-work (AcSIR) of CSIR-IICB, Kolkata

Abstracts Presented:

Number of Abstracts in National Conference: 1

Honors & Awards:

Reviewers of various reputed international journals (i.e., *Tetrahedron*, *Bioorganic and Medicinal Chemistry Letters*, *Synthesis etc.*) and project proposals of government organizations (i.e., DST, CSIR).

Human Resource:

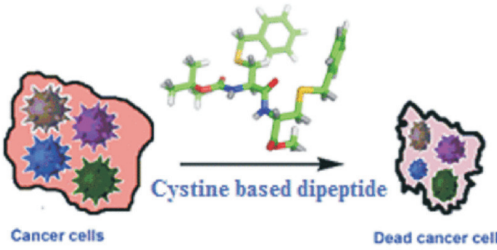
Research Fellow(s): Kaushik Brahma, Bimolendu Das, Priyanka Kundu

Dr Biswadip Banerji
Chemistry Division

Researches in my laboratory are mainly focused on the design, synthesis of New Chemical Entities (NCE) and study their biological properties. Also work is going on the synthesis and biophysical studies of nano-materials derived from small peptides as well as non-peptidic scaffolds. In our earlier studies, We had also successfully used a magnetic ironoxide nano-particle (INP) as drug carrier.

Potent anticancer activity of Cystine-based dipeptides and their interactions with serum albumins

Cancer is a severe threat to the human society. In the scientific community worldwide cancer remains a big challenge as there are no remedies as of now. In this present study a suitably protected cystine based dipeptide and its deprotected form have been synthesized. Potent anticancer activities were confirmed by MTT assay. The IC_{50} value, a measure of the effectiveness of a compound in inhibiting biological or biochemical function, of these compounds ranges in the sub-micro molar level. The binding interactions with serum albumins (HSA and BSA) were performed with all these molecules and all of them show very strong binding at submicromolar concentration.



This study suggested that the cystine-based dipeptides were potential anticancer agents. These peptides also showed very good binding with major carrier proteins of blood, the serum albumins. We are currently working on determining the detailed mechanism of anticancer activity of these molecules.

Copper(I) oxide nanoparticle and tryptophan as its biological conjugate: a modulation of cytotoxic effects

Recent investigations indicated that copper oxide nanoparticles can selectively induce apoptosis and effectively suppress the proliferation of tumor cells. Thus, it showed a great potential to be used as a drug for cancer treatment. Here we report an easy synthesis of spheroidal cuprous oxide nanoparticles (CuNPs) and their organic conjugate with L-tryptophan (Trp) using surfactant, sodium dodecyl sulfate as a capping reagent. The particles looked golden yellow and showed a strong affinity to bind blood carrier proteins such as bovine serum albumin and human serum albumin. However, both optical behavior and texture of the particles altered upon conjugation with Trp. The average size of the CuNPs was estimated to be 70 nm as appeared under transmission electron microscope or atomic forcemicroscope. The biological conjugate with Trp was 85 nm and looked light sky blue in aqueous suspension. The surface of the conjugated nanoparticles was smoother than the

bare CuNPs. The CuNPs were found to be toxic to different cultured cancerous cells; however, conjugation with Trp attenuated the toxicity, and indicated its possible utility in developing a drug candidate for cancer in a controlled fashion. Reduced toxicity also indicated a possible use of the conjugated particle as a drug delivery system.

Publication Details:

Biswadip Banerji, Sumit Kumar Pramanik , Uttam Pal and Nakul Chandra Maiti; Potent anticancer activity of cystine-based dipeptides and their interaction with serum albumins. *Chemistry Central Journal*, 2013, 7:91

Biswadip Banerji , Sumit Kumar Pramanik , Priyankar Sanphui, Sameer Nikhar, and Subhas Chandra Biswas; Synthesis and Cytotoxicity Studies of Novel Triazolobenzoxazepine as New Anticancer Agents. Chemical Biology & Drug Design, 2013, 82 (4), 401-409

Biswadip Banerji, Sumit Kumar Pramanik, Uttam Pal, and Nakul Chandra Maiti; Binding of Hemoglobin to Ultrafine Carbon Nanoparticles: A Spectroscopic Insight into a Major Health Hazard. *RSC Adv.*, 2014 (DOI: 10.1039/C4RA02569E)

Mritunjoy Maity, Sumit Kumar Pramanik, Uttam Pal, Biswadip Banerji and Nakul Chandra Maiti; Copper (I) oxide nanoparticle and tryptophan as its biological conjugate: a modulation of cytotoxic effects. *J Nanopart Res*, 2013, 16 (1), 1-13.

Invited Lecture:

Delivered one (1) number of invited talk in India

Academic Performance:

Acted as Associate Professor at AcSIR, CSIR-IICB, Kolkata and Course Teacher for NIPER, Kolkata

PhD Thesis Awarded:

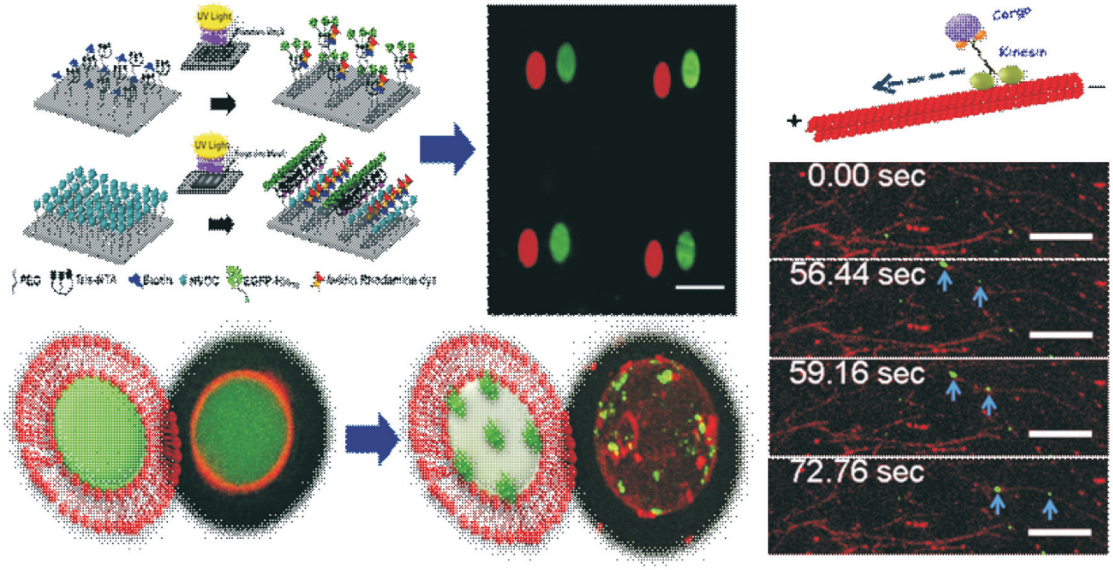
Sumit Kumar Pramanik, Jadavpur University

Human Resource:

Research Fellow(s): Moumita Chatterjee, Suvankar Bera, Shatadru Chatterjee, Sunil Killi, K. Chandrasekhar, Saswati Adhikary, Chinmoy Nayan, Souvik Sinha
Project Assistant(s): Ramanji, Srinivas, Suneeta, Varalaxmi.

Dr. Surajit Ghosh
Chemistry Division

We are trying to develop various platforms for reconstitution of biological events. Recently,we have developed biotin and Tris-NTA functionalized EM grid, biotin micropatterned surface, micropatterned surface with the presence of Tris-NTA and biotin functionality both in same micropattern as well as individual in adjacent micropattern using UV light illumination through photo-mask, which is extremely useful for immobilization of oligohistidine and biotin tagged multiple biomolecules/proteins.In addition, we have developed artificial cellular like system using liposome for studying peptide- protein interaction with membrane. We also reconstitute kinesin mediated cargo transport using nanomaterials.We are also trying to understand how peptide self-assembles and forms various soft structures using molecular simulation and various microscopic techniques. Few representative images from our recent findings are shown underneath.Currently, we are involved in design and synthesis of small molecules with envisions that those may perturb microtubule dynamics. These molecules will be screened against various cancer cell lines.



Publication Details:

Biswas A, Saha A, Jana B,Kurkute P, Mondal G and Ghosh S (2013) Facile generation of biotin micropatterned surface by photo destruction serves as a novel platform for microtubule organisation and DNA hybridisation. ChemBioChem, 14, 689-694.

Saha A, Mondal G, Biswas A, Chakraborty I, Jana B and Ghosh S (2013) In vitro reconstitution of a cellular like environment using liposome for amyloid beta peptide aggregation and its propagation. Chem. Commun.,49, 6119-6121. (Accepted in Front Cover)

Jana B, Mondal G, Biswas A, Chakraborty I and Ghosh S (2013) Functionalised TiO2 nanoparticles deliver oligo-histidine andavidin tagged biomolecules simultaneously into the cell. RSC Adv., 3, 8215-8219.

Saha A, Chakraborty I,Kraft C, Bhushan S and Ghosh S (2013) Microtubule nucleation from a functionalised SiO_2 EM grid. RSC Adv.,3, 7688-7691.

Chakraborty I, Saha A and Ghosh S (2013) Fabrication of Biotinfunctionalised SiO2 EM grid for studying biotin tagged biomolecules. IJC-A Special issue: 'Complex Chemical Systems', 52A, 1026-1030.

Jana J, Kar RK, Ghosh A, Biswas A, Ghosh S, Bhunia Aand Chatterjee S (2013) Human Cathelicidin Peptide LL37 Binds Telomeric G-Quadruplex. Mol. Biosyst., 9, 1833-1836.

Jana B, Mondal G, Biswas A, Chakraborty I, Saha A, Kurkute P and Ghosh S (2013) Dual functionalised graphene oxide serves as a carrier for delivering oligo-histidine and biotin tagged biomolecules into cell. MacromolBiosci.,13, 1478-1484. (Accepted in Front Cover)

Biswas A, Saha A, Ghosh D, Jana B and Ghosh S (2014) Co- and distinct existence of Tris-NTA and biotin functionalities on individual and adjacent micropatterned surfaces generated by photo-destruction. Soft Matter,10, 2341-45.(Accepted as Inside Front Cover page)

Baral A, Roy S, Dehsorkhi A, Hamley IW, Mohapatra S, Ghosh S and Banerjee A (2014) Assembly of an Injectable Non-Cytotoxic Peptide-based Hydrogelator for Sustained Release of Drugs. *Langmuir,* 30, 929-36.

Biswas A, Kurkute P, Jana B, Laskar A and Ghosh S (2014) Amyloid inhibitor octapeptide forms amyloid type fibrous aggregate and affect in microtubule motility. *Chem. Commun.*, 50, 2604-2607.

Chowdhury R, Jana B, Saha A, Ghosh S and Bhattacharyya K (2014) Confocal Microscopy of Cytoplasmic Lipid Droplets in a Live Cancer Cell: Number, Polarity, Diffusion and Solvation Dynamics. *MedChemComm*., 5, 536-539.

Invited Lectures:

Delivered **3** numbers of invited talks in India & **2** numbers in abroad which are shown below:

Topic: In vitro reconstitution of a cellular like environment using liposome for Aβ peptide

aggregation, its propagation, peptide-lipid interaction and drug screening
Venue: *4th Asia Specific Peptide Symposium (APIPS) at Osaka, Japan*
Date: *November 6, 2013*

Topic: Surface Modification and Patterning for Reconstitution of Biological Events and Delivering Therapeutic Molecules
Venue: *1st KANSAI Nanoscience and Nanotechnology International Symposium at OSAKA, JAPAN*
Date: *February 3, 2014*

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

Abstracts Presented:
Number of Abstracts in National Conference: **3**
Number of Abstracts in International Conference: **2**

Human Resource:

Research Fellow(s)	:	10
Research Associate(s)	:	1
Project Assistant(s)	:	1
Summer Trainee(s)	:	2

Dr. Sanjay Dutta
Chemistry Division

Discovery and delivery of RNA binders targeting Hepatitis C Virus (HCV) Internal Ribosome Entry Site (IRES) RNA to hepatocytes.

Our laboratory is working in an interdisciplinary approach to find solutions related to antivirals and antibiotic and anticancer therapy. We have students both from chemistry and biology discipline working for the common goal. Hepatitis C Virus (HCV) infection is one of the major liver diseases and is a global health concern. HCV infection affects almost 175 million people worldwide which represent almost 3% of the world population. HCV infection in liver leads to liver failure and hepatocellular carcinoma. Till date absolute therapy of Hepatitis C virus is problematic. There is an urgent need for the development of antivirals targeting HCV infection. My laboratory at IICB-Kolkata is engaged in the discovery and development of novel antivirals targeting Hepatitis C virus RNA.

Asialoglycoprotein receptor (ASGPR) is a high capacity galactose-binding receptor expressed on hepatocytes that binds with its natural substrates (such as GalNAc, Me-Gal, Lactose) with low affinity. ASGPR plays an important role in the lysosomal processing of N-acetylgalactosamine (GalNAc) and galactose (Gal) containing glycopeptide substrates. The ASGPR is predominantly expressed on the

basolateral surface of mammalian hepatocytes and is responsible for the clearance of glyco- and lipoproteins. In our laboratory the research is focused on the delivery of HCV targeting small molecules with this asialoglycoprotein receptor pathway.

Publication Details:

Rynearson KD, Dutta S, Tran K, Dibrov SM & Hermann T. Synthesis of oxazole analogs of streptolidine lactam (2013) *Eur. J. Org Chem*., 7337-7342.

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

Honors & Awards:

DBT Awarded Research grant on "DISCOVERY OF RNA BINDING LIGANDS-TARGETING HEPATITIS C VIRUS RNA**".**

Human Resource:

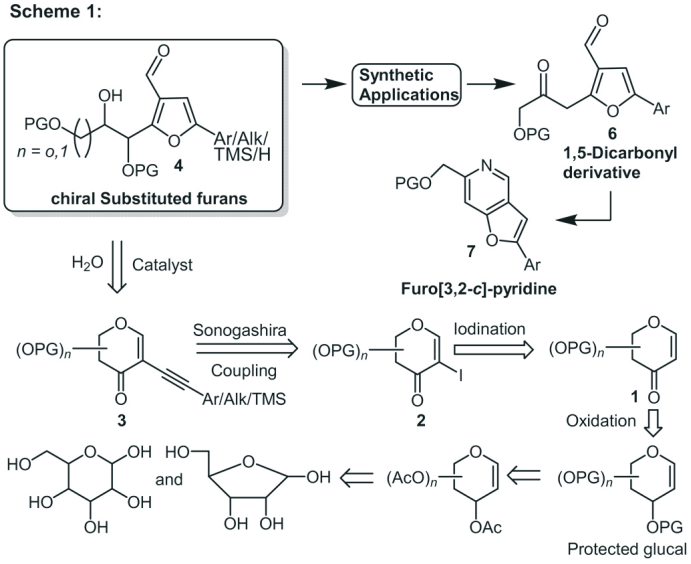
Research Fellow(s) : 6
Summer Trainee(s) : 2
NIPER Trainee(s) : 2

Dr. Indrajit Das
Chemistry Division

Gold(III) Chloride Catalyzed Synthesis of Chiral Substituted 3-Formyl Furans from Carbohydrates

This report describes a gold(III) catalyzed efficient general route to densely substituted chiral 3-formyl furans under extremely mild conditions from suitably protected 5-(1-alkynyl)-2,3-dihydro-pyran-4-one using H_2O as a nucleophile. The reaction proceeds through the initial formation of an activated alkynegold(III) complex intermediate, followed by either a domino nucleophilic attack/*anti-endo-dig* cyclization, or the formation of a cyclic oxonium ion with subsequent attack by H_2O. To confirm the proposed mechanistic pathway, we employ MeOH as a nucleophile instead of H_2O, in which resulting in substituted furo[3,2-*c*]pyran derivative, as anticipated. The similar furo[3,2-*c*]pyran skeleton with a hybrid carbohydrate-furan derivative has also been achieved through PDC oxidation of a substituted chiral 3-formyl furan. The corresponding protected 5-(1-alkynyl)-2,3-dihydro-pyran-4-one can be synthesized from the monosaccharides (both hexoses and pentose) following oxidation, iodination and Sonogashira coupling sequences. Furthermore, to demonstrate the potentiality of chiral 3-formyl furan derivatives, a $TiBr_4$-catalyzed reaction of these derivatives has shown to offer efficient access to 1, 5-dicarbonyl compound, which on treatment with NH_4OAc in slightly acidic conditions affording substituted furo[3,2-*c*]pyridine (see Scheme 1).

Scheme 1:



Publication Details:

Kanchan Mal, Abhinandan Sharma, and Indrajit Das in Gold(III) Chloride Catalyzed Synthesis of Chiral Substituted 3-Formyl Furans from Carbohydrates: Application in the Synthesis of 1,5-Dicarbonyl Derivatives and Furo[3,2-c]pyridine *Chem. Eur. J.* 2014, *20*, 11932 11945.

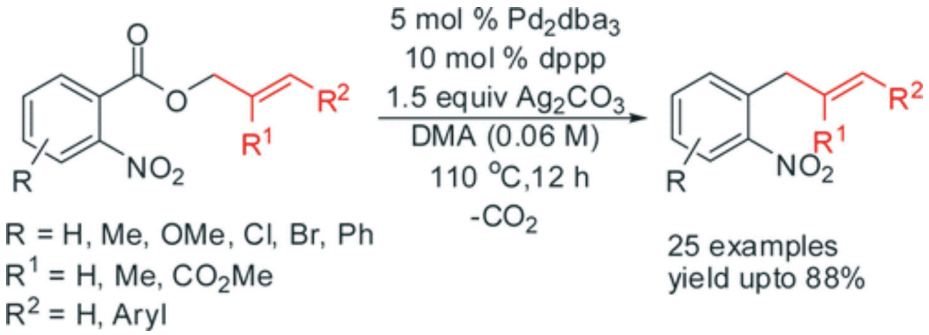
Kanchan Mal, Abhinandan Sharma, Prakas R. Maulik, and Indrajit Das in PPh_3·HBr-DMSO Mediated Expedient Synthesis of γ-Substituted β,γ-Unsaturated α-Ketomethylthioesters and α-Bromo Enals: Application to the Synthesis of 2-Methylsulfanyl-3(*2H*)-furanones *Chem. Eur. J.* 2014, *20*, 662 667.

Human Resource:

Research Fellow(s): 3
Summer Trainee(s): 2

Dr. Ranjan Jana
Chemistry Division

Nitrogen containing heterocyclic compounds such as indoles, carbazoles are ubiquitously found in many natural products, biologically active compounds and high utility synthetic materials. My group is involves in the synthesis of biologically active compounds via inert C-C, and C-H bond activations. This strategy will enable to generate a library of compounds, and diversification at the late stage without any rigorous prefunctionalization procedures. Therefore, medicinal scaffolds including amino acids can be functionalized in a cost-effective manner. In this vein, recently, we have accomplished a Palladium(0)-Catalyzed Intramolecular Decarboxylative Allylation of Ortho Nitrobenzoic Esters. This methodology will afford the starting material for a plethora of nitrogen-containing heterocycles.



Publication Details:
Hossian, A. Singha, S, and Jana, R. (2014) Palladium(0)-Catalyzed Intramolecular Decarboxylative Allylation of Ortho Nitrobenzoic Esters, Org. Lett., 16, 3934-3937.

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

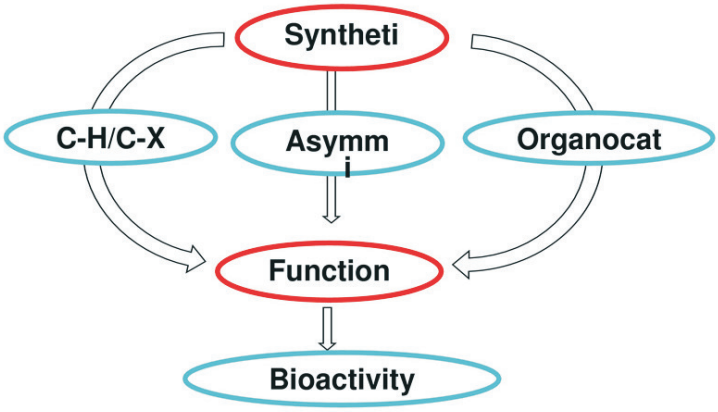
Honors & Awards:
Awarded Ramanujan Fellowship, 2013

Human Resource:
Research Fellow(s): Mr. Asik Hossian, Mr. Bijaya Kumar Singh, Mr. Manash Kumar Manna, Mr. Samir Kumar Bhunia, Mr. Arghya Polley

Dr. Indu Bhusan Deb

Chemistry Division

Our research interests lie in the development of new catalytic system using transition metal (mainly, Pd, Fe & Ni) to perform chelation assisted C-H/C-X bond cleavage reaction using the substrates containing different directing groups for the synthesis of nitrogen containing heterocycles (e.g. indole, pyrrole etc) and functionalized nucleosides.



Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata

Dr. Arindam Talukdar

Chemistry Division

Our lab aims to answer fundamental questions that lie at the interface of chemistry and biology by integrating the concept of organic chemistry, biochemistry and molecular modeling to perform structure-based design and synthesis of novel chemical entity to unravel the molecular mechanism and develop potential treatment for human diseases.

Epigenetic modifying enzymes as novel therapeutic targets:

The main focus is to perform structure-based design and synthesis of small-molecule regulators of epigenetics modifying enzymes such as histone methyltransferases (HMT) as tools to unravel the complex biology of epigenetics and contribute towards epigenetic-based drugs for the treatment of a number of diseases such as cancer, autoimmunity, diabetes, or neurological disorders.

Probing Endosomal Toll-like Receptors (TLRs):

TLRs are members of the larger family of evolutionarily conserved pattern recognition receptors which are critical first line of defence for self-nonself discrimination by the host immune response. Aberrant endosomal TLR activation is implicated in autoreactive inflammation in different autoimmune diseases. The goal is to rationally design selective inhibitors for the nucleic acid-recognizing TLRs for devising novel therapeutic strategies in relevant clinical contexts.

Dr. R. Natarajan
Chemistry Division

Molecular recognition with macrocycles, cages and metal-organic frameworks

We aim to design and synthesize novel synthetic small molecule receptors for selective biologically relevant recognition of guest molecules with an aim towards biomedical applications. We also explored with a water soluble macrocyclic receptor, namely cucurbit[7]uril, towards recognition of saccharides. We found that cucurbit[7]uril selectively encapsulates amino saccharides and stabilizes them as α-anomer.

We have initiated a program on synthesizing novel cyclic and acyclic water soluble receptors for sequence selective peptides with relevance to amyloid inhibition.

We have further initiated a research program on exploring endogeneous and non-toxic steroid derivatives as organic linker for nanoscale metal-organic frameworks towards biomedical applications.

Publication Details:

Jung, Y; Natarajan, R.*; Ko, Y. H; Kim, K.* Cucurbit[7]uril: A High-Affinity Host for Encapsulation of Amino Saccharides and Supramolecular Stabilization of Their α-Anomers in Water. *Angew. Chem. Int. Ed.* 2014, *53*, 1003-1007.

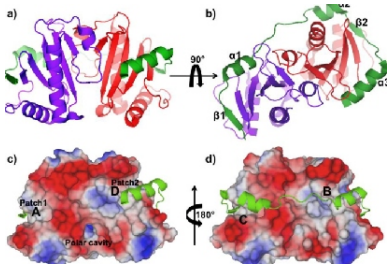
Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

Human Resource:

Research Fellow(s): Mr. Jayanta Samanta, Mr. Shoven Kr Sen

SB&BD



Structural Biology & Bioinformatics Division

Prof. Siddhartha Roy, Drs. Chitra Dutta (Head), Debasish Bhattacharyya, Subrata Adak, Soumen Datta, Krishnananda Chattopadhyay, Jayati Sengupta, Saikat Chakrabarti, Nakul C Maiti, Sujoy Mukherjee, Sucheta Tripathy, Siddhartha Roy (Jr.)

The Structural Biology & Bioinformatics is engaged in studies of various macromolecular machines and cellular pathways of biomedical interest from structural as well as mechanistic perspective. There are two parallel wings of the division - experimental structural biology and computational biology. Scientists from diverse areas of biological, chemical, physical, mathematical and computational sciences are working together to probe into macromolecular interactions at different levels of biological organization using integrative, trans-disciplinary approaches. One of the major objectives of such studies is to gain a better insight into the quality control mechanisms in protein folding. Projects have been designed to address the key issues on protein misfolding, aggregation and amyloid formation, e.g, explicating the molecular/sub-molecular processes responsible for the onset and progress of protein aggregation /amyloidogenesis; characterizing the pre-amyloidogenic states of proteins along the aggregation pathway, delineating the physicochemical features of natively unfolded proteins and peptides of clinical importance, navigating the native protein folding routes in various pathogenic microbes, elucidating cellular defenses against aberrant protein folding and developing novel strategies for amelioration of protein misfolding disorders. State-of-the-art facilities and technologies like nuclear magnetic resonance (NMR), mass spectrometry, diode array stopped-flow spectrophotometry fluorescence correlation spectroscopy, cryo-electron microscopy, X-ray crystallography, and other biochemical and biophysical methods are being employed or will be employed for structural characterization of different macromolecules at atomic resolution. Various other studies such as enzyme kinetics, oxidative stress responses in *Leishmania*, structural analysis of RNA-Protein complexes, cryo-EM studies of ribosomal complexes, structure and dynamics of macromolecular systems responsible for cancer, tuberculosis and other diseases etc are also being conducted by the experimental wing of the division. In parallel, *in-silico* studies are being pursued to address the issues pertaining to genome harvesting, pathway simulation, protein-protein interactions, rational drug design, evolution of extremophilic microbes and metagenomic analysis of human microflora. A number of software packages and knowledgebases have been designed and developed for high throughput genome/ transcriptome/proteome analysis.

Dr. Chitra Dutta
Structural Biology & Bioinformatics Division

Niche-specific Genome and Proteome Architectures of *Prevotella* and *Bacillus*

Prevotella, a major component of the human microbiome, is known to be associated with various infections of the central nervous system, urogenital tract(UGT), gastrointestinal tract(GIT) and skin. In order to study habitat-specific divergences in macromolecular architectures, we analyzed genomic/proteomic features of 28 annotated draft genome assemblies from 25 Prevotella species, isolated from human oral cavity, GIT, UGT and skin. The study revealed exclusive presence and absence of different gene families and COG categories in genomes derived from distinct anatomical niches, suggesting that adaptation of Prevotella to specific niches might have been achieved through selective acquisition/elimination of suitable gene-families.

Last year we have reported co-existence of a strong purine asymmetry, strand-biased gene distribution and PolC in Bacillus and other members of Firmicutes, Fusobacteria and Tenericutes. Analysis of protein features in 21 Bacillus species of diverse metabolic, virulence and ecological traits reveals that purine asymmetry, in conjunction with lineage/niche specific constraints, significantly influences protein evolution in Bacillus. All Bacillus species, except the Se-respiring B. selenitireducens, display distinct strand-specific biases in aa usage, which may affect pI of proteins with prevalence of acidic and basic residues in the leading and lagging strand proteins respectively.

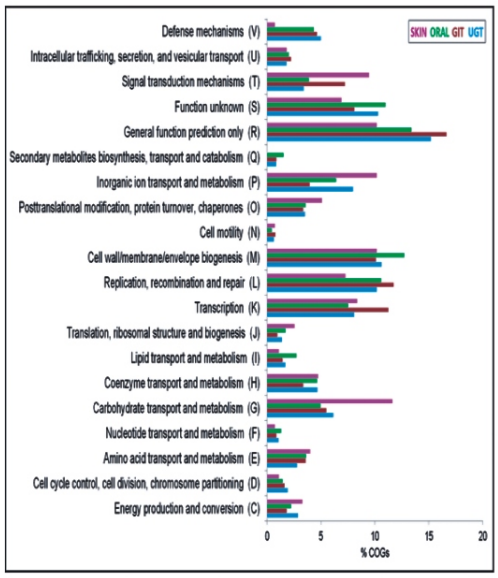


Figure A: Functional COG distribution patterns of the niche specific orthologous gene families in Prevotella genomes isolated from distinct anatomical sites of the human body.

Publication Details:
Saha S, Goswami, A and Dutta C (2014) Association of purine asymmetry, strand-biased gene distribution and PolC within Firmicutes and beyond: a new appraisal *BMC Genomics*, **15**:430.

Invited Lectures:
Delivered two invited talks in India

Academic Performance:
Acted as a Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata
Acted as a Guest Faculty for M.Sc. (Genetics), University of Calcutta
Acted as an Examiner for M.Sc. (Biotechnlogy, Microbiology, Neuroscience) at University of Calcutta
Evaluated projects submitted to DST and DBT, Govt. of India
Examined Ph. D. Thesis of Goa University and ISI, Kolkata
Acted as a Reviewer in various International journals like BMC Genomics, BMC Microb., J. Mol. Evol. J. Biomol. Struc.Dyn., Gene etc.

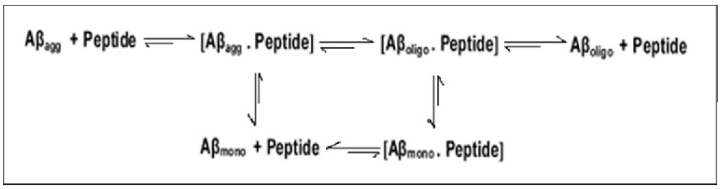
Honors & Awards:
Member, Scientific Advisory Committee (SAC), National Institute of Biomedical Genomics (NIBMG), Kalyan
Member, P.G. Board of Studies, Department of Genetics, University of Calcutta
Member, Project Review Committee, Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, Govt. of India
Member, Selection Committee for Recruitment of Scientists, National Agri-food Biotechnology Institute (NABI), Mohali

Human Resource:
Technical/Administrative Staff(s): Dr. Subhagata Ghosh
Research Fellow(s): Aranyak Goswami, Sanchari Pradhan, Sanjoy K. Saha, Utpal Bakshi, Vinod K. Gupta
Research Associate(s): Dr. Munmun Sarkar
Project Assistant(s): Narendrakumar M. Chaudhari
Summer Trainee(s): Bapi Biswas, Intkhab Alam Ansari, Joyeeta Chakraborty, Shuchi Chouhan

Dr. Debasish Bhattacharyya
Structural Biology and Bioinformatics Division

Destabilization of β-amyloid aggregate, the hallmark of Alzheimer's disease using a component of Russell's viper venom.

Snake venoms are notorious for their life threatening toxicity. However, as the components are highly potent in pharmacological activity, they are also used in medical applications traditionally. Alzheimer's disease is an age related cognition disfunctioning caused by deposition of β-amyloid peptides in brain causing irreversible damage to neuronal connections. We observed that Factor V activator, a component of Russell's viper venom can degrade β-amyloid peptide aggregates *in vitro*. Further analysis revealed that only a small peptide derived from the factor was capable of degrading the aggregate. Thereafter, the peptide was synthesized and the said potency was confirmed using neuronal cell model. It is believed that the peptide binds with the aggregate leading to an unstable entity that ultimately dissociates into smaller fragments as proposed in the box below.



Analysis of human placental extract shows that heparin can stabilize Proteinase K. This has implications in wound healing.

An aqueous extract of human placenta, sold under the trade name 'Placentrex', is used for nonspecific immuno-stimulation and wound healing. In long term collaboration with the manufacturer of the drug, M/s Albert David Ltd, we have identified a number of functional components in the drug and speculated their physiological roles. Recently it has been observed that heparin, a carbohydrate molecule present in the extract can reversibly inactivate Proteinase K, an aggressive protease of fungal origin. Thus the invading character of microbe is partly reduced as the protease becomes inactive by heparin. Since heparin is neither a substrate nor a substrate analogue of Proteinase K, it showed that regulation of biological functionality could be achieved by molecules that are apparently inert to a system.

Publication Details:

Bhattacharjee, P. and Bhattacharyya, D. (2013) Characterization of the aqueous extract of the root of Aristolochia indica: Evaluation of its traditional use as an antidote for snake bite. J. Ethnopharmacol. 145, 220226.

Mitra, J. and Bhattacharyya, D. (2013) Irreversible inactivation of snake venom L-amino acid oxidase by covalent modification during catalysis of L-propergylglycine. FEBS OpenBio. 3, 135-143.

Dutta, S. and Bhattacharyya, D. (2013) Reverse zymography alone does not confirm presence of a protease inhibitor. Protein J. 32, 155-162

De, D., Chakraborty, P.D., Mitra, J., Sharma, K., Mandal, S., Das, A.,, Chakrabarty, S. and Bhattacharyya, D. (2013) 'Ubiquitin-like Protein from Human Placental Extract has Collagenase Activity' PLoS ONE 8, e59585 (1-10).

Dutta, S. and Bhattacharyya, D. (2013) 'Enzymatic, antimicrobial and toxicity studies of the aqueous extract of Ananas comosus (pineapple) crown leaf.' J. Ethnopharmacol. 150, 451-457.

Bhattacharjee, P. and Bhattacharyya, D. (2013) Factor V activator from Daboia russelli russelli venom destabilize β-amyloid aggregate, the hallmark of Alzheimer disease. J. Biol. Chem. 288, 30559-30570.

Bhattacharjee, P. and Bhattacharyya, D. (2013) Medicinal plants as snake venom antidotes. J. Expt. Appl. Animal Sci. 1, 156-181.

Bhattacharjee, P. and Bhattacharyya, D. (2014) 'Therapeutic use of snake venom components: A voyage from ancient to modern India'. Mini Rev. Org. Chem. 11, 1-10

Sharma, K., Mukherjee, C., De, D., Roy, S. and Bhattacharyya, D. (2014) 'Inhibition of Proteinase K by an aqueous extract of human placenta: Role of heparin and other glycoproteins' J. Cell. Physiol. 229, 1212-1223.

Chapter(s) Details:

Bhattacharjee, P. and Bhattacharyya, D. (2014) 'An insight into the abnormal fibrin clots: its pathophysiological roles' in 'Thrombosis and Fibrinolysis' (Ed. K. Konov) InTech, Croatia University Press, Croatia, Chapter 1, pp 3-29.

Invited Lectures:

Topic: Stability of Proteinase K in presence of aqueous extract of human placenta used as wound healer
Venue: Annual Conference of Asian Biophysical Society, Jeju Island, South Korea
Date: 26-29 May 2013

Academic Performance:

Acted as Adjunct Professor at AcSIR, CSIR-IICB; NIPER, Kolkata; Jadavpur University (Biotechnology and Life Sciences); as External Member of Calcutta University Ph.D. committee, Biochemistry Department; Editorial Board Member of the Journal of Chromatography B; reviewer of several international journals.

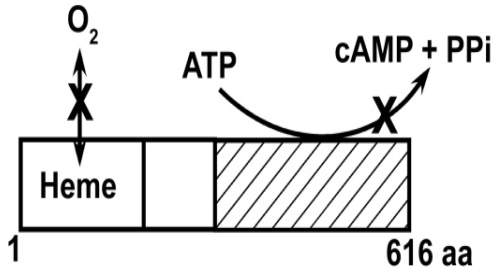
Human Resource:

Technical/Administrative Staff: Samir Roy
Research Fellows: Debratna Mukherjee ,Sangita Dutta , Jyotirmoy Mitra , Payel Bhattacharyya , Kanika Sharma, Namrata Singh, Project Assistant: Chaitali Mukherjee
Summer Trainees: Ankita Banerjee, Sritama Mukherjee

Dr. Subrata Adak
Structural Biology and Bioinformatics Division

Structure-function aspect of globin-coupled heme containing adenylate cyclase from human pathogen Leishmania major

The past few years have witnessed a dramatic increase in the diversity of heme-protein sensory domains, including the known heme containing O_2-sensors FixL, AxPDEA1, NPAS2, EcDOS, DosC, diguanylate cyclase and HemAT-Bs. Four distinct classes of heme-sensing domains have been discovered e.g. globin, PAS domain, regulatory site of CooA, and guanylate cyclase. These domains sequentially control signal transduction domains that include histidine kinases, phosphodiesterases, DNA-binding domains, guanylate cyclases, diguanylate cyclase, and aerotaxis transducers. As the globin-coupled oxygen sensor protein structures and the signal transduction mechanisms differ from those of other oxygen sensor types, such as FixL and EcDOS containing the heme-bound PAS fold domain, it is important to explore the oxygen sensing mechanisms of these enzymes. Recently we have described the globin-coupled heme containing adenylate cyclase from *Leishmania major* (HemAC-Lm) that shows an O_2 dependent cAMP signaling (Sen Santara, et. al. Proc. Natl. Acad. Sci. U.S.A. 110, 1679016795 (2013)). The heme iron of HemAC-Lm is expected to participate in oxygen binding and activates adenylate cyclase activity during catalysis, but its interactions with O_2 are uncharacterized. We have utilized the HemAC-Lm and stopped-flow methods to study the formation and decay of the HemAC-Lm oxygenated complex at 25 °C. Mixing of the ferrous HemAC-Lm with air-saturated buffer generates a very stable oxygenated complex with absorption maxima at 414, 540 and 576 nm. The distal axial ligand in the deoxygenated ferrous HemAC-Lm is displaced by O_2 at a rate of ~10 s^{-1}. To prepare apoprotein of heme iron in HemAC-Lm, we have mutated the proximal His161 to Ala and characterized the mutant protein. The apo as well as heme reconstituted ferric state of the mutant protein shows a ~30 fold lower catalytic activity compared to oxygenated form of wild type protein. The oxygenated form of heme reconstituted mutant protein is highly unstable (decay rate = 6.1 s−1). Decomposition of the oxygenated intermediate is independent of O_2 concentration and is monophasic. Thus, the stabilization of ferrous-oxy species is an essential requirement in the wild type HemAC-Lm for a conformational alteration in the sensor domain that, sequentially, activates the adenylate cyclase domain, resulting in the synthesis of cAMP.



Globin-coupled heme containing adenylate cyclase from *Leishmania major* (HemAC-Lm) that shows an O_2 dependent cAMP signaling

Publication Details:

Roy, J., Sen Santara, S., Bose, M., Mukherjee, S., Saha, R., and Adak, S. The ferrous-dioxy complex of Leishmania major globin coupled heme containing adenylate cyclase: The role of proximal histidine on its stability. (2014) Biochim. Biophys. Acta. 1844, 615-622

Saha, R., Bose, M., Sen Santara, S., Roy, J. and Adak, S. Identification of proximal and distal axial ligands in Leishmania major pseudoperoxidase (2013) Biochemistry 52, 8878−8887.

Sen Santara, S., Roy, J. Mukherjee, S., Bose, M., Saha, R., and Adak, S. Globin coupled heme containing oxygen sensor soluble adenylate cyclase in Leishmania prevents cell death during hypoxia (2013) Proc. Natl. Acad. Sci. U.S.A. 110, 1679016795

Saha, R., Bose, M., Sen Santara, S., Roy, J. Yadav, R.K., and Adak, S. Effect of distal His mutation on the peroxynitrite reactivity of Leishmania major peroxidase (2013) Biochim. Biophys. Acta. 1834, 2057-2063

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Abstracts Presented:

Number of Abstracts in National Conference: **2**

Human Resource:

Research Fellow(s): Sumit Sen Santara**,** Jayasree Roy, Aditi Mukherjee, Ayan Adhikari
Research Associate(s): Dr. Rina Saha

Dr. Soumen Dutta
Structural Biology and Bioinformatics Division

Structural and biophysical insights of protein and protein complexes

Many well known gram-negative bacteria like *Yersinia, Pseudomonas, Aeromonas, Shigella, Salmonella* and others possess a contact dependent protein delivery system, known as Type Three Secretion System (T3SS). These bacteria use T3SS to inject effector or virulent proteins within the host cell, resulting in the bacterial infection. Proteins encoded by T3SS can be categorized as chaperones; proteins forming the injectisome or type three secretion apparatus; translocator proteins forming the translocon; effectors and regulator proteins. During infection, a continuous narrow channel is needed for the translocation of the effectors and their injection into the host cell cytoplasm, this continuous conduit is also known as functional injectisome. Translocon formed at the tip of the needle complex consists of three translocator molecules.

Our laboratory is primarily working on proteins related to different parts of T3SS. Beside that we are also working on pantothenate and CoA biosynthesis pathway proteins. The selected highlights from our laboratory are given below.

We have recently solved the crystal structure of effector-chaperone complex (ΔExoT-SpcS) from *Pseudomonas aeruginosa* (Figure 1). In patothenate synthesis pathway, we have got crystals of phosphopantetheine adenylyltransferase (PPAT) with different substrates (Figure 2).

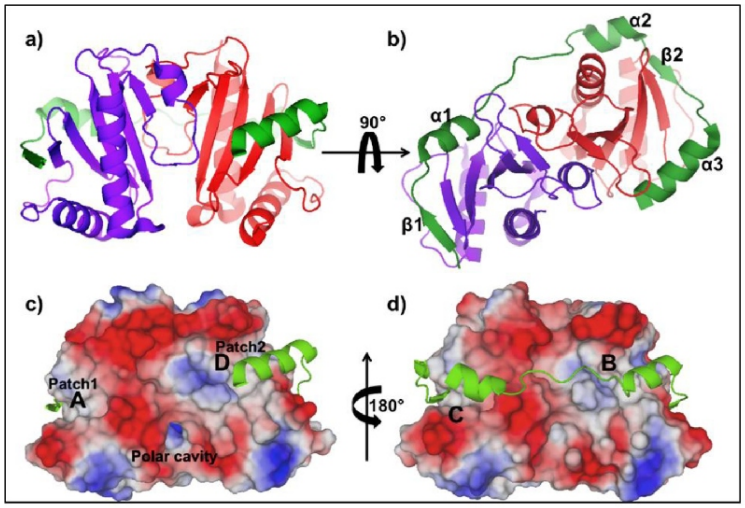


Figure 1. Structural overview of ExoT-SpcS complex (a) Frontal view and (b) Side view of the chaperone binding domain of ExoT (green) wrapped around SpcS dimer. This CBD domain essentially consists of 3α helices and 2β sheets (c) Electrostatic potential mapped onto the molecular surface of SpcS dimer wrapped around by ExoT. A 180° rotation around the vertical axis reproduces figure (d).

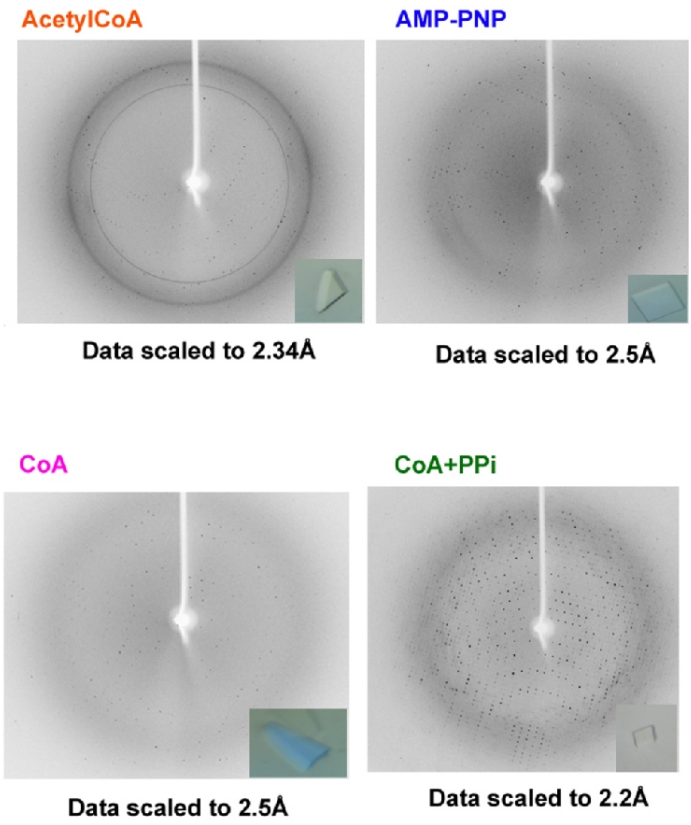


Figure 2. Diffractions of PPAT crystals (given in the insets) with AcetylCoA (top left), AMP-PNP (top right), CoA (bottom left) and CoA+PPi (bottom right).

Publication details:

Basu A, Das U, Dey S, Datta S. PcrG protects the two long helical oligomerization domains of PcrV, by an interaction mediated by the intramolecular coiled-coil region of PcrG. BMC Struct Biol. 2014 Jan 24;14(1):5. doi:10.1186/1472-6807-14-5.

Dey S, Datta S. Interfacial residues of SpcS chaperone affects binding of effector toxin ExoT in Pseudomonas aeruginosa: novel insights from structural and computational studies. FEBS J. 2014 Jan 4. doi: 10.1111/febs.12704.

Academic performance:

Acted as teacher for course works at CSIR-IICB and NIPER, Kolkata

Dr. Krishnananda Chattopadhyay
Structural Biology and Bioinformatics Division

We have been studying protein conformation, dynamics and aggregation using different biophysical methods including Fluorescence correlation spectroscopy (FCS). FCS is an important technique to measure the diffusional and conformational fluctuations of fluorescently labeled molecules at single molecular resolution. These fluctuations could be analyzed by using suitable correlation functions yielding useful information regarding the shape and/or conformational dynamics of a protein. Previously, we have shown by a number of orthogonal techniques including analytical ultracentrifugation, dynamic light scattering and native gel electrophoresis that aggregation of bovine serum albumin can be minimized by using high concentration of arginine. Urea induced unfolding transition of cytochrome c has been studied by FCS. Measurements of microsecond dynamics using appropriately labeled cytochrome c indicates formation of an intermediate state, which has been found to be absent in the presence of arginine. The hydrodynamic radii of the protein in its native, unfolded, and intermediate states have been determined using FCS. Fluorescence correlation spectroscopy is used to monitor self-association of negative (SDS) and positively (DTAB) charged surfactant monomers at single molecular resolution. Tetramethyl rhodamine 5 maleimide (TMR) has been chosen as a probe because rhodamine dyes have been shown to bind surfactant micelles.

In a recent study, we explored the applications of FCS inside polyacrylamide gel to study the effects of molecular weight and molecular shape in a crowded environment. To understand the effect of molecular weight, we carried out FCS experiments with four model systems of different molecular weights in the presence of varying concentrations of acrylamide. The correlation curves were fit adequately using a model containing two diffusing components; one representing unhindered diffusion, and the other representing the diffusion in the gel phase. We showed that the scaling behavior relating the hydrodynamic radius and the number of amino acids change inside acrylamide gel for the folded and unfolded states of the model proteins. We also showed that the influence of crowding increased measurement resolution.

In a separate study, we investigated the mechanism of a chemical chaperone. For that, we designed a series of mutant proteins in which a tryptophan residue experiences different local environments and solvent exposures. We showed that these mutants corresponded to a series of conformationally altered proteins with varying degree of misfolding stress and aggregation propensities. Using arginine as a model small molecule, we showed that a combination of unfolded state contraction and denaturant like properties results in selective targeting and destabilization of the partially folded proteins, which are aggregation prone. Other small molecules, lacking either of the above two properties, did not offer any specificity towards the misfolded proteins.

Publication Details:

Parmanik, B, Kundu, A., Chattopadhyay, K*, & Patra, A. Study of binding interactions between MPT63 protein and Au nanocluster, RSC Advances 2014, 4, 35059-35066

Basak, S. & Chattopadhyay, K*. Studies of protein folding and dynamics using single molecule fluorescence spectroscopy, Physical Chemistry Chemical Physics 2014, DOI: 10.1039/C3CP55219E,

Sarkar, S. & Chattopadhyay, K*. Studies of early events of folding of a predominately beta sheet protein using fluorescence correlation spectroscopy and other biophysical methods, Biochemistry 2014, 53, 1393-1402

Lahiri, S., Banerjee, S., Dutta, T., Sengupta, S., Dey, S., Roy, R., Sengupta, D., Chattopadhyay, K. &Ghosh, A. K. Enzymatic and regulatory attributes of Trehalose-6-Phosphate Phosphatase from Candida utilis and its role during thermal stress, Journal of Cellular Physiology, DOI: 10.1002/jcp.24562 (2014)

Sharma, S., Sarkar, S., Paul, S.S., Roy, S. & Chattopadhyay, K*. A small molecule chemical chaperone optimizes its unfolded state contraction and denaturant like properties. Sci. Rep. 2013, 3, 3525; DOI:10.1038/srep03525.

Basak S, Chattopadhyay K*. Fluorescence Correlation Spectroscopy Study on the Effects of the Shape and Size of a Protein on Its Diffusion Inside a Crowded Environment. Langmuir. 2013, 29, 14709-14717.

Nidhi Joshi , Anindita Mukhopadhyay , Sujit Basak , Goutam De , and Krishnananda Chattopadhyay*. Surface Coating Rescues Proteins from Magnetite Nanoparticle Induced Damage. Part. Part. Syst. Charact. 2013, 30, 683694

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Human Resource:

Technical/Administrative Staff(s): Dr. Ramdhan Majhi
Research Fellow(s): Sunny Sharma, Suparna Sarkar, Sujit Basak, Simanta Sarani Paul, Pallabi Sil, Amrita Kundu, Sumanta Ghosh, Sourav Choudhury, Achinta Sannigrahi
Research Associate(s): Dr. Sangeeta Kundu
Project Assistant(s): Nidhi Joshi
Summer Trainee(s): Samrat Basak, Debanjali Gupta, Debasish Dutta

Dr. Jayati Sengupta
Structural Biology and Bioinformatics Division

Following studies are going on:

- Structure and dynamics of functional complexes of mycobacterial 70S ribosome during translation as well as nascent polypeptide chain processing
- Functional mechanisms of ribosome biogenesis/maturation factors
- Role of eukaryotic ribosomes and ribosomal rRNAs (Yeast and Leishmania) in protein folding
- Identification of new regulatory factors in association with the *E. coli* ribosome

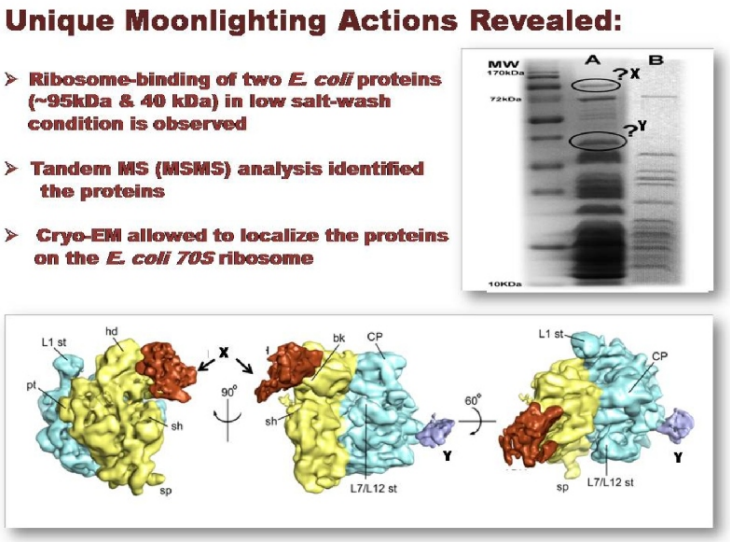


Figure 1: Outcome of the project focusing on the identification of E. coli ribosome-associated new regulatory proteins

Invited Lectures:

Delivered **2** invited talks in India

Abstracts Presented:

Number of Abstracts in National Conference: **2**
Number of Abstracts in International Conference: **1**

(Albany 2013: The 18th Conversation, Albany, NY, USA, Abstract no.34: Vol 31, Suppl.1, Special Issue JBSD)

Human Resource:

Research Fellow(s): Mr. Manidip Shasmal, Mr. Biprashekhar Chakraborty, Mr. Sandip De
Project Assistant(s): Mr. Sayan Bhakta
Summer Trainee(s): Mr. Sejpal Nikunjkumar Vinodray , Ms. Priya Das , Ms. Shreya Ghosh

Dr. Saikat Chakrabarti
Structural Biology & Bio-Informatics Division

Understanding the molecular mechanisms of host-pathogen interaction and its pathogenicity during infection

Our research interests are to study the structure, function and evolution of pathogenic proteins involved in different diseases especially those mediated by pathogens. The primary aim is to understand the hidden properties of protein-protein interactions (PPI) of either inter host-pathogen or intra host/pathogen systems leading to infection via network biological approach. Construction of such PPI networks are done through integration of several experimentally derived informations followed up with computational analysis under standardized protocol. During the last one year we have assembled and curated the intra PPI networks of very important human pathogen, *Plasmodium falciparum*.Using network biological approach we have successfully identified several key regulators of these PPI. Their importance is further investigated by a novel network perturbation method, also developed during the last one year period.We have simultaneously initiated a study to understand the sequential and structural properties of host-pathogen protein complexes, in an aim to predict host-pathogen protein-protein interactions from sequence and structural data in near future. Furthermore, our group is investigating another human pathogen,*Leishmania sp.* proteins in order to gain more insight into the pathogenicity of leishmaniasis disease.We have initiated the compilation and analysis of whole protein interactome data of *Leishmania sp*. so as to study their protein interaction properties both at their systems and molecular level. We are also studying the co-infection cases of *Mycobacterium tuberculosis* during *Leishmania sp*. infection to understand underlying process of con-infective pathogenicity.

We have also undertaken a computational systems biology approach to build a meta-interaction network of proteins and signaling pathways using text mining, network assembly and graph theoretical approach to understand the complex diseases (e.g. Brain cancer). In this regard we have developed a pathway assembly tool named PALM-IST (Pathway Assembly from Literature Mining an Information Search Tool),a platform combining both text mining and data mining methodologies to generate meta-pathways from biomedical abstracts with an objective to identify key crosstalk and bottleneck proteins from the plethora of protein signaling network information. We are also studying and trying to represent a holistic picture

of cellular interactome by integrating different types of biological processes at the level of signaling, transcriptional regulation and metabolic networks.

For the last one year, our laboratory has assembled and maintained a resource of 4.2 Teraflops of computational power and we have successfully utilized this resource into intensive computational calculations of molecular dynamic simulations, molecular docking, molecular-modeling and sequence alignment programs to solve intricate biological problems. In one such example, our team is investigating the effect of cholesterol during leishmaniasis on human MHC-II protein embedded within a lipid bilayer membrane using molecular dynamic simulations. In another instance of molecular dynamic simulation, we are exploring the effect of different single site mutations on the Cytochrome P450B1 enzyme structure, leading to the development of glaucoma in human. Extensive molecular modeling and docking analysis is also carried out to understand the interaction between pathogenic type-III secretion system protein PopB and its chaperone PcrH from *Pseudomonas aeruginosa.* From the last year onwards, we have extended our research interest to field of RNA biology also. We have started to analyze the RNA-RNA interaction properties between bacterial small RNAs and their target genes. We have developed a method to identify such small RNAs and their target genes and investigating their role in pathogenicity.

In short, our aim is to undertake a multi-faceted research plan integrating the available experimental information with subsequent development and application of several computational techniques for better understanding and prediction of molecular mechanisms underlying specific host-pathogen interactions.

Publication details:

Chakraborty, A. and Chakrabarti, S. (2014) A survey on prediction of specificity-determining sites in proteins. *Brief Bioinform*.

Chakraborty, A., Mukherjee, S., Chattopadhyay, R., Roy, S. and Chakrabarti, S. (2014) Conformational adaptation in the E. coli sigma 32 protein in response to heat shock. *J Phys Chem B*, 118, 4793-4802.

Paul, A., Samaddar, S., Bhattacharya, A., Banerjee, A., Das, A., Chakrabarti, S. and DasGupta, M. (2014) Gatekeeper tyrosine phosphorylation is autoinhibitory for Symbiosis Receptor Kinase. *FEBS Lett*, 588, 2881-2889.

Banerjee, A., Dey, S., Chakraborty, A., Datta, A., Basu, A., Chakrabarti, S. and Datta, S. (2014) Binding mode analysis of a major T3SS translocator protein PopB with its chaperone PcrH from Pseudomonas aeruginosa. *Proteins*, 82, 3273-3285.

Anshu, A., Mannan, M.A., Chakraborty, A., Chakrabarti, S. and Dey, M. (2014) A Novel Role for Protein Kinase Kin2 in Regulating HAC1 mRNA Translocation, Splicing and Translation. *Mol Cell Biol*.

Theeya, N., Ta, A., Das, S., Mandal, R.S., Chakrabarti, O., Chakrabarti, S. and Ghosh, A.N. (2014) An

Inducible and Secreted Eukaryotic-like Serine/Threonine Kinase of Salmonella Typhi Promotes Intracellular Survival and Pathogenesis. *Infect Immun*.

Nayak, M.K., Agrawal, A.S., Bose, S., Naskar, S., Bhowmick, R., Chakrabarti, S., Sarkar, S. and Chawla-Sarkar, M. (2014) Antiviral activity of baicalin against influenza virus H1N1-pdm09 is due to modulation of NS1-mediated cellular innate immune responses. *J Antimicrob Chemother*.

Roy, K., Ghosh, M., Pal, T.K., Chakrabarti, S. and Roy, S. (2013) Cholesterol lowering drug may influence cellular immune response by altering MHC II function. *J Lipid Res*, 54, 3106-3115.

Mazumder, A., Bose, M., Chakraborty, A., Chakrabarti, S. and Bhattacharyya, S.N. (2013) A transient reversal of miRNA-mediated repression controls macrophage activation. *EMBO Rep*, 14, 1008-1016.

De, D., Datta Chakraborty, P., Mitra, J., Sharma, K., Mandal, S., Das, A., Chakrabarti, S. and Bhattacharyya, D. (2013) Ubiquitin-like protein from human placental extract exhibits collagenase activity. *PLoS One*, 8, e59585.

Academic Activity:

PhD course work classes of Bioinformatics/Computational Biology & Macromolecular Structures course for CSIR-IICB

Pharmacoinformatics practical classes at NIPER-Kolkata

Invited Lectures:

Delivered four (**4**) numbers of invited talks in India

Abstracts Presented:

Number of Abstracts in National Conference: **1**
Number of Abstracts in International Conference: **2**

Human Resource:

Research Fellows: Abhijit Chakraborty , Madhumita Bhattacharyya , Aneesha Das , Anindyajit Banerjee , Sapan Mandloi, Shreemoyee Dutta Majumder , Ishita Mukherjee,
Project Assistants: Tanmayee Rath , Arghya Adhya

Dr. Nakul C. Maiti
Structural Biology and Bioinformatics Division

Intrinsically Disordered Human Proteins: Their function and link to amyloid disease formation

Formation of amyloid fibrils from proteins which is soluble in their native state involves several intermediates and the mechanistic detail of the process is still very obscure. It has been, however, observed that to nucleate the amyloid fibril formation partial unfolding of globular proteins or some structural order for disordered protein is desirable. These make overall physicochemical properties, such as hydrophobicity, PI, charge and other, of a protein very important factors, apart from amyloidgenic region which is a stretch of amino acid residues in a protein sequences prone to form amyloid fiber for a protein's solubility, stability and energetic of amyloid fiber. Based on sequence analysis we presented statistical comparison and distribution pattern of isoelectric point (pI), hydrophobicity, aliphatic index (AI) and instability index (II) of amyloidogenic and non-amyloidogenic proteins present in human proteome. We further determined the structural propensity of sequences present in intrinsically disordered proteins, amyloidogenic region and low complexity regions.

Experimentally we showed that AdK, which has an inherent tendency to form inactive soluble aggregates, could be disaggregated by cyclophilinderived from L. donovani (LdCyP) in an isomerase- independent fashion, resulting in reactivation. Also examined the chaperon action of cyclophilin on insulin fibrilization and disaggregation

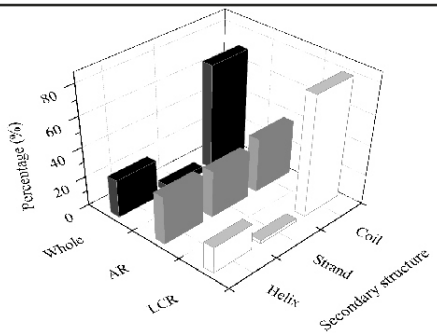
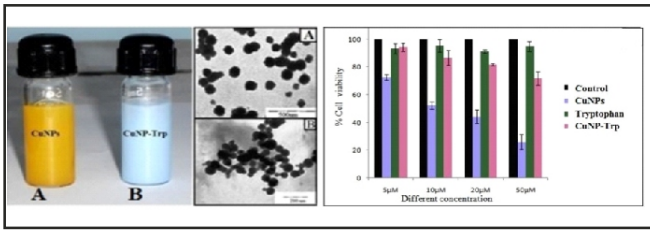


Fig.1 Structural propensity of sequences present in intrinsically disordered proteins (whole), amyloidogenic region (AR) and low complexity regions (LCR).

Bio-nanomaterials

We further established and described an easy synthesis of spheroidal cuprous oxide nanoparticles (CuNPs) and their organic conjugate with L-tryptophan using surfactant, sodium dodecyl sulphate as a capping reagent.



Color photograph of aqueous suspension of CuNPs and its conjugate with L-tryptophan under room light (left). TEM images of CuNPs (A) and its conjugate, CuNP-Trp (B) (middle). Cytotoxicity study of CuNPs and its conjugate on **HEP G2** cell line. Cells were treated with the CuNPs for 24 hours (right).

Publication Details:

Pal, U.; Sen, S.; Maiti, N.C. Cα-H Carries Information of Hydrogen Bond Involving Geminal Hydroxyl Group: A Case Study With Hydrogen Bonded Complex of HFIP and Tertiary Amines. *J. Phy. Chem. A.* 2014, 118(6), 1024-1030

Das, S.; Pal, U.; Das, S.; Bagga, K.; Roy, A.; Mrigwani, A.; Maiti, N.C. Sequence Complexity of Amyloidogenic Regions in Intrinsically Disordered Human Proteins. *PLOS ONE (Accepted)*, 2014

Sen, S.; Pal, U.; Maiti, N.C., pK_a Determination of D-Ribose by Raman Spectroscopy, *J. Phys. Chem. B.* 2014, 118(4), 909-914

Das, S.; Pal, U.; Das, S.; Maiti, N.C., Chaperone action of cyclophilin on lysozyme and its aggregate *J. Proeins Proteomics* 2013, 4 (2), 129.

Maity, M; Pramanik, SK; Pal, U; Banerji, B; and Maiti, N.C., Copper(I) oxide nanoparticle and tryptophan as its biological conjugate: a modulation of cytotoxic effects, *J. Nanopart. Res.* 2014, 16:2179

Chattopadhyay, P; Bhattacherjee, D; Ghorai, A; Pal, U; Maiti, N.C., Stereoselective Domino Azidation and (3+2) Cycloaddition: A Facile Route To Chiral Heterocyclic Scaffolds From Carbohydrate Derived Synthons; *RSC Adv.* 2013 (accepted)

Mukherjee, D ; Patra, H ; Laskar, A ; Dasgupta, A ; Maiti, N.C. and Datta, AK Cyclophilin-mediated reactivation pathway of inactive adenosine kinase aggregates, *Arch. Biochem. Biophys.* 2013, 537, 82-90

Bhowmik, A.; Das, N.; Pal, U.; Mandal, M.; Bhattacharya, S.; Sarkar, M.; Jaisankar, P.; Maiti, N. C.; Ghosh, M. K. 7. 2,29-Diphenyl-3,39-Diindolylmethane: A Potent Compound Induces Apoptosis in Breast Cancer Cells by Inhibiting EGFR Pathway, *PLOS ONE,* 2013, 8, e59798,

Banerji, B,; Pramanik, S. K,; Pal, U.; Maiti, N. C.; Potent Anticancer Activity of Cystinebased Dipeptides and Their Interaction with Serum Albumins, *Chem. Cent. J.* 2013, 7:91

Rudra, D. S.; Pal, U.; Maiti, N. C.; Jeiter, R. J.; Swarnakar, S. Melatonin inhibits matrix metalloproteinase-9 activity by binding to its active site *J. Pineal Res.; 54:398405*

Banerji, B,; Pramanik, S. K,; Pal, U.; Maiti, N. C.; and Chaudhuri, K.; Dipeptide derived from benzylcystine forms unbranched nanotubes in aqueous solution , *Journal of Nanostructure in Chemistry 2013, 3:12*.

Invited Lectures:

Delivered **3** invited talks in India

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Refresher course in chemistry with emphasis on education and research for college and university lectures, University of Calcutta

Abstracts Presented:

Number of Abstracts in National Conference: **7**
Number of Abstracts in International Conference: **2**

Human Resource:

Research Fellow(s): Swagata Das, Uttam Das, Mritunjoy Maiti, Supriya Das, Anupam Roy, Sudeshna Sen
Summer Trainee(s): Arpita Mrigwani, Joyita Bhattacharya, Baisali Bhattacharya, Paramita Chakraborty , Mangaldeep Kundu
Senior Project Fellow: Sandip Dolui, Biswajit Chakraborty

Dr. Sujoy Mukherjee
Structural Biology and Bioinformatics Division

Role of backbone conformational flexibility in amyloid formation of transthyretin

Transthyretin (TTR) is a thyroxine transporter protein that is responsible for neuropathy, cardiomyopathy, ocular and other forms of amyloidosis. Biophysical characterization of wild type and mutant TTR reveals that protein aggregation is mediated through a transiently formed non-native intermediate state that is formed at low population. Although conformational dynamics has been indicated to be a key factor facilitating protein aggregation, its role is unclear. We have investigated the backbone dynamics of TTR using solution NMR and combined them with molecular dynamics (MD) simulations to gain insights into the process of protein aggregation. Results of backbone ^{15}N spin relaxation measurements, followed by estimation of dynamic order parameters (S^2) suggests that dynamic residues exhibiting picoseconds to nanoseconds scale fluctuations reside in the unstructured regions in TTR's periphery while the hydrophobic core is rigid and is in agreement with extensive (~1 μs) MD simulations. We also probed the existence of slower (~ms) motions using relaxation dispersion NMR and found that the dynamic residues are predominantly located in the β-strands of TTR's hydrophobic core, unlike the fast time scale fluctuations mentioned above. Our results also show that ~10% of the native TTR exists in chemical exchange with a minor conformer, which can be an intermediate of protein aggregation.

Invited Lectures:

Delivered **2 (two)** numbers of invited talks in India

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata

Abstracts Presented:
Number of Abstracts in National Conference: **2**

Human Resource:
Research Fellows: Gopa Mahesh, Jitendra K Das, Juhi A Rasquinha, Shyam S Mall, Aritra Bej
Project Assistant: Soumyadeep Chatterjee
Summer Trainee: Arka Pal

Dr. Sucheta Tripathy
Structural Biology and Bioinformatics division

Deciphering the code of life of Gut commensal bacteria Lactobacillus casei strain Lbs2

Lactobacillus casei constitutes one of the most popularly used probiotic strains marketed throughout the world, e.g., *L. casei* Shiorta (Yakult Honsha, Japan) and *L. casei* Immunitas (Actimel). Although complete *L. casei* genome sequences (NC_008526.1, NC_014334.1, NC_010999.1, NC_017474.1, NC_017473.1, NC_018641.1, NC_021721) are available and genome analysis describes its symbiotic mechanisms, information is still lacking on immunomodulatory molecules of *L. casei* . We are reporting genome sequences of a novel strain Lbs2, which is an indigenous isolate of healthy Indian gut - identified by 16S rRNA sequencing (KM203837) and available at the probiotic repository established at Molecular Biology Unit, NDRI, Karnal (India). The strain possesses probiotic attributes, such as acid and bile tolerance, hydrophobicity, auto and co-aggregation properties. Intragastric administration of Lbs2 to mice induced strong regulatory response with the generation of $CD103^{+}$ DCs and $FoxP3^{+}$ Treg cells in the mesenteric lymph nodes and intestinal lamina propria. we analysed proteins secreted in culture supernatant of Lbs2 through SDS-PAGE coupled with MALDI-TOF/TOF Mass Spectrometer. MASCOT search revealed high-confidence. The final annotation has about Final annotated assembly has about 2894 structural genes, 2453 CDSs, 402 pseudogenes, 8 rRNAs, 29 tRNAs and 2 ncRNA. (Bhowmik S., et al. (2014) Draft Genome sequence of Lactobacillus casei Lbs2. Genome Announcement [In press]

Publication Details:
Jiang RH, et al., Distinctive expansion of potential virulence genes in the genome of the oomycete fish pathogen Saprolegnia parasitica. PLoS Genet. 2013 Jun;9(6):e1003272

Invited Lectures:
Delivered 2 numbers of lecture in India and 1 invited lecture in USA which is shown below:

Topic: EuMicrobeDB-M: A light weight Oomycete Genome Database based on Mysql with C++ API
Venue: Asilomar, CA USA
Date: April 2013

Session Chaired:

1. Oomycetes Molecular Genetics Network meeting in Asilomar, CA, USA, April, 2013.
2. Delivered key note address and chaired session at IFGTB Coimbatore, September, 2013.

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata and NIPER, Kolkata.

Deputation Abroad:

OMGN meeting Asilomar, CA, USA, April 2013
Genome Informatics meeting 30th Oct 2 nd November 2013, Cold Spring Harbour, USA.
Gene Building Workshop, Cold spring harbor, 29th October 30 October, 2013, USA.

Human Resource:

Research Fellow(s): Lubna Sheikh, Subhadeep Das, Mathu Malar C, Arijit Panda
Research Associate(s): Swati Bhowmik
Project Assistant(s): Deeksha Singh, Arpita Ghorai
Summer Trainee(s): Neha Varshney, Anindya Haldar, Vikas Ranjan

Dr. Siddhartha Roy (Jr.)
Structural Biology & Bioinformatics Division

Structural characterization of histone interacting proteins from *Plasmodium falciparum*

Plasmodium is a parasitic protozoan that has significant medical importance being the causative agent for malaria. This organism is found predominantly in the tropical and sub-tropical regions of the world and around half of world's population is at risk of malaria. Digenetic lifestyle of Plasmodium, require a rapid adaptation to different environmental conditions, and hence the chromatin of these organism is comparatively loosely packaged. Chromatin structure of this microorganism is an area of extensive research as new therapeutics can be designed. Histone chaperones are important class of proteins involved in dynamic chromatin assembly/disassembly. Histone chaperones coordinate the assembly of distinct chromatin complexes correlated with different DNA regulatory processes. From Genomic annotations of Plasmodium several homologous proteins have been identified. We have started cloning, expression and purification of some of the major histone chaperone family members.

Publication Details:

Das C, **Roy S**, Namjoshi S, Malarkey CS, Jones DN, Kutateladze TG, Churchill ME, Tyler JK(2014). Binding of the histone chaperone ASF1 to the CBP bromodomain promotes histone acetylation. Proc Natl Acad Sci U S A. 111(12):E1072-81.

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

Honors & Awards:

Ramanujan Fellowship from DST, Govt. of India (2013)

Human Resource:

Research Fellow(s): Dushyant Kr. Srivastava, Anirban Dasgupta , Sambit Dalui
Project Assistant(s): Shantanu Adhikary

Prof. Siddhartha Roy
Structural Biology and Bioinformatics division

Indirect read-out of the promoter DNA by RNA polymerase in the closed complex

Transcription is initiated when RNA polymerase recognizes the duplex promoter DNA in the closed complex. Due to its transient nature, the closed complex has not been well characterized. How the initial promoter recognition occurs may offer important clues to regulation of transcription initiation. In our laboratory we have carried out single-base pair substitution experiments on two *Escherichia coli* promoters belonging to two different classes, the −35 and the extended −10, under conditions which stabilize the closed complex. Single-base pair substitution experiments indicate modest base-specific effects on the stability of the closed complex of both promoters. Mutations of base pairs in the −10 region affect the closed complexes of two promoters differently, suggesting different modes of interaction of the RNA polymerase and the promoter in the two closed complexes. Two residues on σ^{70} which have been suggested to play important role in promoter recognition, Q437 and R436, were mutated and found to have different effects on the closed-complex stability. DNA circular

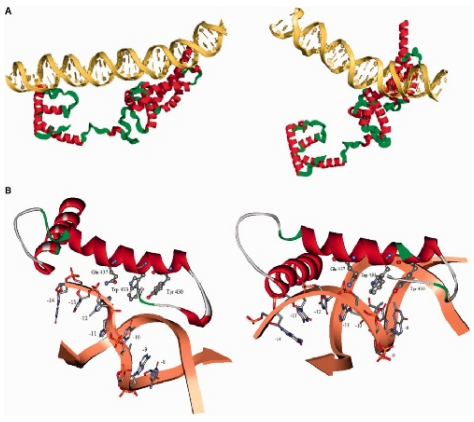


Figure: Docking of interacting part of σ^{70} to the λ-PR promoter (left) and the galP1 promoter (right).

dichroism (CD) and FRET suggest that the promoter DNA in the closed complex is distorted. Modeling suggests two different orientations of the recognition helix of the RNA polymerase in the closed complex (*NUCLEIC ACIDS RESEARCH, 2013, **41**(1):366-377*). We propose that the RNA polymerase recognizes the sequence dependent conformation of the promoter DNA in the closed complex.

Publication Details:

Debnath S., Roy N.S., Bera I. Ghoshal N., Roy S. 2013. Indirect read-out of the promoter DNA by RNA polymerase in the closed complex. NUCLEIC ACIDS RESEARCH, 41(1) : 366-377.

Kundu T.K., Jaisankar P., Roy S. 2013. International Symposium on Challenges in Chemical Biology : Toward the Formation of Chemical Biology Society of India. ACS CHEMICAL BIOLOGY, 8(4) : 658-661.

Manna A.K., Kumar A. Ray U., Das S., Basu G., Roy S. 2013. A cyclic peptide mimic of an RNA recognition motif of human La protein is a potent inhibitor of hepatitis C virus. ANTIVIRAL RESEARCH, 97(3) : 223-226.

Roy A., Chakraborty P., Polley S., Chattopadhyay D., Roy S. 2013. A peptide targeted against phosphoprotein and leader RNA interaction inhibits growth of Chandipura virus - An emerging rhabdovirus. ANTIVIRAL RESEARCH, 100 : 346-355

Sharma S., Sarkar S., Paul S. S., Roy S., Chattopadhyay K. 2013. A small molecule chemical chaperone optimizes its unfolded state contraction and denaturant like properties. SCIENTIFIC REPORTS, 3: 3525.

Kumar A., Manna A. K ., Ray U., Mullick R ., Basu G ., Das S., Roy S. 2014. Specific Sequence of a Beta Turn in Human La Protein May Contribute to Species Specificity of Hepatitis C Virus. JOURNAL OF VIROLOGY, 88: 4319-4327

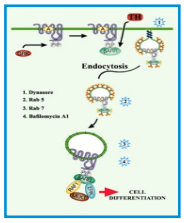
Chakraborty A., Mukherjee S., Chattopadhyay R., Roy S., Chakrabarti S . 2014. Conformational Adaptation in the *E. coli* Sigma 32 Protein in Response to Heat Shock , *J. Phys. Chem. B,118:*47934802

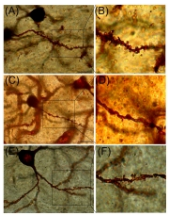
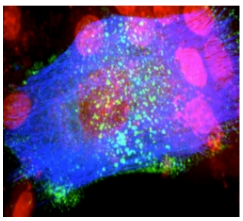
Balganesh T., Kundu T.K., Chakraborty T.K., Roy S. 2014. Drug Discovery Research in India: Current State and Future Prospects. ACS MEDICINAL CHEMISTRY LETTERS, 5: 724-726

Roy S., Kundu T. K. 2014. Gene regulatory networks and epigenetic modifications in cell differentiation. IUBMB LIFE , 66 : 100-109

Students Awarded PhD:
Neeladri Sekhar Roy, CU

Human Resource
Technical/Administratice Staff(s): Mohanlal Jana, Jishu Mandal,
Research Fellow(s): Gitashri Naiya, Prosenjit Chakrabotry, Basushree Ghosh, Priya Mondal,
Research Associate(s): Dr. Madhumita Chakraborty, Dr. Raka Ghosh
Pool Officer(s): Dr. Shampa Mallick,
Project Assistant(s): Piya Ghosh,



CB&P

Cell Biology And Physiology Division

Drs. K.P. Mohanakumar, Sumantra Das (Head), Syed N. Kabir, Arun Bandopadhyay, Sib Sankar Roy, Sandhya R. Dungdung, Tushar Chakraborty, Subhas C Biswas, Rupasri Ain, Partha Chakrabarti

This division boasts of scientists with varied interests in the various pathophysiology of disease states and employ cellular and animal models for understanding the mechanisms thereof. Neurodegenerative diseases, cardiac hypertrophy, obesity, diabetes, drug addiction, uteroovarian dysfunction, ovarian development, developmental neurobiology, placental morphogenesis, sperm motility are the major areas of interest for the group. A number of intra- and inter-institutional collaborative programs are being undertaken for this purpose, with much success. The details of work carried out by individual laboratories of the division are detailed below. Many of the members of the division actively participate in postgraduate teaching at various Universities in addition to mentoring PhD students and summer trainees. Regular biweekly journal clubs are organized, which are enthusiastically attended by both students and faculty. These seminars cover the latest developments in the field, and are given generally by the graduate students in the Division. The Division also conducts regular workshops and symposia in the area of cellular physiology. The recently held APSN School, Kolkata 2013 on “Glia in neuronal health and disease” held on January 27-31 is one such noteworthy international event under the aegis of Asia-Pacific Society for Neurochemistry and funded generously by the International Society for Neurochemistry.

Dr. Kochupurackal P. Mohanakumar
Cell Biology and Physiology Division

Neurodegenerative diseases (NDD) treatment strategies that use non-canonical pathways:

The neurohormone, melatonin is demonstrated to effectively repair post-synaptic medium spiny GABA-ergic neuronal dendritic spines in the striatum to provide relief to mice from parkinsonian syndromes and pathology (Fig. 1). This curative effect of melatonin is demonstrated in another NDD, Huntington's disease (HD) where behavioral recovery is demonstrated following dendritic spine repair (Fig. 2) unequivocally establishing melatonin's therapeutic potency (Naskar et al., 2013).

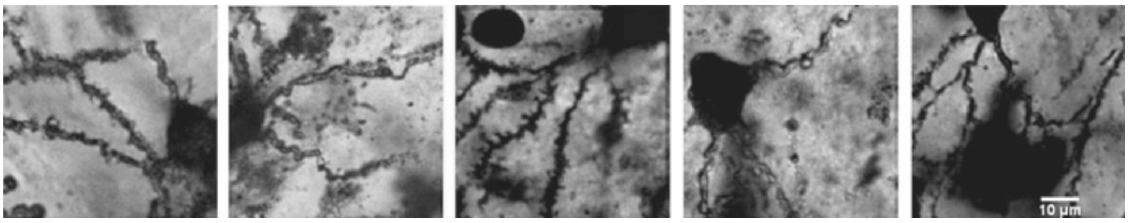


Fig. 1. MPTP and/or L-DOPA-induced loss of dendritic spines of medium spiny neurons of the striatum in is repaired by melatonin: Low magnification (60 X, phase-contrast imaging with z-stacking) images of medium spiny neurons in the striatum of control (A), MPTP treated (B), melatonin and MPTP treated (C), MPTP and L-DOPA treated (D) and MPTP-, L-DOPA- and melatonin-treated (E) mice. The control, melatonin, and MPTP-treated, as well as the MPTP + melatonin + L-DOPA-treated medium spiny neurons bear normal spines, whereas MPTP treated and MPTP+L-DOPA treated striatal medium spiny neurons bear spines with beaded appearance

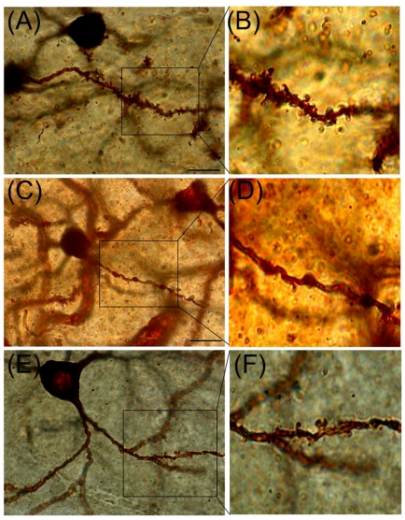


Fig. 2. Melatonin treatment attenuated striatal spine loss in 3-nitropropionic acid-induced HD: Animals were sacrificed on the 5th day and striatal tissue was processed for Golgi staining. (A) and (B) show the dendritic spines of striatal neuron in control animals. (C) and (D) show the loss in spines in 3-NP treated striatum. (E) and (F) show the retention of spines after 10 mg/kg melatonin treatment. Scale bar is 20 µm.

Differentiated embryonic stem cells' (ESC) transplantation cures behavioral recovery in PD experimental model:

In hemiparkinsonian rats, carefully standardized differentiated ESC neurons provided protection against behavioral recovery, following about four-fold upregulation of glial derived neurotrophic factor in the ipsilateral striatum, as a result of astrocytosis around the striatal graft. This led to the protection of dopaminergic neurons in substantia nigra pars compacta (SNpc) ipsilateral to the side of neuronal lesion (Fig. 3) (Chakraborty et al., 2014).

Differentiated cybrids retain pathological characteristics of undifferentiated PD cybrids: The laboratory had created mitochondria-less neuronal cell lines (0 cells), and introduction of PD mitochondria into 0 cells helped to produce PD cybrids with parkinsonian mitochondrial defects. We demonstrated that differentiated neurons from the cybrids retain all the pathological defects native to PD platelets, and therefore these differentiated PD cybrids-neurons could be effectively used in drug screening against PD drugs (Tripathy et al., 2013).

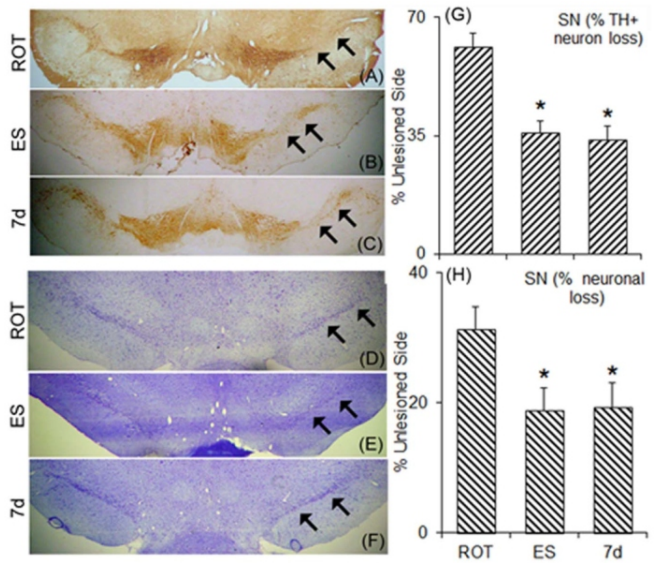


Fig. 3. Neuroprotection following striatal transplantation of differentiated ESC. Neurons in SNpc of the animals that received unilaterally grafts in the ipsilateral striatum. Sections passing through the SNpc were cut and immunostained for tyrosine hydroxylase (arrows; ipsilateral SNpc) (AC) or stained for neurons with cresyl violet (DF). The sections passing through nigral region of the midbrain of rats that received the vehicle, without cells (A, D), undifferentiated embryonic stem cells (ES; B,E) or 7 days differentiated ES (7 d; C,F). There appeared a significant percentage of improvement in the total number of neurons in the ipsilateral SNpc relative to the contralateral side (G), and in TH-positive dopaminergic neurons (H). Results are presented as Mean 6 SEM. *p≤ 0.05, as compared to control or ES transplanted group. Sections from 3 different brain samples were considered for each group.

Publication Details:

Naskar A, Manivasagam T, Chakraborty J, Singh R, Thomas B, Dhanasekaran M, Mohanakumar KP (2013).Melatonin synergizes with low doses of L-DOPA to improve dendritic spine density in the mouse striatum in experimental Parkinsonism. *J. Pineal Res.* 55, 304-312.

Appukuttan TA, Ali N, Varghese M, Singh A, Tripathy D, Padmakumar M, Gangopadhyay PK, Mohanakumar KP (2013). Parkinson's disease cybrids, differentiated or undifferentiated, maintain morphological and biochemical phenotypes different from those of control cybrids. *J. Neurosci. Res.* 91, 963-970.

Tripathy D, Haobam R, Nair R, Mohanakumar KP (2013). Engraftment of mouse embryonic stem cells differentiated by default leads to neuroprotection, behaviour revival and astrogliosis in parkinsonian rats. PloS One. 8(9), e72501.

Borah A, Paul R, Choudhury S, Choudhury A, Bhuyan B, Das Talukdar A, Dutta Choudhury M, Mohanakumar KP (2013). Neuroprotective potential of silymarin against CNS disorders: insight into the pathways and molecular mechanisms of action. *CNS Neurosci. Ther.* 19, 847-853.

Chakraborty J, Singh R, Dutta D, Naskar A, Rajamma U, Mohanakumar KP (2014). Quercetin improves behavioral deficiencies, restores astrocytes and microglia, and reduces serotonin metabolism in 3-nitropropionic acid-induced rat model of Huntington's Disease. *CNS Neurosci. Ther.* 20, 10-19.

Verma D, Chakraborti B, Karmakar A, Bandyopadhyay T, Singh AS, Sinha S, Chatterjee A, Ghosh S, Mohanakumar KP, Mukhopadhyay K, Rajamma U (2014). Sexual dimorphic effect in the genetic association of monoamine oxidase A (MAOA) markers with autism spectrum disorder. *Prog. Neuropsychopharmacol. Biol. Psychiatry* 50,11-20.

Chakraborty J, Nthenge-Ngumbau DN, Rajamma U, Mohanakumar KP (2014). Melatonin protects against behavioural dysfunctions and dendritic spine damage in 3-nitropropionic acid-induced rat model of Huntington's disease. *Behav. Brain Res.* 264, 91-104.

Karmakar A, Maitra S, Verma D, Chakraborti B, Goswami R, Ghosh P, Sinha S, Mohanakumar KP, Usha R, Mukhopadhyay K (2014). Potential contribution of monoamine oxidase a gene variants in ADHD and behavioral co-morbidities: scenario in eastern Indian probands. *Neurochem. Res.* 39, 843-852.

Chakraborty J, Rajamma U, Mohanakumar KP (2014). A mitochondrial basis for Huntington's disease: therapeutic prospects. *Mol. Cell. Biochem.* 389, 277-291.

Invited Lectures:

Delivered **10** numbers of invited talks in India

Session Chaired:

Chaired a session in the International Neuroscience Conference, Ravenshaw University, Cuttack, Orissa on November 10, 2013.

Chaired a session in the NeuroUpdate-2013, IACS Auditorium, Kolkata on November 30, 2013.

Chaired a session in the Amrita BioQuest 2013: International meeting on Biotechnology innovative applications, Amrita University, Kerala on August 13, 2013

Chaired a session in the One day workshop on "Role of CPCSEA in animal welfare", held at West Bengal University of Animal & Fishery Sciences, Beliaghata, Kolkata on August 2, 2013.

Academic Performance:

- Examined the PhD thesis entitled "Modulatory role of amygdala on hippocampal and frontal cortical functions in stress" by Mr. Christofer Thomas, NIMHANS, Deemed University, Bengaluru, India.
- Examined the PhD thesis entitled "Neurosupportive role of hesperidin against rotenone and 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine induced cellular and mice model of Parkinson's disease" and conducted the *viva voce* examination of Mr. K. Tamilselvam, submitted to Biochemistry & Biotechnology, Annamalai University, Annamalai Nagar, Tamil Nadu.
- Examined the PhD thesis entitled "Glutamatergic NMDA and AMPA Receptors Functional Regulation in Streptozotocin-Induced Diabetic Rats: Effect of Vitamin D_3 and Curcumin Supplementation" of Mr. Jayanarayanan S, submitted to Department of Biotechnology, Cochin University of Science and Technology, Cochin
- Examined the PhD thesis entitled "Biochemical and histopathological study of Duchenne Muscular Dystrophy (DMD) and related neuromuscular disorders" and conducted the *viva voce* examination of Ms. Renjini R National Institute of Mental Health & Neurosciences, Bangalore.
- Examined the PhD thesis entitled "GABA and 5-HT chitosan nanoparticles enhanced liver cell proliferation and neuronal survival in partially hepatectomised rats: $GABA_B$ and $5\text{-}HT_{2A}$ receptors functional regulation" Ms. Shilpa Joy Cochin University of Science and Technology, Cochin
- Examined the PhD thesis entitled "Disposition kinetics and efficacy of intravenous ceftriaxone with adjunct therapy of some orally administered medicinal plant parts in induced chronic mastitis in goats" Mr. Jeevan Ranjan Dash, Veterinary Pharmacology & Toxicology West Bengal University of Animals & Fishery Sciences, Kolkata.
- Mentoring Committee (PhD) member of SRM University, Chennai, Thiruvananthapuram
- PhD mentoring Committee member of Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram.
- Supervised the PhD thesis work of Ms. Debasmita Tripathy, who submitted a thesis entitled "Transplantation studies in animal model of Parkinson's disease" to Jadavpur University, Faculty of Science; October, 2013.
- Supervised the PhD thesis work of Mr. Joy Chakraborty, who submitted a thesis entitled "Mutant huntingtin gene expression and cell death: A mitochondrial basis for Huntington's disease" to Jadavpur University, Faculty of Science, February, 2014.

Deputation Abroad:
International Society for Neurochemistry (ISN) Biennial Meeting, and ISN Council meeting, Cancun, Mexico. April 20-25, 2013.

Abstracts Presented:
Number of Abstracts in National Conference: **6**
Number of Abstracts in International Conference: **4**

Conference/Workshop/Symposia Organized:
Chief Advisor of Asia Pacific Society for Neurochemistry (APSN)-International Society for Neurochemistry (ISN) Neuroscience School entitled "Glia in neuronal health and disease". A hands-on workshop for graduate students (21 students) from Asia-Pacific region, conducted in CSIR-IICB; 27-30 Jan 2014.

Organizing Chairman of NeuroUpdate-2013, a National symposium of neurologists and neurobiologists held in IICB in collaboration with Calcutta National Medical College, Kolkata.

Chief advisor of one-day ISN funded International Symposium on "Neurochemistry of Ageing Brain" on Jan 31, 2014 at CSIR-IICB.

Honors & Awards:
Fellow of National Academy of Medical Sciences, by *National Academy of Medical Sciences*, Recognition of the outstanding contribution to medical science
NIH, USA Project Review Committee member for RFA-TR-13-002 on Rare Diseases Clinical Consortia
Appointed Editor of a Special Issue Nitric Oxide: Biology & Chemistry, Elsevier: Special issue on "Legacy of Nirtic Oxide: Impact on Disease Biology" (Eds): P Srinivas, D Wink; KP Mohanakumar, MR Pillai.
Editorial Board Member of 5 Journals: (i) Neurochemistry International (Elsevier), (ii) Neurochemical Research (Springer Verlag), (iii) Anatomy & Cell Biology (Korean Academy of Anatomists), (iv) Neuroscience & Medicine (Scientific Research Publishers, Germany), (v) Journal of Cell and Tissue Research (CTR Publishers, India).
Globally Elected Council Member of International Society for Neurochemistry (ISN)
DBT Neuroscience Taskforce member
Selection Committee Member of Academies' Graduate Fellowships for Students and Faculty in Biological Discipline

Human Resource:
Technical/Administrative Staff(s): Mr. Debdas Guhathakurta

Research Fellow(s): Ms. Debasmita Tripathy, Mr. Joy Chakraborty, Mr. Amit Sarkar, Mr. Raghavendra Singh, Mr. Debashis Dutta, Ms. Nilufar Ali, Ms. Poonam Verma, Ms. Alpana

Singh, Mr. Nthenge Dominic Ngumbau Ngima, Ms. Anu Raju, Ms. Meghna Banerjee, Mr. Paidi Ramesh Kumar.

Research Associate(s): Dr. Emili Banerjee
Project Assistant(s): Mr. Abhshesk Karmakar
Summer Trainee(s): Ms. Meghna Banerjee, Mr. Paidi Ramesh Kumar, Mr. Sanjeev Kumar Baraiya, Mr. D V Krishna Reddy, Ms. Tiyash Parira, Ms. Trishita Basak, Ms. Resiya Beegam S.

Dr. Sumantra Das
Cell Biology and Physiology Division

Treatment and understanding of addiction

Morphine action on the post-translated forms of neurofilaments (NFs) in cortex and mid brain during abstinence:

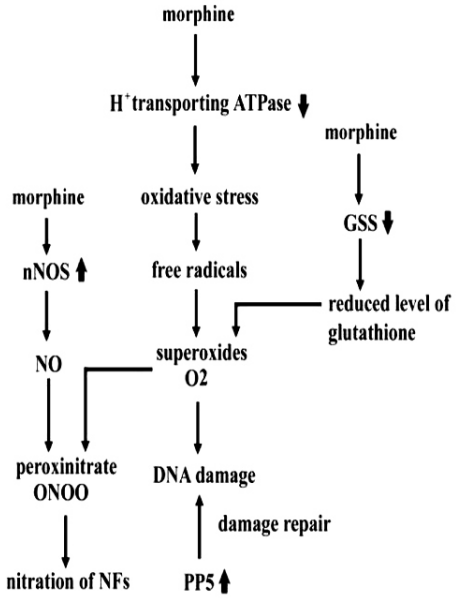
Studies were undertaken to understand the fate of NFs during morphine abstinence coinciding with periods of relapse in mice model. A long-lasting alteration in the stoichiometric ratio of the three NFs was observed under both conditions in both cortex and mid brain. Morphine abstinence caused significant alterations in the phosphorylated and nitrated forms of the three NF subunits. Nitrated neurofilament light chain (NFL) was significantly increased during chronic morphine treatment which persisted even after two months of morphine withdrawal. Mass spectrometric analysis following 2DE-gel electrophoresis of cytoskeleton fractions of both cortex and midbrain regions identified enzymes associated with energy metabolism, cytoskeleton associated proteins as well as neurofilaments which showed sustained regulation even after abstinence of morphine for two months. It is suggestive that alteration in the levels of some of these proteins may be instrumental in the increased nitration of NFL during morphine exposure. Such gross alteration in NF dynamics is indicative of a concerted biological process of neuroadaptation during morphine abstinence.

Schematic model on possible mechanism of morphine induced oxidative stress leading to nitration of NFs. Downregulation of glutathione synthase (GSS) and H+ transporting ATPase by morphine enhance superoxide production and subsequent DNA damage. The superoxides produced can react with nitric oxide, known to be induced by morphine through upregulation of nNOS, to form peroxinitrate, thereby enhancing nitration of NFs.

Genetic epidemiology:

This study is part of our ongoing collaborative projects with a psychiatric clinic, Baulmon, Kolkata as well as Chittaranjan National

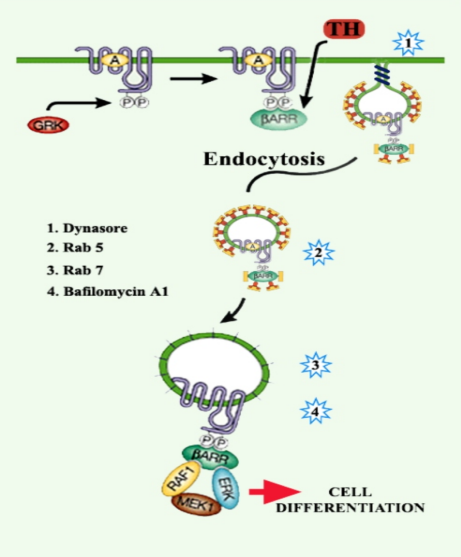
Medical College, Kolkata. Genetic epidemiological studies on opioid addiction are being carried out to identify the possible association of specific single nucleotide polymorphisms (SNP) of candidate genes in addiction using PCR based RFLP as well as DNA sequencing analysis. Nitric oxide synthase (NOS), the constitutive, Ca^{2+}-calmodulin-dependent form of NOS that is found in the brain is hypothesized to be involved in the centrally mediated properties of nitric oxide like memory formation, response to stroke and development of tolerance or sensitization to drugs of abuse. A study is presently underway to identify the SNPs at selective areas of NOS gene in heroin as well as in alcohol addicts and to compare them with that in the control population.



Mechanism of action of thyroid hormones in astrocyte differentiation

During development, astrocytes undergo progressive changes in morphology under the influence of TH. We have previously observed that the beta adrenergic receptor (β-AR) system acts downstream of TH-induced differentiation and maturation of astrocytes, the underlying mechanisms of which are poorly understood. We have further explored the

effect of TH on β-AR signaling during this differentiation process. Unlike β1-AR, β2-AR levels in cell membranes was significantly decreased at 2 h of exposure to TH which came back to control values after 24 h. Distribution of β2-AR levels in the cytosol, suggest that TH may induce endocytosis of the receptor. qRT-PCR as well as western blot analysis demonstrated that unlike β-ARK1 and β-ARK2, the mRNA levels of β-arrestin-1 as well as the active β-arrestin-1 level increased in the early phase of TH exposure. siRNA mediated β-arrestin gene knockdown study suggested requirement of both β-arrestin-1 and β-arrestin-



2 isoforms for endocytosis of receptor. These and further studies suggest that TH transcriptionally upregulate β-arrestin-1 for facilitating endocytosis of β2-AR which may influence endosomal signaling required to drive the differentiation of astrocytes.

Publication details:

Gharami K and Das S. (2014) BDNF local translation in viable synaptosomes: Implication in spine maturation. *Neurochem Int.* 69, 28-34.

Pal A, Chakraborty J and Das S. (2014) Association of CREB1 gene polymorphism with drug seeking behaviour in eastern Indian addicts. *Neurosci. Lett.* 570, 53-57.

Academic Performance:

Delivered a course of lectures on Neurobiology as part of curriculum (Special paper) for second year M. Sc. students of the Department of Biochemistry as well as first year M. Sc. students of the Department of Neuroscience, Calcutta University.
Lecturer and Examiner of NIPER, Kolkata
Supervised the project work of one M. Sc. Student

Human Resource:

Technical/Administrative Staff(s): Mr. P. C. Deuri
Research Fellow(s): Ms. Ayantika Paul, Mr. Tuhin Subhra Banerjee, Ms. Maitreyi Das
Research Associate(s): Dr. Kusumika Gharami

Dr. Syed N. Kabir
Cell Biology and Physiology Division

Post-coital or emergency contraception (EC) is a popular form of birth control option today. We have earlier demonstrated that puerarin counteracts proliferative action of estrogen and disrupts embryo-uterine communication to inhibit implantation in rat. But high effective concentration of puerarin (300 mg/kg/day) was a major limitation. We, therefore, developed poly lactic-co-glycolic acid-puerarin nanoparticles (PNP) and explored its contragestative potential in rats. Oral administration of PNP at 75mg/kg body weight for day 1-2 of pregnancy resulted in complete implantation failure.

To further explore the precise mechanism of PNP action, we checked uterine expression of Indian hedgehog (Ihh), bone morphogenetic protein-2 (BMP2), chicken ovalbumin upstream promoter transcription factor 2 (COUP-TFII) by RT-PCR analysis in D5 pregnant rat. The effect on decidualization process was studied in cultured human endometrial stromal cell lines (hESCs) by directed migration of the cells together with immunofluorescence detection of desmin, extracellular-signal-regulated kinases (ERKs) and pERK. PNP downregulated the migration of decidualized endometrial cells. Disruption of endometrial receptivity was evidenced by attenuated endometrial expression of desmin, ERK and pERK. Gelatin zymography analysis showed that in a pseudopregnant rat model, PNP down regulated the endometrial expression of matrix metalloproteinases 9 (MMP-9) that are characteristically expressed in the d5 uterus during implantation. Central to this array of anti-decidualizing events was the attenuated IhhCOUP-TFIIBMP signaling axis. In conclusion, PNP, by way of its attenuating effect on decidualization process, prevents implantation and therefore may be envisioned as prospective candidate molecules for non-steroidal emergency contraceptive formulation.

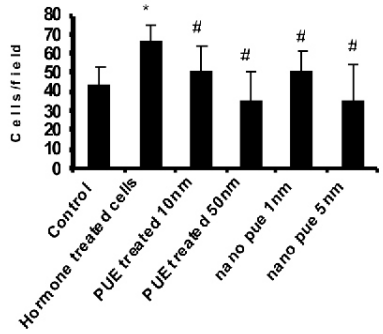


Figure 1. Inhibitory effect of puararin and PNP on the migration of hESCs.

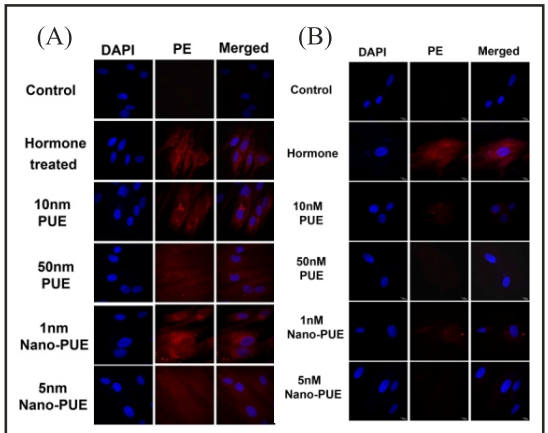


Figure 2. Dose-dependent attenuation of ERK (A) and pERK (B) expression by puerarin (PUE) and nano-PUE

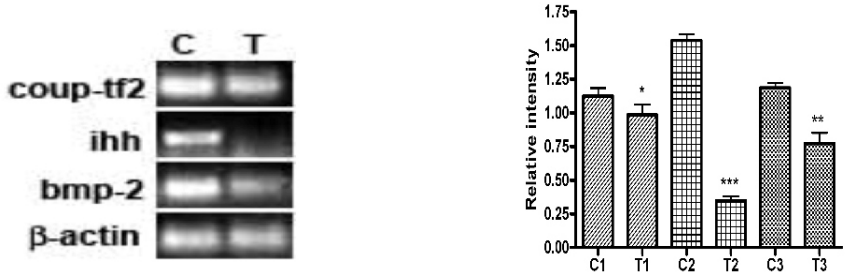


Figure 3. PNP down-regulates uterine expression of coup-tf2, ihh and bmp-2 in D5 pregnant rat.

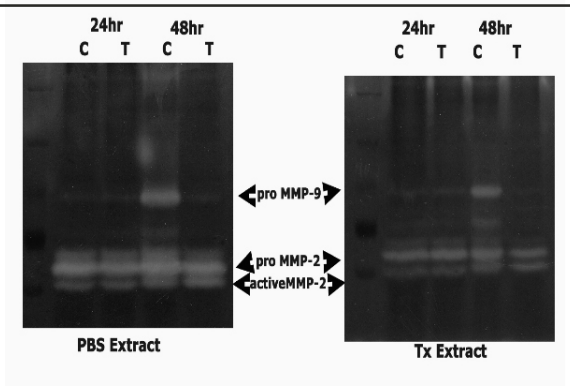


Figure 4. PNP down-regulates endometrial expression of pro-MMP9 in day 5 psuedopregnant rat.

Publication details

Chakraborty P, Saraswat G, Kabir SN (2014). α-Dihydroxychalcone-glycoside (α-DHC) isolated from the heartwood of Pterocarpus marsupium inhibits LPS induced MAPK activation and up regulates HO-1 expression in murine RAW 264.7 macrophage. Toxicol Applied Pharmacol 277, 95107.

Chakraborty P, Banerjee S, Saha P, Nandi SS, Goswami SK, Chakravarty BN, Kabir SN (2013). Aspirin and low-molecular weight heparin combination therapy effectively prevents recurrent miscarriage in hyperhomocysteinemic women. *PLoS ONE, 8:e74155*

Invited lectures

Delivered one number of invited talk in India.

Abstracts Presented

No. of Abstracts presented in National/International Conference: 4
No. of Abstract presented in International (overseas) Conference: 1

Academic Performance

Guest Teacher and Examiner of Calcutta University, Vidyasagar University, Serampore College Member of the Expert committee, M.Sc., Physiology, Rammohan College, Kolkata

Guest Teacher, Examiner, and Member of the Board of Examiners, M. Sc., Physiology, Presidency University

Human Resource:

Technical/Administrative staff: Nita Chakraborty
Womem Scientist: Ms. Prarthana Chatterjee
Research Fellows: Ms. Sayani Banerjee, Ms. Ghungroo Saraswat, Ms. Kalyani Mondal,
Project Assistant: Ms. Tabassum Khanam

Dr. Arun Bandyopadhyay
Cell Biology and Physiology Division

Protective Action of Annexin A6 Against Cardiac Hypertrophy by Mobilizing Intracellular Dynamics of Atrial Natriuretic Peptide

Multiple regulatory pathways control cell size which are prominent in pathological cardiac hypertrophy. Annexin A6 (Anxa6), a members of the Ca^{2+} and phospholipid binding protein family is highly abundant in cardiomyocytes which are known to be altered in cardiac diseases. Here, we show annexin A6 to be a crucial regulator of atrial natriuretic peptide (ANP) mediated counter-hypertrophic responses in cardiomyocytes. Adrenergic stimulation of H9c2 cardiomyocytes by phenylephrine (PE) increased the cell size with enhanced expression of biochemical markers of hypertrophy, concomitant with elevated expression and subcellular redistribution of Anxa6. Stable cell lines with controlled increase in Anxa6 levels were protected against PE induced adverse changes whereas Anxa6 knockdown augmented the hypertrophic responses. Knockdown of Anxa6 also abrogated PE-induced juxta-nuclear accumulation of secretory granules (SG) containing ANP propeptides (proANP), a signature of maladaptive hypertrophy having counteractive functions. Mechanistically, PE treatment prompted a dynamic association of Anxa6 with proANP-SG, parallel to their participation in anterograde traffic. Moreover, Anxa6 mutants that failed to associate with proANP hindered ANP-mediated protection against hypertrophy, which was rescued by WT Anxa6. Additionally, elevated intracellular Ca^{2+} stimulated Anxa6-proANP colocalization and membrane association. It also rescued proANP translocation in cells expressing an Anxa6 mutant (Anxa6 ^{C}). Furthermore, stable overexpression of Anxa6^{T356D}, a mutant with superior flexibility, provided enhanced

protection against PE, compared to WT, presumably due to enhanced membrane-binding capacity. Present study describes a cooperative mechanism where Anxa6 potentiates ANP dependent counter-hypertrophic responses in cardiomyocytes by facilitating regulated traffic of proANP.

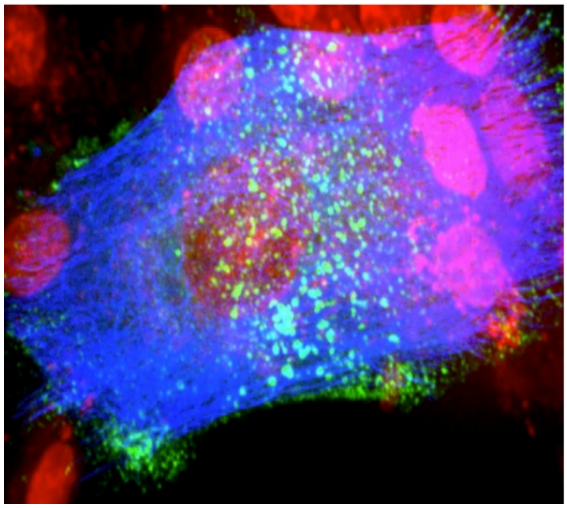


Fig. Movement of Anxa6 clusters resembles anterograde membrane traffic in PE treated cardiomyocytes.

Translocation of multiple Anxa6 clusters in H9c2$^{Anxa6\text{-}EGFP}$ cells after 24 hours of PE treatment was visualized by Andor spinning disc confocal microscope. Pseudocolors: Green represents Anxa6- EGFP; Blue indicates Tubulin-RFP; Red indicates nuclei counterstained with Hoechst 33342.

Publication Details:

Banerjee P and Bandyopadhyay A. (2014) Cytosolic dynamics of annexin A6 triggers feedback regulation of hypertrophy via atrial natriuretic peptide in cardiomyocytes. *J.Biol.Chem*. 289, 5371-5385.

Bhattacharjee P, Paul S, Banerjee M, Patra D, Banerjee P, Ghoshal N, Bandyopadhyay A, Giri AK (2013). Functional compensation of glutathione S-transferase M1 (GSTM1) null by another GST superfamily member, GSTM2. *Sci Rep. (NPG)*. 3:2704 .

Invited Lectures:

Delivered **2 numbers of** invited talks in India & **1 talk** in abroad which is shown below:

Topic: Compensatory roles of annexin A6 in hypertrophied cardiomyocytes

Venue: William Harvey Research Institute, London

Date: September 9, 2013

Session Chaired:
Chaired one scientific session in the 16th All India Congress of Cytology and Genetics and Symposium on "Gene, Environment and Health" which will be held from October 22-24, 2013 at the Department of Botany, University of Kerala, Kariavattom, Trivandrum

Academic Performance:
Acted as Teacher at AcSIR, CSIR-IICB

Deputation Abroad:
7th International conference on Annexin, at William Harvey Research Institute, London, from September 9-11, 2013

Abstracts Presented:
Number of Abstracts in National Conference: **3**
Number of Abstracts in International Conference: **1**

Human Resource:
Technical/Administrative Staff(s): **2**
Research Fellow(s): **6**
Research Associate(s): **1**
Project Assistant(s): **1**
Summer Trainee(s): **1**

Dr. Sibsankar Roy
Cell Biology and Physiology Division

FGF16 promotes invasive behaviour of SKOV-3 ovarian cancer cells:

Several growth factors regulate uncontrolled growth and proliferation by inducing specific signaling pathways. We describe that FGF16, a novel factor, is expressed in human ovary, and its expression is significantly high in ovarian tumors. This finding indicated possible involvement of FGF16 in ovarian cancer progression. Our data suggests that FGF16 stimulates proliferation of human ovarian cancer cells, SKOV-3 and OAW-42. Through the activation of FGF receptor-mediated MAPK pathway, FGF16 regulates the expression of MMP2, MMP9, SNAI1, and CDH1 and thus increases cellular invasion. When we inhibited the FGFR as well as MAPK pathway, the proliferative and invasive behaviour of ovarian cancer cells were observed. Ovarian tumors with up-regulated PITX2 homeodomain transcription factor also showed activation of canonical Wnt pathway that prompted us to investigate possible interaction among FGF16, PITX2, and Wnt pathway. We identified that PITX2 interacts with and regulates the expression of *FGF16*. In addition, activation of

Wnt/b-catenin pathway induces *FGF16 gene*. Moreover, *its* promoter possesses the binding elements of PITX2 and T-cell factor (Wnt-responsive) in close proximity, where PITX2 and b-catenin binds to and synergistically activates it. Our study showed that both PITX2 and T-cell factor elements and the interaction with their binding partners are necessary for FGF16 gene expression (Figure 6 and 7). Therefore, our findings indicate that FGF16 along with Wnt pathway contributes to the cancer phenotype of ovarian cells and suggests that its change in expression in ovarian cells might be a promising therapeutic strategy for the treatment of invasive ovarian cancers (Ref: Basu et al, JBC, 2014).

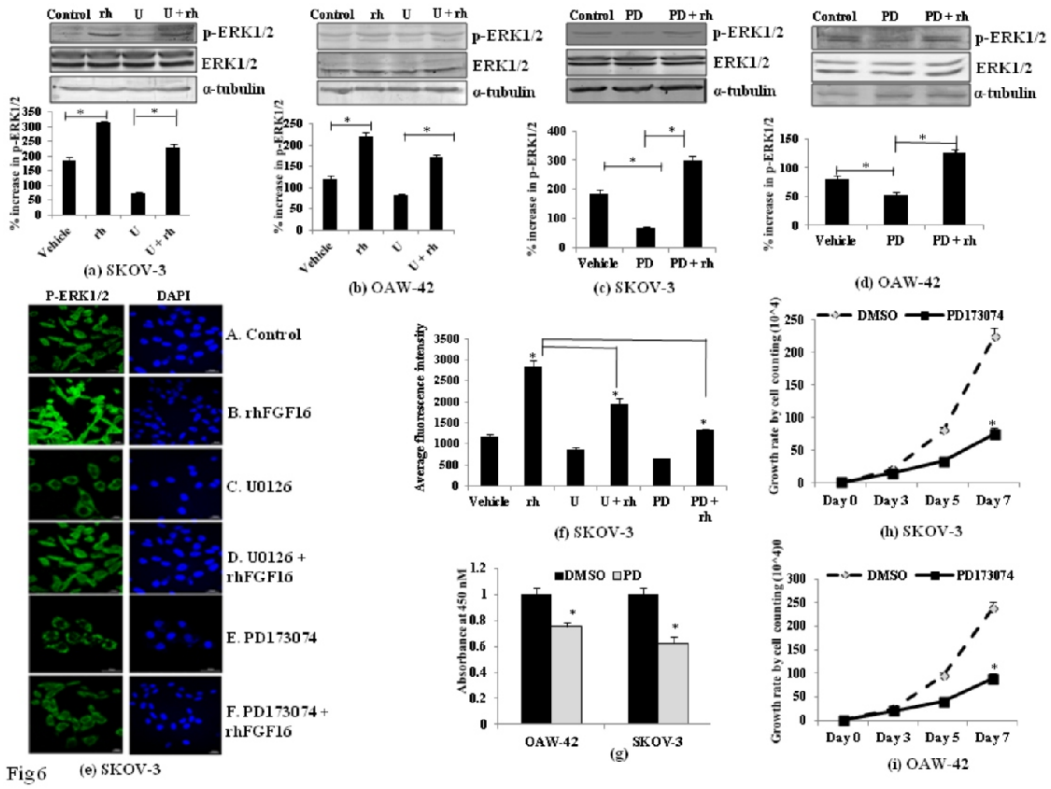


Fig6

Fig 6. FGF16 binds to FGFR and activates ERK1/2 in ovarian cancer cells.Serum-starved SKOV-3 (a) and OAW-42 (b) cells were treated with rhFGF16 (rh; 100 ng/ml) alone, U0126 (U; 50 ng/ml) alone or both followed by immunodetection of p-ERK1/2 and total ERK1/2 in the cell lysate. α-tubulin was used as loading control. The lysates of SKOV-3 (c) and OAW-42 (d) cells treated with DMSO (control), PD173074 (PD, 50 ng/ml) or PD and rhFGF16 were subjected to Western immunoblot with p-ERK1/2, ERK1/2 and α-tubulin antibodies. Densitometric analysis of respective bands of Fig a-d were calculated with ImageJ software (NIH) and represented as percent increase in p-ERK compared to total ERK level. (e) The confocal images of p-ERK1/2 in SKOV-3 cells treated as mentioned were shown, where the left panel represents the image of cells stained with anti-p-ERK1/2 antibody followed by anti-rabbit Alexa Fluor-488 (green). The right panel shows the nuclei stained with DAPI. The images were taken at the same exposure time. Scale bar: 20 μm. (f) The average fluorescence intensity of individual cell treated as in (e) was plotted. (g) Cell proliferation was assessed by BrdU incorporation assay in SKOV-3 and OAW-42 cells treated as earlier. (h-i) The effect of PD on cell growth at indicated days were measured by counting. The statistical analysis is done as described previously. * represents $p < 0.05$.

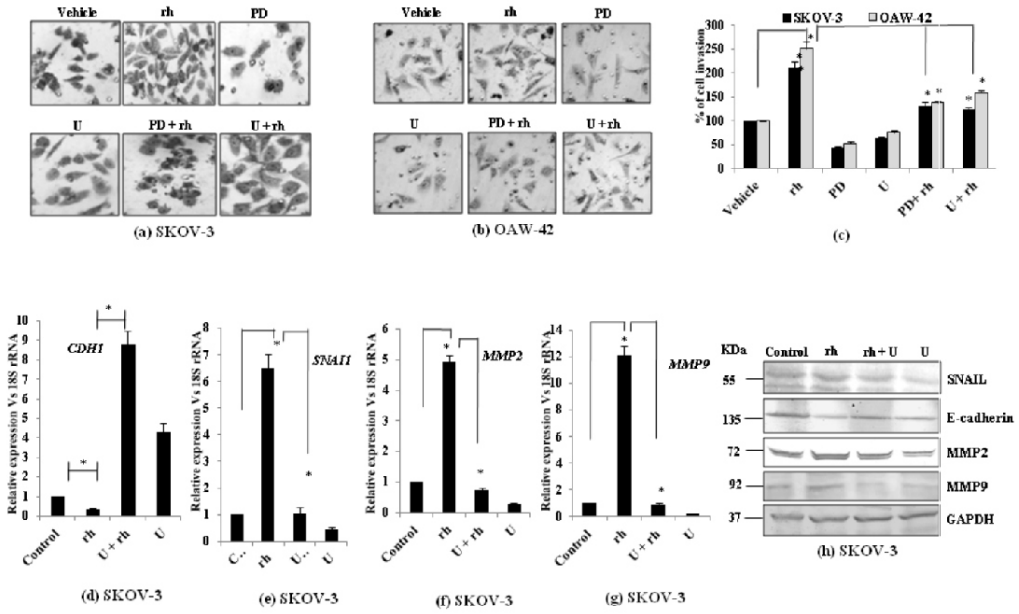


Fig.7. FGF16 stimulates invasion of ovarian cancer cells and regulates the expression of relevant genes through MAPK pathway. Cells were plated in matrigel-coated membranes in the upper chamber of transwells. rhFGF16 (rh; 100ng/ml), U0126 (U; 50 ng/ml), PD173074 (PD; 50 ng/ml) or in combination of rhFGF16 and inhibitors were added to the media in the lower chamber. SKOV-3 (a) and OAW-42 (b) cells penetrating the membrane were fixed, stained and photographed. (c) The respective percent values of migrated cells treated as above with respect to control is shown as histogram. (d-g) Cells were treated as earlier for 6h followed by RNA isolation and Q-PCR with the primers of SNAI1, CDH1, MMP2 and MMP9. (h) Lysates of the SKOV-3 cells treated as indicated were immunoblotted with respective antibodies and the representative gel image was shown. The statistical analysis is done as described previously. * represents $p < 0.05$.

Identification of key factors responsible in fatty acid induced obesity and insulin resistance:

High level of lipid deposition in skeletal muscle results in insulin resistance. The molecular mechanisms of the events that lead to insulin resistance in insulin target tissues are not yet known. We investigated the impact of lipotoxicity on the expression of genes regulating fatty acid oxidation (FAO) in skeletal muscles and liver. High concentration of palmitic acid differentially expresses the genes associated with the FA-transport in muscle cells, leading to incomplete FAO and accumulation of ceramides causing insulin resistance. The derangement in FAO was reversed by fenofibrates. Through extensive screening we have identified a protein involved in retinol metabolism, which was highly expressed in HFD-treated rat liver. We have shown the mechanism of how this protein takes part in obesity associated insulin resistance.

Publications:

Moitri Basu, Satinath Mukhopadhyay, Uttara Chatterjee and Sib Sankar Roy (2014) FGF16 promotes invasive behavior of SKOV-3 ovarian cancer cells through activation of MAPK signaling pathway. J. Biol. Chem. 289:1415-1428.

Chatterjee D, Bhattacharya P, Sau TJ, Das JK, Sarma N, Bandyopadhyay AK, Roy SS, Giri AK (2014) Arsenic exposure through drinking water leads to senescence and alteration of telomere length in humans: A case-control study in West Bengal, India. Mol. Carcinog. Doi: 10.1002/mc.22150.

Invited Lecture:

Delivered **2** number of invited talks in India

Organizing the Seminar:

Acted as Treasurer in SBC (I) Kolkata Chapter conference, held at Sankarpur, WB, August 23-25, 2013.

Abstract Presented:

No. of Abstracts presented in National/International Conference: **2**

Teaching and Examiner:

Acted as teacher in CSIR-IICB course work and Calcutta University
Acted as Examiner, IIT-KGP MTech Exam, several PhD theses, acted as examiner of PhD viva voce, paper setter of Vijaygarh College MSc course, etc.
Acted as convener, Examination Committee of CSIR-IICB Coursework

Training Program:

Organized with Dr. SN Kabir, 3-day long hands on training twice on Multicolor Flow Cytometry for CSIR-IICB research Fellows, experts from BD was also involved in this training program.

PhD Awarded:

Dr. Shyam Sundar Nandi ,Jadavpur University
Dr. Moitri Basu, University of Calcutta.

Human Resource:

Research Fellow(s): Ms. Nabanita Das, Mr. Sudarshan Bhattacharjee, Ms Upasana Roy, Ms. Tulika Mitra, Mr Ashok Mandala, Mr. Rahul Bhattacharya

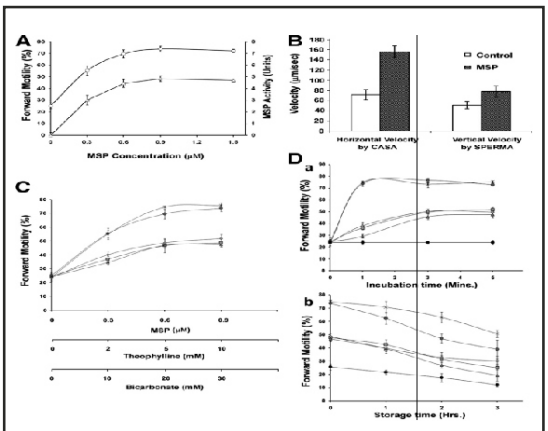
Project Assistant(s): Ms. Shreya Roychowdhury, Ms. Shreya Bandyopadhyay

Summer Trainee(s): Ms Sohini Chanda, Ms. Deblina Roychowdhury, Ms. Ramya S, Ms. Rubia Mandal, Ms. Jhilik Dey

Dr. S. R. Dungdung
Cell Biology and Physiology Division

Sperm motility stimulating protein: Identification, characterization and functional significance.

Sperm motility is essential for fertilizing an ovum. A sperm motility stimulating protein (MSP) is purified from caprine blood serum. Loss of MSP activity after trypsinisation confirms its protein nature. MSP is a heat stable 66 kDa monomeric protein and its novelty was shown by N-terminal amino acid sequencing. At 0.9M, MSP showed much higher forward motility than other activators like bicarbonate, theophylline and their combination helped in longer motility maintenance. Motility analyzers CASA & SPERMA showed increase in horizontal and vertical velocities respectively. MSP action is cAMP independent. Its occurrence is higher in testis although blood is the richest source. MSP is localized mainly on sperm head and neck regions. Its antibody caused significant inhibition of sperm motility and inhibited fertilization to an extent of 100% at 1:25 dilution which showed its contraceptive efficacy. MSP has high efficacy to enhance sperm forward motility thus may be used in biomedical application in infertility clinics and animal breeding centers. Our research provides a potential nonsteroidal biomolecule and its antibody that may solve some major global reproductive problems.



Biochemical characteristics of MSP (A) Effect of goat serum MSP at different concentrations on sperm motility.(B) Effect of MSP on horizontal and vertical velocities of goat cauda sperm. (C) Effect of goat MSP (-●-, red), theophylline (-■-, orange), bicarbonate (-▲-, green), theophylline + bicarbonate (-♦-, blue), and MSP + theophylline + bicarbonate (-X-, black) at different concentrations on sperm motility. (D) Effect of goat MSP, 0.9 mM (-●-, red), theophylline 5 mM (-■-,orange), bicarbonate 20 mM (-▲-, green), theophylline + bicarbonate (-♦-, blue), and MSP + theophylline + bicarbonate (-X-, black) on sperm motility with respect to the control (-●-, black).

Publication Details:

Saha S, Das S, Bhoumik A, Ghosh P, Majumder GC and Dungdung SR (2013) Identification of a novel sperm motility stimulating protein from caprine serum: its characterization and functional significance. *Fertil Steril*, 100(1), 269-279.

Bhattacharya S, Das T, Biswas A, Gomes A, Gomes A, Dungdung SR (2013) A cytotoxic protein (BF-CT1) purified from Bungarus fasciatus venom acts through apoptosis, modulation of PI3K/ AKT, MAPKinase pathway and cell cycle regulation. *Toxicon*, 74, 138-150.

Session Chaired:
Chaired one scientific session in the 2nd CSIR-IICB Annual Research Meet 2014

Academic Performance:
Acted as Reviewer of a manuscript for Indian Journal of Experimental Biology and CSIR Project funding

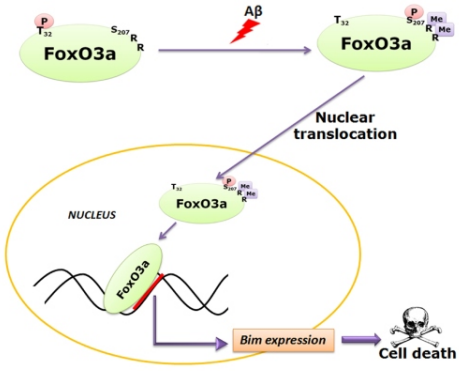
Abstracts Presented:
Number of Abstracts in National Conference: **2**
Number of Abstracts in International Conference: **1**

Human Resource:
Research Fellow(s): Arpita Bhoumik, Shamik Bhattacharya
Project Assistant(s): Prasanta Ghosh
Summer Trainee(s): Soumiya Pal, sudipto Das, Devesh Choukikar

Dr. Subhas Chandra Biswas
Cell Biology & Physiology Division

Alzheimer's disease: transcription factor FoxO3a mediates neuron death via pro-apoptotic protein Bim

Alzheimer's disease (AD) is most common progressive neurodegenerative disease characterized by synapse and neuron loss, formation of neurofibrillary tangles and senile plaques in selective areas of brain. A central hypothesis in AD pathogenesis is that the accumulation and oligomerization of amyloid-β peptide (Aβ) due to altered proteolytic processing of amyloid precursor protein and/or clearance of this peptide, is an early and critical event leading to widespread synaptic dysfunction and selective neuronal loss. However, the mechanisms by which Aβ induces neuronal apoptosis in AD are incompletely understood. Using primary neuronal cultures or animals exposed to Aβ and transgenic AD mice, we investigated mechanism of neuron death. Transcriptional activation of death associated



genes is required for cell death. The Forkhead transcription factor, FoxO3a has emerged as an important mediator of cell fate including apoptosis. Our findings support a model (See Figure) in which FoxO3a is phosphorylated by Akt and remains in cytosol in absence of Aβ. On

Aβ exposure, Akt mediated phosphorylation of FoxO3a decreases with simultaneous increase in its phostphorylation at ser207 by *mammalian sterile 20-like kinase 1* and arginine methylation by protein arginine methyltransferase1. These post translational modifications result in increased nuclear accumulation of FoxO3a. The nuclear FoxO3a binds directly to promoter of a pro-apoptotic protein, Bim leading to its increased expression, which in turn activates the intrinsic apoptotic pathway resulting in neuron death.

Publication Details:

Sanphui P and Biswas SC (2013) FoxO3a is activated and executes neuron death via Bim in response to beta-amyloid. *Cell Death Dis.,* 4, e625.

Sanphui P, Pramanik SK, Chatterjee N, Moorthi P, Banerji B and Biswas SC (2013) Efficacy of Cyclin dependent kinase 4 inhibitors as potent neuroprotective agents against insult relevant to Alzheimer's disease. *PloS One,* 8, e78842.

Zareen N, Biswas SC and Greene LA (2013) A feed-forward loop involving Trib3, Akt and FoxO mediates death of NGF-deprived neurons. *Cell Death Differ.,* 20, 1719-1730.

Banerji B, Pramanik SK, Sanphui P, Nikhar S and Biswas SC (2013) Synthesis and cytotoxicity studies of novel triazolo-benzoxazepine as new anticancer agents. *Chem. Biol. Drug. Des.,* 82, 401409.

Invited Lectures:

Delivered **1** number of invited talk in India & **1** number in abroad which is shown below:

Topic : Role and regulation of cell division cycle 25A phosphatase in Alzheimer's disease related neurodegeneration
Venue : San Diego, California, USA
Date : November 09, 2013

Session Chaired:

Chaired one scientific session in the neuroupdate 2013 at kolkata, India, on November 29, 2013
Chaired one scientific session in the Kolkata Neuroscience Conference 2014 at kolkata, India, on February 1, 2014

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata

Deputation Abroad:

Annual Neuroscience meeting organized by Society for Neuroscience (SFN) at San Diego, CA, from Nov 9-13, 2013

Abstracts Presented:

Number of Abstracts in National Conference: **3**
Number of Abstracts in International Conference: **2**

Conference/Workshop/Symposia Organized:

Joint Organizing Secretary of Asian-Pacific Society for Neurochemistry Workshop followed by International Neuroscience Conference from Jan 27- Feb 1, 2014

Human Resource:

Research Fellow(s):	Six
Project Assistant(s):	One
Summer Trainee(s):	Four

Dr. Rupasri Ain
Cell Biology & Physiology Division

Cellular rendezvous and miRNA-mediated gene regulation at the maternal-fetal interface directs placental morphogenesis.

Placental development is the result of co-ordination between the driving forces of morphogenesis, cell proliferation, differentiation and cell-cell interaction at the maternal-fetal interface to accommodate the needs of the developing embryo. The goal of our research is to further our understanding of cellular interaction and molecular regulation of placental development and trophoblast cell differentiation and function.

MicroRNA regulation of Insulin like growth factor-II during mouse placental development:

Insulin-like growth factor (IGF)-II is known to have effects on both fetal and placental growth, with IGF-II null animals developing small placentas. Because of their abundance and diversity, miRNAs are likely play a central role in gene regulatory pathways controlling function of placental trophoblast cells. We found using bioinformatic analysis that IGF-II is a common predicted target of miR200a and miR141. This led us to speculate that these miRNAs participate in posttranscriptional regulation of IGF-II during mouse gestation. We tested this hypothesis by determining whether distribution of these miRNAs correlates with that of IGF-II mRNA in the uterus. Using real time Taqman assay we found that miR200a and miR141 expression gradually decreases in decidua/placenta with a concomitant increase in IGF-II mRNA till day 13 of gestation. Interestingly, on day17 of gestation IGF-II mRNA levels drastically decreases with reciprocal rise in the levels of miR200a and miR141. These data indicate that IGF-II mRNA might be post-transcriptionally regulated by

miR 200a and miR141. To further validate our hypothesis, we used two independent gain-of-function (using microRNA mimics) and a loss-of-function (miRNA inhibitors) strategy to show that miR200a and miR141 repress IGF-II translation ex vivo in trophoblast stem cells. We are currently working on miRNA regulation of key transcription factors such as Hand1, mash2, Gcm-1, Eomes and Cdx-2 during trophoblast cell development and differentiation.

NOSTRIN and NOSIP regulate angiogenesis at the maternal-fetal interface by fine-tuning the endothelial nitric oxide synthase activity:

A conspicuous feature of hemochorial placentation is extensive angiogenesis at the maternal-fetal interface, accompanied by a marked increase in uterine blood flow. Disruptions in these processes can lead to early pregnancy loss or intrauterine growth retardation. We are investigating the role of NOSTRIN and NOSIP in feto-placental angiogenesis. Using quantitative real-time PCR analysis we demonstrated that both NOSTRIN and NOSIP mRNA levels gradually increase from day 8 to day 17 decidua/placenta during mouse gestation. Interestingly, eNOS mRNA levels are inversely correlated with NOSTRIN and NOSIP expression at the maternal-fetal interface. eNOS expression levels are maximum in day 10 decidua. As expected, NOSTRIN and NOSIP co-immunoprecipitate with endothelial nitric oxide synthase (eNOS) from placental protein extracts. Mouse endothelial cells express NOSTRIN and NOSIP and eNOS. Over expression of NOSTRIN and NOSIP in mouse endothelial cells affect ex-vivo angiogenesis and also affects angiogenesis-related gene expression as observed using micro-array analysis. Our data suggest that NOSTRIN and NOSIP are essential in regulating angiogenesis at the maternal-fetal interface.

Invited Lectures:

Delivered one invited talk at the International conference in India

Academic Performance:

Acted as Teacher at AcSIR, CSIR-IICB, Kolkata.

Abstracts Presented:

Number of Abstracts in International Conference: **4**

Human Resource:

Research Fellows: Mr. Jaganmoy Chowdhury, Ms. Sarbani Saha, Ms. Shreeta Chakraborty, Ms. Trishita Basak, Ms. Debdyuti Nandy

Project Assistant: Ms. Priyanka Sengupta

Summer Trainee: Ms. Tanusree Mukherjee

Dr. Partha Chakrabarti
Cell Biology & Physiology Division

The broad objective of our lab is to understand the pathophysiology of metabolic disorders, particularly type2 diabetes and obesity. We work on two different aspects of metabolic disorders: (1) Understanding the molecular basis for the aberrant lipid metabolism in diabetes, and (2) Understanding the pathophysiology of diabetes in human.

- Intracellular lipid accumulation in different metabolic tissues has been shown to be associated with altered metabolic outcome. We focus on the lipolysis pathway in liver and skeletal muscle. To this end, our approach was to look at the regulation of Adipose Triglyceride Lipase (ATGL), the rate-limiting enzyme of lipolytic pathway. We showed that ATGL in the liver gets uniquitinated by E3 ligase COP1. We are now trying to dissect the molecular pathways and the metabolic outcome of our findings. In muscle ATGL improves metabolic outcome by augmenting fatty acid oxidation and mitochondrial respiration.

- Type 2 diabetes is often preceded by a long asymptomatic stage called prediabetes. We have shown that increased plasma Dipeptidyl Peptidase-4 (DPP4) activity, a target for diabetes therapy, is linked to the progression of type 2 diabetes. This increase was due to augmented release of DPP4 from the peripheral mononuclear cells, specifically Th17 cells. Our data suggests that treatment with DPP4 inhibitors could be beneficial in prediabetes stage.

Publication Details:

Partha Chakrabarti, Ju Youn Kim, Maneet Singh, Yu-Kyong Shin, Jessica Kim, Joerg Kumbrink, Yuanyuan Wu, Mi-Jeong Lee, Kathrin H. Kirsch, Susan K. Fried, and Konstantin V. Kandror. Insulin inhibits lipolysis in adipocytes *via* the evolutionarily conserved mTORC1-Egr1-ATGL-mediated pathway. (2013) Mol Cell Biol, 33:3659-66

Somnath Paul, Nilanjana Banerjee, Aditi Chatterjee, Tanmoy J Sau, Jayanta K Das, Prafulla K Mishra, Partha Chakrabarti, Arun Bandyopadhyay, Ashok K Giri. Arsenic-induced promoter hypomethylation and over-expression of ERCC2 reduces DNA repair capacity in humans by non-disjunction of the ERCC2Cdk7 complex. (2014) Metallomics 6 (4), 864-873

Academic Performance

Teaching Tissue Engineering to the PhD students at CSIR-IICB
Academic advisory board member at Ramakrishna Mission Bidyamandir, Belur Math

Honours and Awards

Editorial Board Member, Endocrinology (The Endocrine Society, USA)

Human Resource

Research Associate: Dr Susmita Chandra, Dr Md. Wasim Khan
Research Fellows: Mainak Ghosh, Dipsikha Biswas, Moumita Adak, Titli Nargis, Sougata Niyogi

NETWORK PROJECTS IN TWELFTH FIVE YEAR PLAN (2012-17)

In Twelfth Five Year Plan, CSIR-IICB is involved in **19** projects of which five **(5)** are **Nodal Network Projects** and fourteen (**14**) are **Partner Network Projects**. The projects mentioned hereunder are sanctioned by CSIR and the financial clearances are received by CSIR-IICB.

NODAL NETWORK PROJECTS

Sl No.	Project Title (with Acronym)	Project Code	Nodal Scientists	Co-Nodal Scientists
1	Bio-energetic Disorders: A multi-model approach to monitoring and management (**BenD**)	BSC 0206	Bandyopadyay Uday	Roy Sib Sankar
2	Neurodegenerative diseases: Causes and Corrections (**miND**)	BSC 0115	Mohanakumar K.P	Biswas Subhas
3	Therapeutics of chronic obstructive pulmonary disease (COPD) and related respiratory disorders (**TREAT**)	BSC 0116	Bandyopadyay Arun	Bandyopadyay Santu
4	Understanding and Designing the SupraMolecular Ensembles and Machines (**UNSEEN**)	BSC 0113	Roy Siddhartha	Sengupta Jayati
5	Host Interactome analysis: Understanding the Role of Host molecules in Parasitic Infection (**Hope**)	BSC 0114	Ali Nahid	Bhattacharya Suvendra

PARTNER NETWORK PROJECTS

Sl No.	Project Title (with Acronym)	Project Code	Nodal Institute	Participating Scientists from CSIR-IICB
1	Competent gamete production and reproductive dysfunction (**PROGRAM**)	BSC 0101	CSIR-CDRI	Kabir S.N, Roy Sib Sankar, DundDung SR, Ain Rupasri
2	Centre for BIOtherapeutic Molecule DISCOVERY (**BIODISCOVERY**)	BSC 0120	CSIR-IMT	Roy Syamal, Roy Siddhartha Prof., Sen Malini, Ali Nahid, Roychoudhury Susanta
3	Genomics and Informatics Solutions for Integrating Biology (**Genesis**)	BSC 0121	CSIR-IMTECH	Dutta Chitra, Ghoshal Nanda,Dana Syamal, Ray Kunal, Chakrabarty Saikat, Maiti Nakul, Padmanabhan
4	Man as a Superorganism: Understanding the Human Microbiome (**HUM**)	BSC 0119	CSIR-IMTECH	Chowdhury Rukhsana,Dutta Chitra,Chaudhury Keya, Swarnakar Snehasikta, Chakrabarty Saikat
5	Medicinal Chemistry for stem cell biology and regenerative medicine (**MEDCHEM**)	BSC 0108	CSIR-IIIM	Ghosh K Mrinal
6	Plant-Microbe and Soil Interactions (**PMSI**)	BSC 0117	CSIR-CCMB	Chattopadhyay Sharmila, Dutta Samir
7	Integrated NextGen approaches in health, disease and environtmental toxicity (**Indepth**)	BSC 0111	CSIR-IITR	Swarnakar Snehasikta,Das Sumantra, Bandyopadyay Arun, Swarnakar Snehasikta, Dhar Tarun, Biswas Tuli, Giri Ashok, Mohanakumar K.P, Ray kunal, Ali Nahid, Chowdhury Rukhsana, Mandal Chitra

8	Genomics of Medicinal Plants & Agronomically Important Traits (**PlaGen**)	BSC 0107	CSIR-NBRI	Chattopadhyay Sharmila, Dutta Samir
9	Development of Noval CSIR Technology for manufacturing tailored and patent- specific bioceramic implants and biomedicinal devices at affordable cost (**BIOCERAM**)	ESC 0103	CSIR-CGCRI	Mandal Chitra, Chattopaday Partha, Konar Aditya, Ghosh Surajit, Kumar G Suresh
10	Emerging and re-emerging challenges in infectious diseases: Systems based drug design for infectious diseases (**SPlenDID**)	BSC 0104	CSIR-CDRI	Bandyopadyay Uday
11	Organic reactions in generating innivative and natural scaffolds (**ORIGIN**)	CSC 0108	CSIR-IICT	Jaisankar P, Chattopadyay Partha, Kumar G Suresh, Mandal N.B, Banerjee A.K, Chowdhury Chinmay, Banerji Biswadip, Das Indrajit , Garai Saraswati, Ghosh Surojit
12	Genome Dynamics in cellular organization, differentiation and enatiostatis (**GenCODE**)	BSC 0123	CSIR-IGIB	Suresh Kumar G
13	CSIR Knowledge Gateway and Open Source Private Cloud infrastructure (**KNOWGATE**)	ISC 0102	CSIR-NISCAIR	N.C. Ghosh
14	Epigenetic in Health and Disease (**EpiHeD**)	BSC 0118	CSIR-CCMB	Arun Bandyopadyay

Nodal Network Project DETAILS

1) TITLE: Understanding and designing the supra molecular ensembles and machines (UNSEEN)

Participating Laboratories: CSIR-IGIB, CSIR-CCMB, CSIR-CDRI, CSIR- IMT

Core Objectives:
In living systems most proteins exist in large dynamic macro-molecular ensembles. To solve the structure and intrinsically complex dynamics of large bio-macromolecular complexes and machines (which are difficult to crystallize as such) using a 'Hybrid Approach'

Uniqueness and importance of core objective:
The proposed study is expected to greatly enhance our understanding of the structure and dynamics of several important biological assemblies and molecular motors involved in key cellular processes. To our knowledge, a structural biology project of this kind does not exist nationally. Additionally, many of the proposed studies have far reaching implications in human diseases. The proposed project would provide scientific information which would be useful to design therapeutic strategies.

Most significant milestones achieved towards attainment of core objective:

- Purification of several relevant macromolecules
- Atomic force microscopy applied to visualize the full length p300 (transcriptional co-activator) in complex with p53
- SAXS studies and modeling based visualizing large scale domain repositioning during streptokinase-plasminogen
- interactions and visualization of the elusive open shape of g-actin in solution by SAXS data analysis

Publications emanating from the project: 15 (fifteen)

2) TITLE: Therapeutics of chronic obstructive pulmonary disease (COPD) and related respiratory disorders (TREAT)

Participating Laboratories: CSIR-IGIB, CSIR-IITR, CSIR-IICT, CSIR-IIIM, CSIR-NEIST

Core Objective:
To explore New Targets for the treatment of Chronic Obstructive Pulmonary Disease (COPD) and Related Respiratory Disorders

Uniqueness and Importance of Core Objective:
Scientific Knowledge Creation about overlapping pathways between asthma and COPD which might lead to development of molecular medicine.

Most significant milestones achieved towards attainment of core objective: Design and synthesis of new structures initiated; environmental impact on health in coal mines started.

Publications/patent applications/HRD emanating from the project:
1 patent (under process), 1 paper (submitted), 5 Ph.D.(Ongoing)

3) TITLE: Neurodegenerative diseases: Causes and Corrections (miND)

Participating Laboratories: CSIR-CCMB, CSIR- IITR, CSIR-CDRI, CSIR-NCL, CSIR-IICT

Core Objective:
To address disease pathology by uncovering the non-canonical, emerging mechanism that govern neuro-degeneration, and apply the knowledge for development of new treatment.

Uniqueness and Importance of Core Objective:
The project addresses pathways that are novel, off from the typically addressed pathological features of Parkinson's and Alzheimer's diseases.

Most significant milestones achieved towards attainment of core objective:
1. Identification of biomolecular targets
2. Development of target based molecules
3. role of miRNA in NDD.

Publications/patent applications/HRD emanating from the project:
Publications 12
Patents (under process) 2
HRD - ~15 (PhD, registered) & ~20 (Technical)

4) TITLE: Host Interactome analysis: Understanding the Role of Host molecules in Parasitic Infection (HOPE)

Participating Laboratories: CSIR-CDRI, CSIR- IMTECH, CSIR-CCMB, CSIR-NCL

Core Objective:
To understand the inter-molecular host parasite interactions in the infection process of Leishmania for the development of new generation drugs.

Uniqueness and Importance of Core Objective:
To address the mode of host-parasite interaction an interdisciplinary strategy involving both molecular and bio-informatic tools will be used the for development of new generation drugs.

Most significant milestones achieved towards attainment of core objective:

- *Leishmania donovani* down-regulates Dicer and miR-122 to Reduce Serum Cholesterol in Infected Mouse Liver.
- Cysteine protease A (cpa), Cysteine protease B (cpb) and Cysteine protease C (cpc) have been identified as putative vaccine candidates against *L. donovani*.

Publications/patent applications/HRD emanating from the project:
Number of Publications: 45
Number of Patent applications: 3 (filed)
Number of trainees: 33

5) TITLE: Bio-energetic Disorder: A multi-model approach to monitoring and management (BEnD)

Participating Laboratories: INTRA- INSTITUTIONAL

Core Objective and Uniqueness:
To understand the reduced bio-energy production and mitochondrial free radical generation through an array of disease models for the development of new generation drugs against mitochondrial diseases.

Most significant milestones achieved towards attainment of core objective:

- Development of a mitochondrially targeted molecule to prevent mitochondrial pathology
- Technique for muscle regeneration by RNA-mediated mitochondrial restoration
- Identification of the role of PITX2 Homeodomain Protein in Human Ovarian Adenocarcinoma

Publications/patent applications/HRD emanating from the project:
Publication: 15
Patent: 1
Trained manpower: 15

P&I, PME

PUBLICATION & INFORMATION AND PLANNING, MONITORING & EVALUATION

Dr. Santu Bandopadhyay, Dr .K.P. Mohanakumar, Dr. G. Suresh Kumar, Dr. Uday S. Chowdhury, Dr. Tanmoy Mukherjee, Dr .Moonmoon Bhaumik, Dr. Samir K. Dutta, Dr. Prasanta Chakraborty, Mr. Arupesh Majumder, Mr. Binayak Pal, Mr. Sankar Bhakta,Mr. Sukhendu Biswas, Mr. Pallab Mukherjee, Mr. Nishikanta Naskar, Mr. Soumalya Sinha, Mr. Samir Thami

The scientific administration, supervision and thus management of different R&D activities of the institute are the primary foci of this division. The activities of this division are carried out by six major sections, *e.g.* [a] Publication & Information; [b] Planning, Monitoring & Evaluation; [c] Art & Photography; [d] ISTAD-IICB; [e] Intellectual Property Management Cell; [f] Business Development Group. Therefore the success of this division mostly depends upon strong interrelation among these sections and excellent communication with R&D departments. Thorough interactions and proper attention in execution of the time-bound tasks facilitated successful management of this division. The details of the scientific management activities of the individual sections are given below separately for the reporting year.

Publication & Information Section

Dr. Tanmoy Mukherjee and group

This section deals with diverse informational activities, publication and monitoring of reports and dissemination of information in electronic and printed forms. The major contribution of this section lies in assisting scientists in day to day maintenance of the institute activities and innovations, project profiles, publication records and research utilization data. The section was involved in the following wide spectrum of programmes during the report year.

- Preparation of CSIR-IICB Annual Report (2012-13)
- Preparation of documents released during events.
- Preparation of Annual Plan (2014-15) and Budget.
- Dissemination of information to scientific milieu on relevant subjects.
- Documents on CSIR-IICB inputs for "CSIR Annual Report 2012-13" and "CSIR Research Output 2013".
- Assistance to scientists, fellows and staff members for participation in seminars, symposia and conferences.
- Maintenance of database for testing and calibration.
- Assistance for record of the proceedings of Research Council meeting.
- Preparation of a new up-to-date brochure for CSIR-IICB
- Updated information's regarding P&I section for CSIR-IICB website
- Public relations, advertisement and news and views forum.
- Organization display of exhibition and science news dissemination.
- Advice and comments for management of parliament queries whenever required.
- Organization of 'OPEN HOUSE' and active help for 'LAB-VISIT' programmes.
- Reply to Audit report regarding publication matters of the Institute.
- Monthly Report of CSIR-IICB for PPD, CSIR.
- Matters for CSIR News & CSIR-IICB News Letter.
- Preparation of Performance Indicator data for CSIR-IICB.
- CSIR-IICB inputs for National survey of Biomedical laboratories and inventories sorting with Polio Virus material for Ministry of Health & family Welfare, GOI
- CSIR-IICB Inputs for CSIR Society Meeting on 10.07.13
- CSIR-IICB achievements for " CSIR Science Communication Forum"
- CSIR-IICB inputs for CSIR Plan Projects through Slides

Scientist Visit & Events

The P&I Section is also responsible for the announcement and arrangement of seminars for the national and international scientists who often visit the institute and like to share their research activities with CSIR-IICB faculties. About 27 numbers of Scientist visitors delivered their lecture during 2013-14. A total list of '**Scientific Seminars**' is given in a separate page.

The Institute also organized several significant events with the assistance of this section and '**List of Events**' is also shown separately for the reporting year.

Management of Laboratory Visit for Students

On the occasion of CSIR Foundation Day celebration-2013, the members of this section have actively helped for the arrangement of 'OPEN HOUSE' programme where students from various schools/colleges/universities within and around Kolkata visited CSIR-IICB. A large number of students from about Eight schools and colleges with their teachers visited various laboratories and interacted with the scientists expressing great interest and enthusiasm. Members of this section also arranged the laboratory visit for students of outside Kolkata colleges and universities. A total of six (06) numbers of visits were organized throughout the year (2013-14).

Sectional Members

Dr. Uday S. Chowdhury, Dr. Neeta VM Khalkho, Mr. Arupesh Majumdar, Mr. Pallab Mukherjee, Mr. Sankar Bhakta

Intellectual Property Management Cell

Dr. Tanmoy Mukherjee and group

IPM Cell of CSIR-IICB has prepared, maintained and disseminated all information regarding patent application, status of the application, renewal etc. as and when it was required. It has provided all necessary information to Business Development Group of CSIR-IICB for licensed out patents; sent information on patent and technology transfer to IPU, CSIR.
In the reporting year some of the significant jobs done are as follows:

1. Maintenance of CSIR-IICB Patent Database to keep it up-to-date
2. Commercial Working Report for 12 Indian Patents of CSIR-IICB prepared and sent to IPU, CSIR.
3. Year wise documents prepared on total Patents of CSIR-IICB filed and granted.
4. Response to IPU, CSIR regarding IPER, IPRP, OA, Designated Countries and other queries relating to patent application and filing.
5. Information on patent and technology transfer to IPU, CSIR regarding Audit and Parliamentary Questions.
6. Approval of Declaration forms for non patentability of publications
7. Renewal / Lapse recommendations of CSIR-IICB patents prepared for IPU, CSIR. Reports Prepared for several numbers of Foreign Patents and Indian Patents.

During reporting period, the performance at a glance of IPM Cell is as follows:

Patents Filed:

International Patents Filed	…	**4**
National Patents Filed	…	**1**

Patents Granted:

International Patents Granted	…	**4**
National Patents Granted	…	**1**

Filed in India

SNo	Title	Inventors	Prov. Filing Date
1	ANTI-CANCER ACTIVITY OF STEARYLAMINE BEARING CATIONIC LIPOSOMAL DRUG FORMULATIONS	NAHID ALI, MANJARIKA DE, TRIPARNA SEN	19/09/2013

Granted in India

SNo	Title	Inventors	Grant Date	Patent No.
1	A LIPOSOMAL FORMULATION AND USE THEREOF	ALI NAHID, GHOSE JAYEETA, BHOWMICK SWATI	26/04/2013	256052

Filed in Foreign Countries

SNo	Title	Inventors	Country	Comp. Filing Date
1	BIOMARKER FOR VALVULAR HEART DISEASE	ARUN BANDYOPADHYAY, TANIMA BANERJEE, SOMADITYA MUKHERJEE, SANTANU DUTTA	ARIPO	08/05/2013
2	A SYNTHETIC PEPTIDE FORMULATION AGAINST MELANOMA AND OTHER CANCERS OVER-EXPRESSING S100B	AMLANJYOTI DHAR, SHAMPA MALLICK, ISRAR AHMED, ADITYA KONAR, SANTU BANDYOPADHYAY, SIDDHARTHA ROY	AUSTRALIA	01/07/2013
3	A SYNTHETIC PEPTIDE FORMULATION AGAINST MELANOMA AND OTHER CANCERS OVER-EXPRESSING S100B	AMLANJYOTI DHAR, SHAMPA MALLICK, ISRAR AHMED, ADITYA KONAR, SANTU BANDYOPADHYAY, SIDDHARTHA ROY	USA	19/07/2013
4	A SYNTHETIC PEPTIDE FORMULATION AGAINST MELANOMA AND OTHER CANCERS OVER-EXPRESSING S100B	AMLANJYOTI DHAR, SHAMPA MALLICK, ISRAR AHMED, ADITYA KONAR, SANTU BANDYOPADHYAY, SIDDHARTHA ROY	EUROPE	30/07/2013

Granted in Foreign Countries

SNo	Title	Inventors	Country	Grant Date	Patent No.
1	A PHARMACEUTICAL COMPOSITION COMPRISING OENOTHEIN C USEFUL FOR THE TREATMENT OF PEPTIC ULCER DISEASES	SUKDEB BANERJEE, PRATAP K DAS, SUCHANDRA GOSWAMI, C. ANNALAKSHMI, NILENDU PANDA, NIRANJAN PRASAD SAHU, BASUDEB ACHARI	JAPAN	12/07/2013	5313693
2	METHOD FOR TREATMENT OF BRONCHIAL ASTHMA	SIBABRATA MUKHOPADHYAY, MUMU CHAKRABORTY, TULIKA MUKHERJEE, ARUN BANDYOPADHYAY, DIPAK KAR, TANIMA BANERJEE, ADITYA KONAR, DEBAPRASAD JANA, SANTU BANDYOPADHYAY, SIDDHARTHA ROY, BALARAM GHOSH, MABALIRAJAN ULAGANATHAN, RAKESH KAMAL JOHRI, SUBHASH CHANDER SHARMA, GURDARSHAN SINGH, BHOLANATH PAUL, VASANTA MADHAVA SHARMA GANGAVARAM, JHILLU SINGH YADAV, RADHA KRISHNA PALAKODETY	USA	27/08/2013	8519154
3	DNA VACCINE AS IMMUNOPROPHYLAXIS AGAINST KALA-AZAR	RAJATAVA BASU, SYAMAL RAY	USA	03/09/2013	8524677
4	METHANOLIC EXTRACT OF PIPER BETEL LEAVES FOR THE TREATMENT OF HUMAN MALIGNANCIES BY INDUCING OXIDATIVE STRESS	SANTU BANDYOPADHYAY, BIKAS CHANDRA PAL, JAYASHREE BAGCHI CHAKRABORTY, SRABANTI RAKSHIT, LABANYA MANDAL, KAUSIK PAUL, NABENDU BISWAS, ANIRBAN MANNA,	CHINA	16/10/2013	ZL200880124983.2

Sectional Member: Mr. Arupesh Majumdar

Project Monitoring & Evaluation division

Dr. Kochupurackal P Mohanakumar and group

PME set up in August, 2009 effectively manages the Institute's plan and non-plan projects, grant-in-aid, sponsored and collaborative R&D projects. The Division maintain liaison with Principal Investigators-Finance section-Purchase Section and the Grant Giving Agency. PME provides proper logistic support for the management, maintenance and monitoring of Institute's plan and non-plan projects and externally funded projects. PME will help in effective, timely and successful implementation of the institute's commitments. PME is also entrusted with appropriate dissemination of information regarding ongoing and completed projects.

PME of CSIR-IICB like other CSIR laboratories is actively involved in the preparation and timely maintenance of databases for all intramural and extramural research projects, project expenditure monitoring of all projects, monitoring ECF of the Institute, preparation of responses to Parliamentary questions in relation to the activities of the Institute, dissemination of information on all relevant National & International Research Program requests for applications, including fellowships and maintenance of mandatory registration with such agencies, and liaison with all grant giving agencies, make awareness among scientists regarding terms & conditions of relevant funding agencies, responding to various audit queries in relation to both ongoing and completed projects, participation in Institute's annual plan, budget preparation expenditure status, monitoring the receipts of cheques as well as online transfer of fund by the sponsors against the project granted, and request for such fund, and proper record keeping of the projects, regular interactions with finance division regarding the expenditure carried out against the projects in each and every month and recorded in the concerned project, and obtaining approval of projects for submission to external funding agencies from competent authorities (RC, Director, MC, etc.). Twelve projects have been newly sanctioned during the financial year 2013 - 14.
Details of extramural project activities (completed, sanctioned and currently progressing) are provided in a separate page as '**External Funding**',

Sectional Members

Dr. Prasanta Chakraborty, Mr. Sukhendu Biswas, Mr. Soumalya Sinha and Mr. Samir Thami

Art & Photography Section

Dr. Tanmoy Mukherjee and group

Art Section has rendered full support to all the staff members during scientific seminars/symposia and all national events by preparing displays, illustrations, posters, exhibits, and slides. Diagrams, charts, graphs for publication in national and international journals are prepared in this section. They are working in collaboration with the Photography Section for making each exhibition a great success to highlight the institute's achievement. The section also participated in preparing artwork and cover design for Hindi Day and Hindi Report. This section has also carried out work for decoration of floor & institute during various scientific and official programmes. The achievement of this section is the total design & e-publication of CSIR-IICB Annual Report for the year 2012-13.

Photography Section under the able guidance of Mr. Binayak Pal has been successful for coverage of most of the events taking place in the institute. The section is continuously supplying all the photos for publications, Annual Reports, Journals and other related documents. Besides these they are also assisting the scientists of the institute. Apart from that they also handled photographs of scientific activities and experiment slides for publication in different international journals.

Sectional Members
Mr. Binayak Pal, Mr. Nishikanta Naskar

Business Development Group

Dr. G. Suresh Kumar

- The activities of BDG involves maintenance of knowledgebase/products developed, dissemination of information on technologies developed etc.
- Licensing of in house technologies developed, utilization of knowledge base/expertise developed in the laboratory.
- Liaison with industries/R&D institutes/academic institutes/Govt. organizations and other potential clients.
- Negotiating business plans with industries and corporate sectors, and implementing them and also drawing agreements.
- Arranging and conducting meetings between institute and industry/corporate clients, induction of new schemes, arrangement of interaction of clients with scientists.
- Dealing with Parliamentary and other related matters, responses to parliamentary and audit queries and questions etc.
- Distribution of premia, royalty and intellectual fees earned.
- Negotiation of collaborative/interdisciplinary research with academic institutions and signing of agreements, memorandum of understandings.

Diverse activities of this section were personally supervised by the Chief Scientist, Dr. Pijush K. Das with the active help of Dr. Samir K Dutta & Mrs. Shapoo Sengupta. A list of Foreign visit of CSIR-IICB scientists during the reporting year are listed in a separate page as **'Deputation Abroad'.**

Deputation Abroad

Sl. No	Name of the Scientist	Place of Visit	Purpose of visit	Period of deputation	Source of funding
01	Dr. Uday Bandyopadhaya, Principal Scientist	Portugal	For delivering a talk at the conference organized by the school of Allied Health Sciences of the polytechnic of Porto	19.04.2013 to 20.04.2013	ESTSP/IPP and BEnD (BSC 0206)
02	Dr. K. P. Mohankumar, Chief Scientist	Mexico	For attending the upcoming 24th ISN/ American Society for Neurochemistry (ASN) Biennial Meeting	20.04.2013 to 24.04.2013	International Society for Neurochemistry
03	Dr. Syamal Roy, Chief Scientist	Brazil	For presenting a paper in the 5th World Congress on Leishmaniasis	13.05.2013 to 17.05.2013	Host and Strategic Network on Neglected Diseases and Zoonoses (SNNDZ)
04	Dr. Nahid Ali, Chief Scientist	Brazil	For oral presenting of paper in the 5th World Congress on Leishmaniasis	13.05.2013 to 17.05.2013	Project No. 9/1/BS/IICB(2)/2012-13-PPD and DST
05	Dr. Debasish Bhattacharya, Chief Scientist	South Korea	For delivering a lecture at the ABA jeju 2013, The 8th Asian BioPhysics Association Symposium organized by the Korean Biophysical Society	20.05.2013 to 26.05.2013	Budget head P-03of CSIR-IICB and Drug House Project No. SSLP -215 sponsored by M/S Albert Devid Ltd. Kolkata
06	Dr. Pijush K Das, Chief Scientist	U.K	For attending seminars at the University of Glasgow and Imperial College , London	03.08.2013 to 09.08.2013	J C Bose National fellowship Grant

07	Dr. (Mrs) Chitra Mondal, Outstanding Scientist	Italy & Germany	To Chair the session at Milan , Italy and to visit Charite-Universitatamedizin, Berlin, Germany	22.08.2013 to 27.08.2013 & 27.08.2013 to 30.08.2013	BMBF project fund (P-80102), J C Bose Fellowship, Charite-Universitatamedizin, Berlin, Germany
08	Dr. Arun Bandhyopadhay, Sr. Principal Scientist	London	To attend and deliver a talk at the 7th International Conference on Annexin to be held in William Harvey Research Institute , London	09.10.2013 to 11.10.2013	CSIR Network Project TREAT, BSC0116
09	Dr. (Mrs) Chitra Mondal, Outstanding Scientist	Argentina	To participate in the 24th General Meeting of the Academy of Sciences for the Developing World (TWAS) to be held at Buenos Aires, Argentina	01.10.2013 to 04.10.2013	JC Bose National Fellowship, Indian national Science, Academy and CONCICET
10	Dr. P. Jaisankar, Sr. Principal Scientist	Japan	For attending 2nd International Conference of the International Chemical Biology Society	07.10.2013 to 09.10.2013	BSC 0206and CSC108
11	Prof. Siddhartha Roy, Director	Japan	To attend the meeting on 2nd official Conference of International Chemical Biology Society	07.10.2013 to 09.10.2013	JC Bose National Fellowship
12	Dr. Suvendra Bhattacharyya, Principal Scientist	Germany	For presenting a poster in the international meeting on "Non-coding Genome"	09.10.2013 to 12.10.2013	Welcome Trust ISRF(GAP-280

13	Dr. Syamal Roy, Chief Scientist	France	To participate as an invited speaker in the EU-India Science, Technology and Innovation Days 2013	10.10.2013 to 11.10.2013	CNRS on behalf of New INDIGO and STI Days Organizing Committee and project "SEP-215/SSp-288"
14	Dr. Sucheta Tripathy, Principal Scientist	USA	For attending the Genome Informatics Meeting and Ensemble Workshop at the Cold Spring Harbor Laboratory NY, USA	30.10.2013 to 02.11.2013	Contingency Head of Ramalingaswamy Fellowship
15	Dr. Rupak Bhadra, Sr. Principal Scientist	Japan	As Foreign Guest Professor at Osaka Prefecture University, Osaka, Japan	01.11.2013 to 22.11.2013	Host Institute
16	Dr. Subhas Ch. Biswas, Sr. Scientist	USA	For presenting a poster in Annual Neuroscience Meeting at SanDiego, CA	09.11.2013 to 13.11.2013	BSC0115(TA Foreign)
17	Dr. K. P. Mohankumar, Chief Scientist	Nigeria	For attending the Intl. Brain Research Organization- Intl. Society for Neurochemistry, (IBRO-ISN) School of Neuroscience in Africa , University of Ibadan, Nigeria as a resources person	01.12.2013 to 07.12.2013	INRO/ISN
18	Prof. Siddhartha Roy, Director	Germany	To attend and deliver an invited talk in the Indo-German Scientific conference at the Banz Monastery, Bamberg , Germany	08.12.2013 to 12.12.2013	S S Bhatnagar Fellowship and Buchman Institute of Molecular Life Sciences, Germany

19	Dr. Rupak Bhadra, Sr. Principal Scientist	Bangladesh	For giving talk in the 16th US-Japan International Conference on Emerging Infectious Diseases	11.02.2014 to 13.02.2014	Project head BSC 0120
20	Dr. Malini Sen, Sr. Scientist	USA	For an oral presentation of an abstract at the Keystone Symposia on 'The NF-KappaB Sysatem in Health and Disease(B4)'	23.02.2014 to 28.02.2014	P-03(TA Abroad) Budget
21	Prof. Siddhartha Roy	China	To attend the 2014 Queenstown Molecular Biology Meetings in Shanghai, in parallel with the 6th National forum on New Technologies in drug discovery and 3rd Meeting of Chinese Network for drugs and Diagnostics Innovation	11.03.2014 to 14.03.2014	Host Institute

EXTERNAL FUNDING

ONGOING PROJECTS 2013 – 2014

Sl. No.	Project Investigator	Project Title	Funding Agency
1	Bhattacharya Debasish	Biochemical characterization of the drug 'Placentrex'	ALBERT DAVID LTD
2	Giri Dr. A K	PRAMA: Probabilistic Risk Assessment Modelling to inform groundwater Arsenic Mitigation	UKIERI CONTRIBUTION
3	Kabir Syed Nazrul	Characterization of anti-HIV properties of Acaciaside-B and pre-clinical studies towards its development as a potential microbicide-spermicide formulation	DBT NEW DELHI
4	Roy Syamal	New tools for monitoring drug resistance and treatment response in Visceral Leishmaniasis in the Indian subcontinent	DST-European Union
5	Debnath Mita Chatterjee	Physicochemcial and biological evaluation of transition metal chelates of some sulfur containing amino acids	ICMR NEW DELHI
6	Konar Aditya	Nanotechnology based drug delivery system for prevention of cataract: Proof of concept in a Rabbit Model	DBT
7	Saha Krishna Das	Study on Leishmanial integral membrane proteins(s) induced growth inhibition of melanoma cells with exploration of the mechanism involved and characterization of the bioactive protein component(s)	ICMR

8	Bhattacharyya Suvendra	Mechanism of mRNA compartmentalization in the cyloplasm of mammalian cells	Wellcome Trust, London
9	Das Padma	Studies of anticarcinogenic functiions of compounds isolated from the edible mushroom	DBT
10	Biswas Subhas Chandra	Identifying molecular targets for therapeutic intervention in Alzheimer's disease	DST, New Delhi
11	Mondal Nirup Bikash	Chemical tranformation of Andrographolide for enhancement of Anticancer Efficacy	DST, WB
12	Biswas Subhas Chandra	Understanding the molecular basis of neurodegeneration in Alzheimers disease identification and characterization of neurotoxic molecules	DBT
13	Mohanakumar K P	Mitochondrial invlovement in the pathophysiology of neurodevelopmental disorders, ADHD and ASD	DBT
14	Mondal Nirup Bikash	Evaluation of Chenopodium album Seed Extract as Potential Spermicidal Agent in Different Mammalian Species and Chemical Investigations for the Lead Molecule	ICMR
15	Roychowdhury Susanta	Identification of Candidate Tumor Suppressor Genes Loci in Chromsomes 3,4 and 11 Associated with the Development of Uterine Cervical Carcinoma	DST NEW DELHI
16	Bhattacharya Debasish	Figer-printing and Biochemical	Union Drug Company

EXTERNAL FUNDING

		Characterization of the Drug Sterodin	
17	Khowala Suman	Lignocellulolytic enzymes production by the filamentous fungus Termitomyces clypeatus using low cost agro wastes	DBT
18	Sen(Jr.) Asish K	Synthesis and Characterization of Receptor Specific Mannose/Manno-oligosaccharides Linked Miltefosine Derivatives; Biological Evaluation of their Antileishmanial Activity	DBT
19	Jaisankar P	Translation of basic science discoveries on DNA topoisomerases I & II in the clinical arena with respect to leishmaniasis	DBT
20	Mohanakumar K P	PDE-IV as target for Parkinson's disease: Synthesis of congeners of Irsogladine, and their evaluation in cellular and animal models of the disease	DBT
21	Mandal Chitra	Evaluation of a blood-based antigen detection assay by quantitating unique sialoglycoprotein specifically induced on erythrocytes for darly diagnosis and monitoring patients with Indian Visceral Leishmaniasis in two referral centers	ICMR
22	Bhattacharyya Debasish	Growth Inhibition and Destabilation of B-Amyloid Aggregate by Protease Derived Peptides	DST
23	Mohanakumar K P	Effect of hypercholesterolemia on brain function : Effects of indigenous plants	DBT

		components of North-East India	
24	Giri Ashok K	Comparative Genomic Hybridization and MitoChip Array Analysis of Individuals with and without Arsenic Induced Skin Lesions	ICMR
25	Ghosh Mrinal K	Crosstalk between Stat3 and Beta-catenin: Understanding the Mechanisms to Counteract Prostate Cancer	SERB, DST
26	Majumder Hemanta K	A Joint INDO-BRAZIL Project to decipher biological processes of organisms causing diseases of clinical importance in both the countries	DST
27	Maiti Nukul Chandra	-Synuclein and Tau Interaction : Implication on Neurodegenerative Diseases	DBT
28	Chattopadhyay Dr. Partha	Synthesis, conformational studies and self assembly behavior of Triazole/urea based peptidomimetic macrocycle	DST, Govt. of West Bengal
29	Ain Dr. Rupasri	Studies on trophoblast and natural killer cell interaction at the maternal-fetal interface	SERB, DST
30	Chattopadhyay Dr. Sharmila	Cross-talk of glutathione with other signaling Molecules to combat biotic stress in planta	SERB, DST
31	Khowala Suman	Protein stabilization and prevention of Protein aggregation by fugal sucrose from Termitomyces clypeatus an application in biotechnology and biomedical research	DBT

EXTERNAL FUNDING

32	Sen Dr. Malini	Role of Wnt5a Signaling in the Initiation and Progression of Sepsis	DBT
33	Debnath Mita Chatterjee	Evaluation of the therapeutic efficacy of liposomal and nanoparticulated flavonoids in combating oxidative hepatocellular degeneration by nuclear imaging technology using Tc-99m radiopharmaceuticals	BRNS, DAE
34	Adak Dr. Subrata	Examine mechanism of electron transfer Leishmania major (LmAPX) by site directed mutagenesis	DBT
35	Chakrabarti Dr. Partha	Octreotide derivative modified lipid nanoparticles : Preparation, Radiolabeling & applications a tumor radiopharmaceuticals	BRNS, DAE
36	Chattopadhyay Dr. Krishnananda	Experimental and computational study of the aggregation pathway of alpha synuclein	SERB, DST
37	Natarajan Dr. Ramalingam	Metal-Organic Frameworks (MOFs) from Bile Acid Derivatives as Carriers for Drug Delivery	SERB, DST
38	Das Dr. Indrajit	N-Heterocyclic Carbene Catalyzed Diastereoselective Synthesis of Substituted Cyclohexanones from Modified Carbohydrates : Application to the Total Synthesis of Conduramines and Phenanthridone Alkaloids	SERB, DST
39	Chakraborty Partha	Insulin and Nutrient Mediated Regulation of Adipocyte Metabolism	DST

PROJECT SANCTIONED & IMPLEMENTED IN 2013-14

SL. No.	Project Investigato	Project Title	Funding Agency
1	Chattopadhyay Dr.Partha	Synthesis, conformational studies and self assembly behavior of Triazole/urea based peptidomimetic macrocycle	DST
2	Ain Dr. Rupasri	Studies on trophoblast and natural killer cell interaction at maternal-fetal interface	DST
3	Chattopadhyay Dr. Sharmila	Cross-talk of gluathione with other signaling molecules to combat biotic stress in planta	SERB, DST
4	Khowala Dr. Suman & Dr. Snehasikta Swarnakar	Protein Stabilization and Prevention of Protein aggregation by fugal sucrose from Termitomyces clypeatus and application in biotechnology and biomedical research	DBT
5	Sen Dr. Malini	Role of Wnt5a signaling in the initiation and progression of Sepsis	DBT
6	Debnath Dr. Mita Chatterjee & Dr. Sankha Chattopadhyay, Scientific Officer, BRIT, VECC, Kolkata	Evaluation of the Therapeutic efficacy of liposomal and nanoparticulated flavonoids in combating oxidative technology using Tc-99m radiopharmaceuticals	BRNS, DAE
7	Adak Dr. Subrata	Examine mechanism of electron transfer Leishmania major (LmAPX) by site directed mutagenesis	DBT

8	Dr. Partha Chakraborty, Misra Dr. Mridula & Dr. Sankha Chattopadhyay, Scientific Officer, BRIT, VECC, , Kolkata	Octreotide Derivative Modified Lipid Nanoparticles : Preparation, Radiolabeling & Applications As Tumor Targeted Chemotherapeutic Agents/Radiopharmaceuticals	BRNS, DAE
9	Kundu Dr. Sangeeta	Experimental and computational study of the aggregation pathway of alpha synuclein	SERB, DST
10	Natarajan Dr. Ramalingam	Metal-Organic Frameworks (MOFs) from Bile Acid Derivatives as Carriers for Drug Delivery	SERB, DST
11	Das Dr. Indrajit	N-Heterocyclic Carbene Catalyzed Diastereoselective Synthesis of Substituted Cyclohexanones from Modified Carbohydrates : Application to the Total Synthesis of Conduramines and Phenanthridone Alkaloids	DST
12	Chakrabarti Dr. Partha	Insulin and Nutrient Mediated Regulation of Adipocyte Metabolism	DST

PROJECT COMPLETED IN 2013-14

Sl. No.	Project Investigator	Project Title	Funding Agency
1	Giri Dr. Ashok K	PRAMA : Probablistic Risk Assessment Modellin to inform groundwater Arsenic mitigation	UKIERI (UK-India Education and Research Initiative)
2	Kabir Dr. Syed Nazrul	Characterization of anti-HIV properties of Acaciaside-B and pre-clinical studies towards its development as a potential microbicide-spermicide formulation	DBT
3	Roy Dr. Syamal	New tools for monitoring drug resistance and treatment response in Visceral Leishmaniasis in the Indian subcontinent	DST-European Union
4	Saha Dr. Krishna Das	Study on Leishmanial integral membrane proteins(s) induced growth inhibition of melanoma cells with exploration of the mechanism involved and characterization of the bioactive protein component(s)	ICMR
5	Mondal Dr. Nirup Bikash	Chemical tranformation of Andrographolide for enhancement of Anticancer Efficacy	DST, WB
6	Bhattacharya Dr. Debasish	Figer-printing and Biochemical Characterization of the Drug Sterodin	Union Drug Company
7	Giri Dr. Ashok K	Comparative Genomic Hybridization and MitoChip Array Analysis of Individuals with and without Arsenic Induced Skin Lesions	ICMR

EVENTS OF CSIR-IICB

Date	Salient details
April 02, 2013	**CSIR-IICB:** Celebrated its 57th Foundation Day on April 02, 2013. Prof. Samir Bhattacharyya, Emeritus Professor, Visva-Bharati and former Director, CSIR-IICB, Kolkata was present in the occasion as Guest-in chief. Prof. Avadhesha Surolia, Professor of Biophysics, IISc, Bangalore and former Director, NII, New Delhi delivered the 25th Dr. J.C. Ray Memorial Lecture.
June 18, 2013	**CSIR-IICB:** Organized a one day Seminar on Facets of Insilico Chemical Biology for Novel Therapeutics (FICBNIT-2013).The main objective of this seminar was to highlight various aspects of Insilico Chemical Biology. The seminar was designed with three scientific sessions with the lectures covering spectrum from Cheminformatics to Structural Biology. The spectrum contained a package of eight lectures encompassing facets of Insilico Chemical Biology. The programme started with the welcome address by Dr. Chitra Dutta, Chief Scientist, CSIR-IICB. Dr. G.N. Sastry, Sr. Principal Scientist, CSIR-IICT, Hyderabad, delivered the Keynote address entitled, "Specificity in Drug-Receptor Interactions".
July 8 - 15, 2013	**CSIR-IICB:** Organized A "Scientific Communication Skills development Workshop" delivered by British Council for the Ph.D. Course Work students .. About 59 students (in three batches) participated in this programme. Besides the laboratory-based research work, 'Effective Scientific communication skills' are very crucial for PhD students for communicating research work in scientific conferences and also to develop writing skills needed for report and paper writing. The course content for this workshop was comprised of judicious blend of lectures, discussions, and group-exercises. Presentation of seminar, paper writing, and proposal writing along with other standard format needed for communication skill development were included in this specially designed course.
July 20 , 2013	**CSIR-IICB:** Organizes one day Symposium on Leishmaniasis. The meeting was attended by the doctoral students of different institutes in and around Kolkata. The Ph.D. students presented their own work. Professor Siddhartha Roy, Director, CSIR-IICB addressed the gathering and gave away the prizes for 1st, 2nd and 3rd positions to poster presentation, an event

	which was held during "100 years of Antimonials, an international congress".
September 09, 2013	**CSIR-IICB:** Organized an Orientation Program for newly recruited Ph.D Research Fellows. About 68 students participated in this program. Welcome address was delivered by Prof. Siddhartha Roy, Director,CSIR-IICB. In his inspiring speech to the students, Prof. Roy emphasized the balanced approach for developing creativity and imagination in science, the two crucial components for inventors. Dr. Partha Chakrabarti, a newly recruited scientist shared his experiences and views of PhD course work in abroad. Head Academic Affairs Division, Head HRG, Lab-Coordinator, AcSIR and Chairman Academic affairs committee were present in this program. Necessary guidelines about PhD programme and the PhD Course Work were informed by the Head Academic Affairs Division & Head HRG. AcSIR guidelines were also introduced to the students by the Lab Coordinator. In the panel discussion, Prof. S. Roy, Dr. Samit Adhya, Dr. Syamal Roy, Dr. Keya Chaudhuri, Dr. Asish Banerjee, Dr. Uday Bandyopadhyay, Dr. Rupak Bhadra and Dr. P. Jaisankar were present. Prof. S. Roy coordinated the session. The discussion was immense helpful to the inducting students.
September 26, 2013	**CSIR-IICB:** Observed 71st CSIR Foundation Day in the Institute Auditorium. The welcome address was delivered by Director, CSIR-IICB, Prof. Siddhartha Roy. Inaugural address was delivered by Chief Guest Prof. Souvik Bhattacharyya, Vice-Chancellor of Jadavpur University. Foundation day lecture "Networks in Biology" was delivered by Special Guest Prof. Shekhar C. Mande, Director, National Centre for Cell Science, Pune.
October 23, 2013	**CSIR-IICB:** Signs MoU with Bangalore based Narayana Health to work together to establish joint collaborative research in niche areas of translational research by utilizing the facilities and expertise in both the institutes. A team of eight specialists from Narayana Health visited CSIR-IICB to sign this MoU. Dr. I. Rupert, Chief Medical Services, Rabindranath Tagore International Institute of Cardiac Sciences, Kolkata and Mr. Kaushik Bhattacharya, Administrative

	Officer, CSIR- IICB, Kolkata signed the umbrella MoU in the presence of Prof. Siddhartha Roy, Director and other senior scientists of CSIR-IICB.
November 29-30, 2013	**CSIR-IICB:** Organized NEUROUPDATE-2013 jointly with Calcutta National Medical College & Hospital. Various scientific discussions were aimed towards different topics like Brain Imaging, Traumatic Brain Injury, Mitochondrial Diseases, Neuropathic Pain and Dementia.
March 6-8, 2014	**CSIR-IICB:** Organizes the 7th RNA group meet of the Indian RNA biologists at Dr. J.C. Ray auditorium. This RNA group, formed by few RNA fanatics, had its first meeting in 2003 in Bangalore and served its purpose of popularizing RNA research among young researchers in India. This meeting was an excellent gathering of several leaders in RNA research in India that included Prof. Umesh Vashney, Prof. Usha Vijayraghavan and Prof. Saumitra Das from IISc, Bangalore, Prof. Tapas Kundu from JNCASR, Bangalore and Prof. Sudha Bhattacharyya of JNU, New Delhi. The well known virologist Prof. Sahid Jameel from ICGEB, New Delhi who is also the present CEO, DBT-Wellcome Indian Alliance, had also attended this gathering and presented a talk. There were about one hundred participants in this meeting representing almost all major research institutions and universities.
March 31, 2014	**CSIR-IICB:** Organized one day meet on Macromolecular Structures, Methods & Mechanisms. Prof. Bablu Bhattacharyya, Bose Institute presided over the meeting. Prof. Siddhartha Roy, Director, CSIR-IICB delivered the lecture on Mechanism of Macromolecular Structures and Functions.

No.	Date	Speaker	Title
1.	11.04.2013	Dr. Manavendra Singh, Dept. of Cell & Dev. Biology, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA	**"Role of Semaphorin3D in Cardiovascular Development and Disease"**
2.	10.05.2013	Dr. Prabhat Mandal McKusick–Nathans Institute of Genetic Medicine Johns Hopkins University School of Medicine Baltimore, MD 21205, USA	**Human L1 retrotransposon and its role in processed pseudogene formation**
3.	06.06.2013	Prof. Kunal Ray, Associate Director, AcSIR, New Delhi	**Update on AcSIR**
4.	05.08.2013	Dr. Dwaipayan Bharadwaj, Sr. Principal Scientist, CSIR-IGIB, New Delhi	**Life-style Disease : Gene, environment or both**
5.	24.09.2013	Dr. Rahul Das, University of California, Berkeley, USA	**Structural basis for conformational coupling across the plasma membrane in activation of EGFR**
6.	03.10.2013	Dr. Priyabrata Mukherjee, Professor of Pathology, Peggy and Charles Stephenson Endowed Chair in Cancer Laboratory Research, Oklahoma, USA	**Nanomedicine : From Discovery to Therapeutics.**
7.	23.10.2013	Dr. Uttiya Basu, Asst. Professor, Department of Microbiology & Immunology, Columbia University, New York, USA	**Non-coding RNA processing mediated regulation of antigen receptor diversification mechanisms.**
8.	28.10.2013	Dr. Dhruba Chattoraj, Head, Control of DNA Replication Section Centre for Cancer Research NCI, NIH, USA.	**Transition from a plasmid to chromosomal mode of replication in a bacterium with divided genome, vibrio cholerae.**
9.	06.11.2013	Prof. Tapas K Kundu, Head, Molecular Biology & Genetics Unit, JNCASR, Jakkur, Bangalore	**Epigenetic regulations of disease and differentiation : probed by means of Chemical Biology**
10.	27.11.2013	Dr. Kalyaneswar Mandal,	**Total chemical synthesis and**

		Dept. Of Biochemistry & Molecular Biology, The University of Chicago, USA	**crystal structure of a heterochiral (D-protein antagonist plus VEGF-A) protein complex.**
11.	18.12.2013	Dr Sudipto Roy, Associate Professor, Institute of Molecular & Cell Biology, Singapore	**Cilia and Ciliopathies**
12.	13.01.2014	Dr. U. Mabalirajan, MBBS-Ph.D., Scientist-Fellow, CSIR-IGIB, New Delhi	**Is airway epithelium an innocent victim or an important determinant in Lung Diseases?**
13.	17.01.2014	Dr. Anupam Hazra, Thomas Jefferson University Farber Institute of Neurosciences, Philadelphia, USA.	**ß-adrenergic modulation of epileptiform dynamics in vitro : molecular, cellular and circuit mechanisms.**
14.	31.01.2014	Dr. Anupam K Chakravarty, Dept. of Molecular Biology, Sloan Kettering Institute, New York, USA.	**Rewriting the rules of end joining : enzymatic ligation of polynucleotide 3'phosphate and 5'-hydroxyl ends by RtcB.**
15.	13.02.2014	Dr. Animesh Dhar, Associate Professor, University of Kansas Medical Centre, USA.	**Novel epigenetic target in pancreatic cancer**
16.	17.02.2014	Dr. Sanjib Bhattacharyya, Research Associate, Institute for Integrated Cell-Material Science, Kyoto University, Japan	**Nanomaterials at the biological interface and creating artificial identity matter**
17.	19.02.2014	Dr. Sanjta Banerjee, Post-Doctoral Fellow, European Molecular Biology Laboratory, Heidelberg, Germany	**Three to tango : the environment, the host and the pathogen**
18.	21.02.2014	Dr. Kaushik Mitra, Director, Pharmacodynamics, Pharmacokinetics & Drug Metabolism, Merck & Co., Inc., Kenilworth, USA.	**Drug in, Drug out : The interplay of Chemistry, Biology and Biochemistry**
19.	21.02.2014	Dr. Nivedita Chatterjee, Vision Research Foundation,	**HIV Clade specific differences in immunity at the retina : modulating the innate response.**

		Sankara Nethralaya, Chennai.	
20.	03.03.2014	Prof. Subhash C. Basu, University of Notre Dame, Dept. of Chemistry & Biochemistry, USA	**Induction of Apoptosis in Carcinoma Cells by Inhibitors of DNA and GSL Biosynthesis**
21.	06.03.2014	Dr. Debajit Biswas, Dana-Farber Cancer Institute, Boston, USA	**The Role of EGF-Family Receptor Signaling-Induced Nuclear Factor-kB(NF-kB) Activation in Human Breast Cancer.**

COLLOQUIUM LECTURES

No	Date	Speaker	Title
1.	18.04.2013	Dr. Nanda Ghoshal, CSIR-IICB, Kolkata	**Introduction of Chemiinformatics in CSIR-IICB and Journey Further**
2.	29.07.2013	Dr. Keya Chaudhuri, CSIR-IICB, Kolkata	**Journey of Vibrio cholerae in vivo : modulation of bacterial and host response in model systems**
3.	19.12.2013	Dr. Syamal Roy, CSIR-IICB, Kolkata	**24-Summers : Peeling the Onion**
4.	20.01.2014	Dr. Surojit Ghosh, Ramanujan Fellow, CSIR-IICB, Kolkata	**Development of various platforms for reconstitution of Biological Events**
5.	29.01.2014	Prof. Christian Engwerda, Immunologyf & Infection Laboratory, Queensland Institute of Medical Research, Queensland, Australia.	**Immune regulation during visceral leishmaniasis**
6.	10.02.2014	Prof. Joel P. Schneider, Chemical Biological Laboratory, National Cancer Institute, National Institute Health, USA.	**The evolution of anticancer peptides from hydrogel materials.**

SCIENTIFIC PRESENTATION

No.	Date	Speaker	Title
1.	18.11.2013	Dr. John Gebler, Waters Corporation - Milford	**Use of Mass Spectrometry in proteomics and for Biopharmaceuticals**
2.	02.12.2013	Dr. Anirban Mahapatra, Asst. Director, Editorial Development of ACS Chemical Neuroscience, ACS Medicinal chemistry Letters & Dr. Jitesh Soares, ACS Synthetic Biology & Managing Editor of ACS Chemical Biology and ACS Chemical Neuroscience	**An overview on ACS Biomedical Research Publications.**
3.	03.12.2013	Dr. John Hann, UVP LTD, UK	**Optimizing Gel, Blot and Animal Imaging**
4.	22.01.2014	Dr. Catherine McIntosh Goodman, Senior Editor of Nature Chemical Biology	**Publishing at Nature Chemical Biology**

CSIR-IICB Foundation Day, April 02, 2013

Academic Affairs Division

Dr. Keya Chaudhuri (Head), Dr. Siddhartha Majumdar, Ms Debasree Das, Ms Mahua Bhattacharya, Md. Ayub Shah

The management and co-ordination of activities related to the academic affairs of the institute is the primary focus of this Division. The activities of this division were successfully carried out in functions related to CSIR- IICB PhD programme including co-ordination of CSIR-IICB PhD Course Work program and also academic /administrative management of AcSIR activities in this institute. The CSIR-IICB Academic Affairs Committee constituted by the Director , acts as an Advisory Committee to the Academic Affairs Division in connection with CSIR-IICB PhD program including AcSIR programme .

CSIR-IICB PhD Course Work: To educate and train in multidisciplinary areas, CSIR-IICB offers a mandatory PhD course work for the Research Fellows in their first year, taught by faculty members of in-house as well as from other Institutes/Universities. The framing of the course content & guidelines is designed in the line of AcSIR courses.

The existing CSIR-IICB PhD Course Work programme constitutes basic and advanced courses. The basic course is for bridging the gap between M.Sc. and PhD. The advanced course comprises of frontline areas of research and covers research methodology and review of current literature.

The course comprises of three levels:

Level 100 [basic courses]: Biostatistics, Computation/bioinformatics, Basic Chemistry/ Introduction to Chemical Biology, Research Methodology, Communication/ethics/safety.

Level 200: Biotechniques / Advanced Organic Chemistry, Biology of Macromolecules, Biology of Infection, Protein Science and Proteomics, Cell Biology and Cell signaling, Bioinformatics, Molecular and Cellular Immunology, Advanced Analytical Chemistry, Recent Developments in Asymmetric Catalysis, Advances in Nanoscience and Nanotechnology , Green Chemistry.

Level 300: Cancer Biology, Cell and Tissue Engineering, Microbial pathogenesis, Neurobiology, Genomics, Eukaryotic Gene Regulatory Mechanisms, Chemical Biology, Synthetic & Systems Biology, Understanding Glycan structure & their role in Chemical Biology, Modern Drug Discovery & Design, Supramolecular Chemistry, Total Synthesis, NMR Spectroscopy, Natural Products and Drug Discovery and Seminar & Critical Appraisal.

HUMAN RESOURCE GROUP (HRG)

Dr. Siddhartha Majumdar and group

Human Resource Group (HRG) of CSIR-IICB promotes professional Human Resources Management in this institute by evolving and implementing HR development plan.
The major area where HR group contributes: Activities related to AcademicAdministration concerning RFs & RAs, PhD program, student affairs, Summer/winter Training Programme, and different training programs.
The functions include: oversight, guidance and co-ordination of different HR development program & talent-management activities.

Activities, Guidance and Initiatives:

Student Affairs

- Coordination of NET JRF entrance interview
- Organization of Orientation programme for PhD students
- Maintenance academic databases of PhD students and PG summer/winter trainees
- Content development for Research fellow's handbook (orientation booklet),course catalogue, Teachers Guideline, academic Calendar and different guidelines related to PhD program
- Scrutinisation applications of RFs & RAs related to fellowship, travel grant etc.
- PhD registration related guidance
- PhD course work and PhD program: Management of Class schedule, semester examinations, evaluation, seminar, publication of result & certificates, Awards.
- Organization of science communication and presentation skill development program for the PhD course work students

Highlights (2013-14)

Number of existing Research Fellows & Associates (CSIR/UGC/DST/DBT/ICMR/TLP)	**:**	**403**
Number of Project Assistants	**:**	**56**
Number of Summer Trainee/Project Trainee	**:**	**119**
Total number of Course work students	**:**	**57**

Summer Training / Project Work / Dissertation Work

HRG coordinates the Summer Training Programme for the eligible Post Graduate students of different Universities, Institutions and Colleges for partial fulfilment of their degrees. The aim is to let young minds feel the thrill and excitement of science by working on a project requiring application and critical appreciation of scientific principles. It also aims at active participation in the learning process through experimentation and putting into practice the knowledge acquired in the classrooms.

The summer program is primarily designed to provide them the opportunity to do basic research in top-notch research areas, in a supportive learning environment with plenty of interaction with graduate students and faculty. Detailed guidelines are made available in CSIR-IICB website.

Training & Workshop (Inter & Intra)

Name of Suitable Scientists/Officers are recommended to the Director, CSIR-IICB for consideration of their nomination in different training programme /workshop organized by CSIR-HRDC and also in other National level institutes/organizations. HRG also organizes customized professional /educational training programme and maintained networking with other organizations / agencies/ academic institutes.

[a] Training programs organized by HRG-IICB:

- A "Scientific Communication Skills development Workshop" delivered by British Council for the CSIR-IICB PhD Course Work students from 8th to 15th July, 2013 was organized by HRG at CSIR-IICB. About 59 students (in three batches) participated in this programme**.** Besides the laboratory-based research work, the 'Effective Scientific communication skills' are very crucial for PhD students for communicating research work in scientific conferences and also to develop writing skills needed for report and paper writing. The course content for this workshop was comprised of judicious blend of lectures, discussions, and group-exercises. Presentation of seminar, paper writing, and proposal writing along with other standard format needed for communication skill development were included in this specially designed course.
- An Orientation Program for newly recruited CSIR-IICB Ph.D Research Fellows was organized on 9th September, 2013 at CSIR-IICB. About 68 students (2013-14 Course work batch) participated in this program. Welcome address was delivered by Prof. Siddhartha Roy, Director, CSIR-IICB. In his inspiring speech to the students, Prof. Roy emphasized the balanced approach for developing creativity and imagination in science, two crucial components for inventors. Dr. Partha Chakrabarti, a newly recruited scientist shared his experiences and views of PhD course work in abroad. Head Academic Affairs Division, Head HRG, Lab-Coordinator, AcSIR and Chairman Academic affairs committee were present in this program. Course catalogues, Academic Calendar, weekly schedule, published for this purpose were provided to the course work students and the faculty members. Some important guidelines about the PhD Course Work were informed by the Head Academic Affairs Division & Head HRG. AcSIR guidelines were also introduced to the students by the Lab Coordinator. In the panel discussion, Prof. S. Roy, Dr. Samit Adhya, Dr. Syamal Roy, Dr. Keya Chaudhuri, Dr. Asish Banerjee, Dr. Uday Bandyopadhyay, Dr. Rupak Bhadra and Dr. P. Jaisankar were present. Prof. S. Roy coordinated the session. The discussion was immense helpful to the inducting students.

[b] Training Programme: Nominated/recommended for participation:

- Sri Sandip Kundu, T.A. and Ms. Debasree Das, T.A. were nominated for participation in 'Orientation Training Programme for Technical Personnel III conducted by CSIR-HRDC' held from 08 12 April, 2013, at CSIR-HRDC, Ghaziabad.

- Sri Bisweswar Das Asst. (S&P) Gr. I and Sri A. B. S. Roy Asst. (S&P) Gr. I and Sri S. Banik, Tech. were nominated for participation in the 'Programme on Supply Chain Management in R & D Organisation and CSIR Purchase Procedure' for SOs(S&P) SPAs held at CSIR-HRDC, Ghaziabad from 11 15 November, 2013,

Associated Members: Ms. Debasree Das; Md. Ayub Shah

COMPUTER DIVISION

Dr. Chitra Dutta, Dr. Asoke Dasgupta, Mr. Pradeep Sypureddi, Mr. Sujit K. Majumdar, Mr. Prahlad Das

Computer Division is backbone of the CSIR-IICB which provides various Computing and Network services through Information & Communication Technologies for its Staff members including Scientists, Technical and Administrative Staffs.

The Division helps in providing support to Desktop and Laptop Computers, Printers, Scanners, Software and Network infrastructure time to time along with setup, maintenance and support.

The Division also provides secured network services including the design of campus wide LAN/WAN solutions and internet /intranet solutions besides providing computing services to ongoing R&D projects and conducting periodical training programs. The IT group has been in the forefront of deploying information technologies to help our scientists to be in their chosen area of research.

The Division has extended its service to 1000 users with 100 Mbps ILL connection from NKN. The present CSIR-IICB Network facility management system has been upgraded with latest technologies like Radius Server, Webmail, Band width management and RFID. besides these, 300 desktop PC`s, laptops and printers have been procured and distributed to the Staff members including Scientists, Technical and Administrative Staff.

Technical Activities:

- Wired and Wireless Networking Solutions & Services
- Internet Connectivity to all Scientists, Staff and Students of CSIR-IICB
- Cyber Security Solutions
- Infrastructure Procurement, Installation and Maintenance
- ERP Storage Solutions and Backups
- Web Services include Website / Bulletin board / E-Resource Access

- Electronic Display System Services for various types of Official works
- User Support Services including Software and Hardware installations , printers , scanners and all other computer related devices
- E-mail Service for CSIR-IICB Staff members including Scientists, Technical and Administrative Staffs and Students
- Technical support in Video Conferencing device
- Design and Maintenance of Intranet and CSIR-IICB Websites (www.iicb.res.in)

Facilities:

- High performance Servers managing CSIR-IICB services like Web, DHCP, DNS and Proxy
- Email services for Staff and Students
- WiFi Internet Management System
- VPN Network Service Management System
- SAN and ERP application Servers Management System
- Network Management System with high speed Routers and Switches
- Network Security Management System with Firewalls and Radius servers

New Initiatives:

- The CSIR-IICB Salt lake campus and CSIR-IICB Jadavpur campus inter connected as a fiber extended LAN
- The WiFi System has been introduced at IICB Campus as well as at NIPER Office and NIPER Hostel with latest WIFI MIMO Technology
- Developing and Hosting of research conference websites
- Display System introduced for various types of Official works with instance basis

Library & Documentation Division

Knowledge Resource Centre (KRC)

Dr S. Roychoudhuri , Mr. N. C. Ghosh, Mrs. P. Chatterjee, Mr. S.K. Naskar, Mrs. S. Ganguly, Mr. M. Halder, Mr. S. Nath & Mr. Asoke Ram,

The Division has marked growth in collection, systems, facilities and services during the period under review and has been providing constant supports to its users.

Collections	Up to 31.03.2014
Books (including Hindi)	14140
Journals (online only)	175
Bound volumes	33860
Science-Direct (Back files) (http://www.iicb.res.in/bkfiles_library.html)	202 journals full text up to 1994
Annual Reports	3932
Thesis (CDs)/online	214
Newspapers (English, Bengali & Hindi)	3

National Knowledge Resource Consortium (NKRC), formerly CSIR E-Journal Consortium (http://124.124.221.7/ejournal/ejournalhome1.htm) is a CSIR Network Project implemented by NISCAIR providing access to full text for thousands of exceptional STM Journals and online databases.

Various services have been rendered by the division during the period. Some of such services resented here in quantities

Services	Up to 31.03.2014
Reading Room & E-journals section accessed	4780 users
Photocopy services rendered	4890 pages
Circulation services (Issue/Return)	943 documents
Resource Sharing (Electronic Document Delivery Service)	353 Articles
Walk in users	53

Online Public Access Catalogue (OPAC) is available at http://14.139.223.107:8080/webopac/html/SearchForm which has been utilized as a very useful tool for searching library holdings

Open Access Repository (IR) maintaining in E-prints for archiving peer reviewed journals articles, Conference papers, Theses and other research documents produced by CSIR-IICB researchers. This can be viewed in at: http://www.eprints.iicb.res.in. So far 1444 documents have been uploaded in the repository.

CSIR-IICB is the mentor of NIPER, Kolkata and NIPER- Knowledge Resource Centre has been functioning in the library premises. During this period a good number of text & reference books have been added in its collection. Total collection of books is 922 till 31/03/2014. It has renewed its subscription to **'SciFinder'** for the period under review and login id & password has been provided to all the NIPER students and member of faculties.

Engineering Services Unit

Dr. S. N. Kabir (Head), Mr. U. K. Barua, Mr. Sandip Saha, Mr. C. Debdas, Mr. S. Ray, Mrs. N. Bage, Mr. D. Banik, Mr. S.K. Ghosal, Mr. R. Das, Mr. A. Das, Mr. A. Paul, Mr. P. K. Chanda, Mr. G. Malik, Mr. S. N. Mondal, Mr. S. Pradhan, Mr. S. Biswas, Mr. S. R. Tudu, Mr. S. Nath, Mr. S. Majumder, Mr. U. Roy, Mr. A. Karmakar, Mr. A. Pal

The Engineering Services Unit (ESU) is comprised of the civil engineering, electrical engineering and air-conditioning & refrigeration sections.

Civil Engineering Section

The Civil Engineering Section renders services in board areas of infrastructure development, new construction, renovation of laboratories and common facilities, maintenance of campus, sewerage and drainage systems, cleaning and house-keeping work and also management for the development of CSIR-IICB second campus at Salt lake.

Electrical Engineering Section

The electrical engineering section renders essential services and infrastructure support to R&D activities and other public utilities of the Institute. The section maintains and supplies steady power supply through 6.6 MVA power sub-station of the institute and monitors for uninterrupted power supply system from CESC source. The section also supplies emergency power through available DG Sets and conducts its operation & maintenance.

Air-conditioning and Refrigeration Section

This section looks after the AC facility in all the laboratories, library, auditorium, administrative wings and most importantly the animal house. It also takes care of the refrigerators and deep freezers in the laboratories, maintain the cold rooms and constant temperature rooms and is also responsible for the maintenance of the lifts.

Central Instrumentation Division

Dr. D. Bhattacharyya (Head), Sri T.P. Nandi, Sri R.N. Mandi, Sri S. M. Roy, Sri R. Vignesh

The Central Instrumentation Division of this institute so far offered maintenance of minor equipments that are used routinely in many laboratories together with selected facilities like photo-copying, spectrophotometry, lyophilization, medium speed/ultra centrifugation etc. To be honest, CSIR-IICB never had the orientation of having all major state of the art instruments under one roof and a uniform system of utilization of the instruments starting from feasibility studies, booking of the instruments, analysis of data and finally, interpretation of results. Even physical existence and potential applications of some of the instruments were not clear to scientists. To remove these difficulties and to ensure free access to users, all major instruments are being put under central instrumentation facility. This is also essential for optimum utilization of the instruments and giving maximum benefit to the researchers. At present, most of the instruments have been brought under the umbrella of this division and experienced technical persons are being allotted to operate them. In phases, hands on training for operation of the instruments will be offered to research scholars.

Division of Laboratory Animal Sciences

Dr. A. Konar (Head), Mr. S. S. Verma, Mr. A. Das Mr. R. Sarkar, Mr. A.Sardar. Mr. J. Middya, Mr. P. Middya, Mr. T. Sarkar, Mr. Lalu Sardar, Mr.G.Sardar , Mr. S. Midya

CSIR-IICB with its CPCSEA registered animal facility (Registration No 147/1999/CPCSEA, Date: 22. 07. 1999) is a podium for biomedical research going on in this institute, required for improvement of the quality of human life. This improvement stems in part from progress in ameliorating human disease and disability, in part from advances in animal health and veterinary medicine, and in part from the enlargement of our understanding of complex and intricately connected biological systems of human and animal physiology and its disorders. Besides that, work with living animals is vital to continue progress in many areas of clinical and basic research. Though there are alternatives in the form of cell and tissue culture, lower animal study or computer simulation, the use of whole animal is irreplaceable. The mission of the CSIR-IICB animal facility is to provide animals of required specification for research projects of this Institute as well as to carry out a continuous research on laboratory animals. Through research on these animals, scientists are in search of cures and preventions for a number of human and animal ailments. The other major responsibility of this facility is to ensure the persuasion of 3Rs of animal experimentation and the ethical principles of animal use are followed as per CPCSEA guidelines.

The facility maintains a colony of mice (Balb/C), rats (Sprague-Dawley), hamster (Golden), rabbits (New Zealand) and guinea pigs (English). Two new strains (Swiss albino and C57BL/6) have been introduced in the breeding facility. The in-house breeding colony provides animals for the institutional research projects and housing facility for the experimental animals. Moreover, some other research institutes who have their CPCSEA registration, also collect animals from the facility for their IAEC approved research projects.

The animal carcasses and other biological wastes, used syringes and needles, etc. are disposed through a Pollution Control Board (Govt. of India) approved agency. This procedure has been proved to be user friendly, hygienic as well as cost effective

At any given point of time, CSIR-IICB Animal house maintains about 4000 Rats, 4500 mice, 2200 hamsters, 225 rabbits and 50 Guinea Pigs. The animals are maintained in a conducive environment (*i.e.* Room Temp. 24 , 2 ^{0}C ; relative humidity 55 – 60%; light and dark schedule 12:12 hrs; illumination 350 - 400 lux at 1 mt above the floor). The animals are provided *ad libitum* with balanced and sterilized diet in pelleted form, produced in-house.

A brief account of animal produced/supplied from the animal house in during this period is given in the following table

Statement of Production and Utilization of Animals during 2013-2014

Species	Stock on 1st April 2013	No. of animals		Total (A)	No. of animals issued		No. of animals		Total (B)	Stock (=A-B) on 31.03. 14
		Produced	Purchased		Produced	Purchased	Died in stock	Supplied to other institutes		
Mouse	858	3485	708	5051	2726	508	0	0	3234	1817
Rat	1130	1799	22	2951	2233	0	0	15	2248	703
Hamster	394	414	0	808	516	0	0	0	516	292
Rabbit	82	10	0	92	15	0	0	15	30	62
Guinea pig	50	0	0	50	0	0	45	0	45	05

Administration

General Administration

A wide range of functions are carried out by General Administration which cater to the life cycle of an Officer of the Scientific, Administrative and Technical Cadre encompassing manpower planning, cadre management, recruitment, role definition / allocation, skill assessment, workplace learning, career advancement, transfer, employee benefits, retirement, performance assessment etc. In addition Administration is also responsible for arrangement of all logistics and managing the day to day affairs of the Institute.

Finance & Accounts

This wing of administration is mainly concerned with keeping record of budgetary requirements, controlling & monitoring the expenditure and preparing budget for the Institute regarding plan & non-plan expenditure, which is about Rs.60-70 crores per annum. Keeping track of progressive expenditure of budget for every month, keeping financial records for Networked Projects, externally funded projects, disbursement of pension to pensioners, accounting and auditing files routed through Establishment, Purchase and other scientific divisions. TO Seek grant from outside bodies, *i.e.* UGC, ICMR, DBT *etc*., monthly remittance of P. Tax, I. Tax, Service Tax, etc. and incorporating entire vouchers of the Institute in administrative software. Through this entry, our Annual Accounts and Balance Sheet is generated for onward transmission to CSIR,HQ.

Stores & Purchase

The Stores & Purchase Division caters to the research and other requirement of CSIR-IICB. The annual procurement budget of CSIR-IICB is about Rs 500 million annually comprising of research consumables like chemicals, glass wares, plastic wares etc and various capital items. After successful implementation of online procurement and stores systems since 2007, the division had introduced web based ordering system from last year and continued successfully in the reporting year for Sigma products, Vendor Managed Inventory program, stock of consumable of companies like Fisher, SRL, Spectrochem, Merck, RFCL, JT Baker, Tarson, Axygen, Fermenta, Thermo, BD falcon, Invitrogen, Takara-clontech, MN, Gilson & Eppendorf Pipettes, Computer cartridges of HP, Corning and so on. The division assists scientists and other users to utilize their budget grant within the project deadlines. The division also undertakes the issue of total logistic chain of items from anywhere in the world to CSIR-IICB that are either purchased by CSIR-IICB or being sent as free gifts or samples. It also undertakes customs clearance with concessional customs duty within demurrage free clearing time from Kolkata Airport and Sea port. Adjustment of OB, replies to audit and other statutory authorities, assistance to accounts for bank re-conciliation are other activities performed by the division.

Official Language Activities of the Institute

Official Language in the Institute is being implemented with regular Hindi workshops, publication of Hindi patrika, Hindi quarterly meeting, Hindi week etc. The year 2013 saw many activities of the Official Language with workshop every quarter. Regular Hindi classes were arranged in the Institute wherein some students passed Hindi praveen & pragya examination conducted by the Home Ministry. On 30th May again 30 scientists were trained in unicode in a Hindi workshop. Hindi week was celebrated from 13th to 18th September 2013 in the Institute. During this week many competitions were

held in Hindi. On the 13th of September Hindi noting, drafting competitions were held. All the employees took part in these competitions.

A workshop was arranged for the administrative employees on the 16th September 2013. This workshop was conducted by Sri Naveen Prajapati senior Hindi Officer DVC. This workshop was on 'Unicode' in computers. In this workshop each participant was called to the computer and asked to type in unicode.

17th September 2013 saw the Hindi recitation competition. In this competition Sri Rustam Roy Assistant Director of Central Hindi teaching scheme Kolkata and Sri P. Paliwal senior Hindi Officer CGCRI were present as judges. The members of the Institute took active part in the competition.

Hindi day and closing ceremony of Hindi week was observed on 18th September and Dr. T.K. Dhar senior scientist chaired the programme. At the beginning Dr.Dhar introduced everybody with Rajbhasha activities in the Institute. He gave a speech on the Official language activities of the Institute. He applauded on the regular publication of 'Sanjeevani' patrika in the Institute. The chief guest of the programme was Dr. Shoma Bandopadhay Professor of Hindi department Calcutta University. She harped on the achievements of Hindi in Bengal where she reiterated that the first Hindi Patrika in the country published was “Dainik Jagran” from Bengal. Ms Nilam Sharma Anshu from Red F.M. channel of the radio was the special guest of the day. She gave a very friendly and appealing talk on Official Language and Hindi in general. Lastly the Administrative Officer Sri Kaushik Bhattacharya ended the programme with a vote of thanks. On 27th November, 2013 30 technical Officers were trained in Hindi workshop on unicode.






NATIONAL INSTITUTE OF PHARMACEUTICAL EDUCATION & RESEARCH (NIPER)-KOLKATA

AT

CSIR-INDIAN INSTITUTE OF CHEMICAL BIOLOGY (MENTOR INSTITUTE)

NATIONAL INSTITUTE OF PHARMACEUTICAL EDUCATION & RESEARCH (NIPER)-KOLKATA AT CSIR-INDIAN INSTITUTE OF CHEMICAL BIOLOGY (MENTOR INSTITUTE)

Establishment of NIPER-Kolkata: The National Institute of Pharmaceutical Education & Research-Kolkata (NIPER-Kolkata) was established as an Institute of National Importance by the Government of India through Act of Parliament (NIPER Act 1998 & NIPER amendment Act 2007). The Institute is presently housed at the CSIR-Indian Institute of Chemical Biology (CSIR-IICB) a premier Institute of the Council of Scientific & Industrial Research (CSIR), India, which is the Mentor Institute.

Objectives: The main objectives of NIPER-Kolkata are:

- To tone up the level of pharmaceutical education and research.
- To produce leaders in the field and provide opportunities for training of future teachers and research scientists for the industry and the profession.
- To be a centre for innovation in pharmaceutical sciences and technology.
- To encourage research and studies in new and emerging areas like discovery of pharmacologically active molecules, cellular and molecular biology, immunology and immunodiagnostics, recombinant DNA technology and monoclonal antibody technology, novel drug delivery systems, chemical and biochemical process technology, etc.
- To provide scientific basis for traditional medicines.

NIPER-Kolkata was inaugurated on November 05, 2007.

Since its inception the Institute has been conducting Masters' level programmes in three different disciplines, Medicinal Chemistry, Natural Products and Pharmacoinformatics, leading to M.S. (Pharm.) degree.

Admission of students in 2013-2014
Counselling for admission of students took place in NIPER-Mohali in the month of July, 2013.

Discipline	No. of students
Medicinal Chemistry	17
Natural Products	17
Pharmacoinformatics	16

The orientation programme for the students took place on 1st August, 2013 and the first year first semester classes commenced from 2nd August, 2013

Academic Programme

•Twenty nine Masters Students of the first batch who graduated in June, 2009 received their M.S. (Pharm.) degree scrolls in the first convocation held on 11th June, 2010.Thirty two Masters Students of the second batch who graduated in June, 2010 and the third batch of 40 students who graduated in June, 2011 received their degree scrolls in the second convocation held on 18th May, 2012.

•The fourth batch of 49 students, who graduated in June, 2012 and the fifth batch of 47 students, who graduated in June, 2013 received their degree scrolls in the third convocation held on 25th October, 2013.

•The sixth batch of 37 students is in their 4th semester and they will be graduating in June, 2014.

•The seventh batch of 49 students is doing their 2nd semester and will have their second semester end-term examination in June- July, 2014.

•A total of 500 books have been purchased by NIPER-Kolkata. The Institute subscribes for SciFinder.

Convocation

The third convocation held on 25th October, 2013 was presided over by Sri.Shambhu Kallolikar, IAS, Joint Secretary, Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, Govt. of India & Member Steering Committee of NIPER-Kolkata and Prof.Padmanabhan Balaram, Director, Indian Institute of Science; Bangalore was the Guest-in-Chief. 52 students received their M.S. (Pharm.) degree scrolls from Sri.Shambhu Kallolikar and forty four students were awarded their degrees in absentia.

Third Convocation

On the dais

The exhortation

Prof.P.Balaram delivering the convocational address

Sri. Shambhu Kallolikar delivering the Chairman's address

The degree recipients

Placement activities:

- Most of the students of the first four batches have been absorbed in the Industries, Colleges and Research institutes. A number of students are pursuing higher studies within the country as well as abroad. Placement was achieved for these students according to their options for employment in companies as well as in centres for teaching and higher studies.

- The campus placement for the fifth batch of students has been not up to expectation and only one got placed through campus interview. However, a number of the students have since secured openings in colleges, research institutes and industries.

- The placement activities for the sixth batch of students have been initiated and the placement brochure has already been brought out.

Events & activities

A) A six week workshop was conducted for the second year students by British Council to improve their language skill.

B) Each second year student is allowed to attend one scientific conference.

Foundation day

The NIPER-Kolkata foundation day was celebrated on 5th November, 2013 with scientific session in the forenoon and cultural programme in the evening.

The Faculty:

The faculty involved in teaching the M.S. (Pharm.) courses consists of visiting Teachers from Calcutta University, Jadavpur University, West Bengal State University at Barasat and West Bengal University of Technology and Scientists from Bose Institute, Central Research Institute of Ayurveda, Indian Association for the Cultivation of Science, Indian Institute of Chemical Biology, Institute of Post Graduate Medical Education & Research, and Saha Institute of Nuclear Physics and industries like TCG Life Sciences.

Staff and Officers:

NIPER-Kolkata does not have any permanent staff and officers. Retired persons have been appointed on contract basis for running the academic programme, administration, examination activities, and placement of students, students' hostel and other activities. The following are the officials:

Director, CSIR-IICB & Chairman, Advisory and Management Committees, NIPER-Kolkata	: Prof.Siddhartha Roy
Project Director	: Dr.Asish Kr. Banerjee
Advisor	: Dr.Pradip Kr.Sengupta
Registrar	: Dr.J.Rajan Vedasiromoni
Deputy Registar	: Dr.Tarun K. Dhar
Officer on Special Duty	: Dr.S.R.Sarkar
Student Counsellor	: Dr.Probal Chattopadhyay
Course Coordinators	: Dr.Anup Bhattacharjya
	: Dr.Chabbinath Mondal
	: Dr.Sibabrata Mukhopadhyay
Placement Cell Coordinator	: Dr.Sukhendu Bikas Mandal

Grants Received:

Financial Year	Grant received from Ministry
2013-2014	Rs.440.50 lakhs.

Library:

A total number of 922 books are available for NIPER students. All scientific journals are available online to NIPER students from the Mentor Institute library.

Hostel accommodation and facilities:

At present the NIPER-Kolkata students (total 86) are accommodated in the CSIR Scientists Apartment, 428 Prince Anwar Shah Road, Kolkata-700045. The hostels are self-sufficient with canteens, common rooms, facilities and desktop computers with wireless Internet service enabling access to all International and National Journals

Students visited at CSIR-IICB

PUBLICATION HIGHLIGHTS- 2013

Journal Impact Factor (IF) > 4.0

Sl. No.	*Research Publications*	*IF (Last 5 yrs Average)*
1.	Ganguly D., Haak S., Sisirak V., Reizis B. 2013.The role of dendritic cells in autoimmunity. NATURE REVIEWS IMMUNOLOGY, **13**(8) : 566-577	**35.851**
2.	Ghosh J, Bose M, Roy S, Bhattacharyya S.N. 2013. *Leishmania donovani* Targets Dicer1 to Downregulate miR-122, Lower SERUM Cholestrol, and Facilitate Murine Liver Infection.Cell Host Microbe, **13**,277-288.	**13.567**
3.	Mukherjee B., Mukhopadhyay R., Bannerjee B., Chowdhury S., Mukherjee S., Naskar K., Allam U.S., ChakravorttyD., Sundar S., Dujardin J.C., Roy S. 2013. Antimony-resistant but not antimony-sensitive Leishmania donovani up-regulates host IL-10 to overexpress multidrug-resistant protein 1. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, **110**(7) : E575-E582.	**10.583**
4.	Sen Santara S., Roy J., Mukherjee S., Bose M., SahaR., Adak S. 2013. Globin-coupled heme containing oxygen sensor soluble adenylate cyclase in Leishmania prevents cell death during hypoxia. PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA, **110**: 16790-16795	**10.583**
5.	Guha R., Gupta D., Rastogi R., Vikram R., Krishnamurthy G., Bimal S., Roy S., Mukhopadhyay A. 2013.Vaccination with Leishmania Hemoglobin Receptor-Encoding DNA Protects Against Visceral Leishmaniasis. SCIENCE TRANSLATIONAL MEDICINE, **5**: 202	**10.481**
6.	Ghosh D. 2013. Carcumin Nanoparticles : A Potent Oral Formulation in Preventing Alcohol Induced Liver Damage in Rat Model. JOURNAL OF HEPATOLOGY, **58** : S217-S217	**8.857**
7.	Bhattacharjya S., Nath S., Ghose J., Maiti G.P., Biswas N., Bandyopadhyay S., Panda C.K., Bhattacharyya N.P., Roychoudhury S. 2013. miR-125b promotes cell death by targeting spindle assembly checkpoint gene MAD1 and modulating mitotic progression. CELL DEATH AND	**8.395**

	DIFFERENTIATION, **20**(3) : 430-442.	
8.	Zareen N, Biswas S. C, Greene L. A. 2013. A feed-forward loop involving Trib3, Akt and FoxO mediates death of NGF-deprived neurons. CELL DEATH AND DIFFERENTIATION, **20**: 1719-1730	**8.394**
9.	Debnath S., Roy N.S., Bera I. Ghoshal N., Roy S. 2013. Indirect read-out of the promoter DNA by RNA polymerase in the closed complex. NUCLEIC ACIDS RESEARCH, **41**(1) : 366-377.	**8.055**
10.	Adak S., Pal S. 2013. Ascorbate Peroxidase Acts As a Novel Determiner of Redox Homeostasis in Leishmania. ANTIOXIDANTS & REDOX SIGNALING, **19**(7) 746-754.	**7.548**
11.	Mazumder A., Bose M., Chakraborty A., Chakrabarti S., Bhattacharyya S.N. 2013.A transient reversal of miRNA-mediated repression controls macrophage activation. EMBO REPORTS, **14**: 1008-1016	**7.396**
12.	Repudi S.R., Patra M., Sen M. 3013. WISP3-IGF1 interaction regulates chondrocyte hypertrophy. JOURNAL OF CELL SCIENCE, 126(7) : 1650-1658.	**6.375**
13.	Guha R., Chowdhury S., Palui H., Mishra A., Basak S., Mandal T.K., Hazra S., Konar A. 2013. Doxorubicin-loaded MePEG-PCL nanoparticles for prevention of posterior capsular opacification. NANOMEDICINE, **8**: 1415-1428	**6.236**
14.	Saha A., Mondal G., Biswas A., Chakraborty I., Jana B., Ghosh S. 2013. In vitro reconstitution of a cell-like environment using liposomes for amyloid beta peptide aggregation and its propagation. CHEMICAL COMMUNICATIONS, **49**(55) : 6119-6121.	**6.226**
15.	Pramanik M., Chatterjee N., Das S., Das Saha K., Bhaumik A. 2013. Anthracene-bisphosphonate based novel fluorescent organic nanoparticles explored as apoptosis inducers of cancer cells. CHEMICAL COMMUNICATIONS, **49** : 9461-9463	**6.226**
16.	Bhattacharjee P., Banerjee M., Giri A.K. 2013. Role of genomic instability in arsenic-induced carcinogenicity. A review. ENVIRONMENT INTERNATIONAL, Vol : **53** : 29-40.	**6.122**
17.	Chatterjee A., Chatterjee U., Ghosh M. K. 2013. Activation of protein kinase CK2 attenuates FOXO3a functioning in a PML-dependent manner: implications in human prostate cancer. CELL	**6.044**

	DEATH & DISEASE, Vol. 4 Article No.: e543.	
18.	Sanphui P., Biswas S.C. 2013. FoxO3a is activated and executes neuron death via Bim in response to beta-amyloid. CELL DEATH & DISEASE, **4**, Article Number: e625.	**6.044**
19.	Bindu S., Mazumder S., Dey S., Pal C., Goyal M., Alam A., Iqbal M.S., Sarkar S., Azhar Siddiqui A., Banerjee C., Bandyopadhyay U. 2013. Nonsteroidal anti-inflammatory drug induces proinflammatory damage in gastric Mucosa through NF-kappa B activation and neutrophil infiltration: Anti-inflammatory role of heme oxygenase-1 against nonsteroidal anti-inflammatory drug. FREE RADICAL BIOLOGY AND MEDICINE, **65**: 456-467	**5.969**
20.	Ghosh K., Sharma G., Saha A., Kar S., Das P.K., Ukil A. 2013. Successful Therapy of Visceral Leishmaniasis With Curdlan Involves T-Helper 17 Cytokines. JOURNAL OF INFECTIOUS DISEASES**, 207**(6) : 1016-1025.	**5.914**
21.	Chakrabarti P., Kim J.Y., Singh M., Shin Y.K., Kim J., Kumbrink J., Wu Y., Lee M.J., Kirsch K.H., Fried SK., Kandror K.V. 2013. Insulin Inhibits Lipolysis in Adipocytes via the Evolutionarily Conserved mTORC1-Egr1-ATGL-Mediated Pathway. MOLECULAR AND CELLULAR BIOLOGY,**33**(18) : 3659-3666.	**5.745**
22.	Vanaerschot M, Decuypere S, Berg M, Roy S, Dujardin JC. 2013. Drug-resistant microorganisms with a higher fitness - can medicines boost pathogens? CRITICAL REVIEWS IN MICROBIOLOGY, **39**: 384-394	**5.615**
23.	Kundu T.K., Jaisankar P., Roy S. 2013. International Symposium on Challenges in Chemical Biology : Toward the Formation of Chemical Biology Society of India. ACS CHEMICAL BIOLOGY**, 8**(4) : 658-661.	**5.478**
24.	Sarkar S., Dutta D., Samanta S.K., Bhattacharya K., Pal B.C., Li J.P. Datta K., Mandal C., Mandal C. 2013. Oxidative inhibition of Hsp90 disrupts the super-chaperone complex and attenuates pancreatic adenocarcinoma in vitro and in vivo. INTERNATIONAL JOURNAL OF CANCER, **132**(3):695-706.	**5.474**
25.	Naskar A., Singh R.,Thomas B., Chakraborty J., Dhanasekaran M., Manivasagam T., Mohanakumar K.P. 2013. Melatonin synergizes with low doses of L-DOPA to improve dendritic spine density in the mouse striatum in experimental Parkinsonism. JOURNAL OF PINEAL RESEARCH, **55**: 304-312	**5.451**
26.	Rudra D.S., Pal U., Maiti N.C., Reiter R.J., Swarnakar S. 2013. Melatonin inhibits matrix metalloproteinase-9 activity by binding	**5.451**

	to its active site. JOURNAL OF PINEAL RESEARCH, **54**: 398-405	
27.	Samanta S.K.., Dutta D., Roy S., Bhattacharya K., Sarkar S., Dasgupta A.K., Pal B.C., Mondal C., Mondal C. 2013. Mahanine, A DNA Minor Groove Binding Agent Exerts Cellular Cytotoxicity with Involvement of C-7-OH and -NH Functional Groups. JOURNAL OF MEDICINAL CHEMISTRY, 56(14): 5709-5721.	**5.383**
28.	Basak J, Chakraborty A, Katarkar A, et al. 2013 . Identification of two novel mutations in exon 20 of brca1 gene among Eastern Indian breast cancer patients. EUROPEAN JOURNAL OF CANCER , **49**: S423-S423	**5.257**
29.	Roy K., Ghosh M., Pal T.K., Chakrabarti S., Roy S. 2013. Cholesterol lowering drug may influence cellular immune response by altering MHC II function. JOURNAL OF LIPID RESEARCH, **54**: 3106-3115	**5.119**
30.	Berg M., Vanaerschot M., Jankevics A., Cuypers B., Maes I., Mukherjee S., Khanal B., Rijal S., Roy S., Opperdoes F., Breitling R., Dujardin J.C. 2013. Metabolic adaptations of Leishmania donovani in relation to differentiation, drug resistance, and drug pressure. MOLECULAR MICROBIOLOGY, **90**: 428-442	**5.099**
31.	Saha S., Dey S.K., Biswas A., Das P., Das M.R., Jana S.S. 2013. The Effect of Including the C2 Insert of Nonmuscle Myosin II-C on Neuritogenesis. JOURNAL OF BIOLOGICAL CHEMISTRY, **288**(11) : 7815-7828.	**5.023**
32.	Chatterjee D., Chaudhuri K. 2013. Vibrio cholerae O395 Outer Membrane Vesicles Modulate Intestinal Epithelial Cells in a NOD1 Protein-dependent Manner and Induce Dendritic Cell-mediated Th2/Th17 Cell Responses. JOURNAL OF BIOLOGICAL CHEMISTRY, **288**(6) : 4299-4309.	**5.023**
33.	Basu M., Roy S.S. 2013. Wnt/beta-Catenin Pathway Is Regulated by PITX2 Homeodomain Protein and Thus Contributes to the Proliferation of Human Ovarian Adenocarcinoma Cell, SKOV-3. JOURNAL OF BIOLOGICAL CHEMISTRY, **288**(6) : 4355-4367.	**5.023**
34.	Banerjee N., Paul S., Sau T.J., Das J.K., Bandyopadhyay A., Banerjee S., Giri A.K. 2013. Epigenetic Modifications of DAPK and p16 Genes Contribute to Arsenic-Induced Skin	**4.836**

	Lesions and Nondermatological Health Effects. TOXICOLOGICAL SCIENCES, **135**: 300-308	
35.	Ghosh M, Roy K, Roy S. 2013. Immunomodulatory effects of antileishmanial drugs. JOURNAL OF ANTIMICROBIAL CHEMOTHERAPY, **68** : 2834-2838	**4.686**
36.	Paul P., Kumar G. S. 2013. Targeting ribonucleic acids by toxic small molecules: Structural perturbation and energetics of interaction of phenothiazinium dyes thionine and toluidine blue O to tRNA(Phe) JOURNAL OF HAZARDOUS MATERIALS, **263**: 735-745	**4.679**
37.	Mandal S., Hossain M., Devi P.S., Kumar G.S., Chaudhuri K. 2013. Interaction of carbon nanoparticles to serum albumin: elucidation of the extent of perturbation of serum albumin conformations and thermodynamical parameters. JOURNAL OF HAZARDOUS MATERIALS, **248** : 238-245.	**4.679**
38.	Bhattacharyya D., Sinha R., Hazra S., Datta R., Chattopadhyay S. 2013. De novo transcriptome analysis using 454 pyrosequencing of the Himalayan Mayapple, Podophyllum hexandrum .BMC GENOMICS, **14**: 748.	**4.615**
39.	Saha P., Das B., Chaudhuri K. 2013. Role of 6-Gingerol in Reduction of Cholera Toxin Activity In Vitro and In Vivo. ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, **57**(9) : 4373-4380.	**4.606**
40.	Goswami S.K., Chakraborty P., Kabir S.N., Chakravarty B.N. 2013. Hyperhomocysteinemia mediated recurrent pregnancy loss: plausible role of bone morphogenetic protein. HUMAN REPRODUCTION, **28** : 368-369. Supplement: 1.	**4.596**
41.	Saha S., Mukherjee T., Chowdhury S., Mishra A., Chowdhury S.R., Jaisankar P., Mukhopadhyay S., Majumder H.K. 2013. The lignan glycosides lyoniside and saracoside poison the unusual type IB topoisomerase of Leishmania donovani and kill the parasite both in vitro and in vivo. BIOCHEMICAL PHARMACOLOGY, **86**: 1673-1687.	**4.529**
42.	Basak Sujit, Chattopadhyay K.2013.Fluorescence Correlation Spectroscopy Study on the Effects of the Shape and Size of a Protein on Its Diffusion Inside a Crowded Environment. LANGMUIR , **29**: 14709-14717	**4.416**
43.	Borah A, Paul R, Choudhury S, Choudhury A, Bhuyan B, Das Talukdar A, Dutta Choudhury M, Mohanakumar K.P. 201 3	**4.381**

	.Neuroprotective Potential of Silymarin against CNS Disorders: Insight into the Pathways and Molecular Mechanisms of Action. CNS NEUROSCIENCE & THERAPEUTICS, **19**: 847-853	
44.	Bhattacharya N., Mukherjee N., Singh R.K., Sinha S., Alam N., Roy A., Roychoudhury S., Panda C.K. 2013. Frequent Alterations of MCPH1 and ATM are Associated with Pr imary Breast Carcinoma: Clinical and Prognostic Implications. ANNALS OF SURGICAL ONCOLOGY, **20** : S424-S432	**4.308**
45.	Sinha R, Bhattacharyya D, Majumdar AB, Datta R, Hazra S, Chattopadhyay S. 2013. Leaf proteome profiling of transgenic mint infected with Alternaria alternata. JOURNAL OF PROTEOMICS, **93**: 117-132.	**4.302**
46.	Dey S.K., Bose D., Hazra A., Naskar S., Nandy A., Munda R.N., Das S., Chatterjee N., Mondal N.B., Banerjee S., Das Saha K. 2013. Cytotoxic Activity and Apoptosis-Inducing Potential of Di-spiropyrrolidino and Di-spiropyrrolizidino Oxindole Andrographolide Derivatives. PLOS ONE, **8**(3) Article No. : e58055.	**4.244**
47.	Mondal P., Datta S., Maiti G.P., Baral A. Jha G.N. Panda C.K., Chowdhury S. Ghosh S., Roy B., Roychoudhury S. 2013. Comprehensive SNP Scan of DNA Repair and DNA Damage Response Genes Reveal Multiple Susceptibility Loci Conferring Risk to Tobacco Associated Leukoplakia and Oral Cancer. PLOS ONE, 8(2) Article Number : e56952.	**4.244**
48.	Dutta A., Katarkar A., Chaudhuri K. 2013. In-Silico Structural and Functional Characterization of a V-cholerae O395 Hypothetical Protein Containing a PDZ1 and an Uncommon Protease Domain. PLOS ONE, **8**(2) Article Number : e56725.	**4.244**
49.	Pradhan S., Mallick S.K., Chowdhury R. 2013. Vibrio cholerae Classical Biotype Is Converted to the Viable Non-Culturable State when Cultured with the El Tor Biotype. PLOS ONE, 8(1) Article No. e53504.	**4.244**
50.	Ghosh A., Sarkar S., Mandal A.K., Das N. 2013. Neuroprotective Role of Nanoencapsulated Quercetin in Combating Ischemia-Reperfusion Induced Neuronal Damage in Young and Aged Rats. PLOS ONE, **8**(4), Article Number: e57735.	**4.244**
51.	De D., Chakraborty P.D., Mitra J., Sharma K., Manda1 S., Das A., Chakrabarti S., Bhattacharyya D. 2013. Ubiquitin-Like Protein from Human Placental Extract Exhibits Collagenase Activity. PLOS ONE, 8(3) Article No. e59585.	**4.244**

52.	Basu A., Jaisankar P., Kumar G.S. 2013. Binding of the 9-O-N-aryl/arylalkyl Amino Carbonyl Methyl Substituted Berberine Analogs to tRNA(phe) PLOS ONE, **8**(3) Article No. e58279.	**4.244**
53.	Maiti G.P., Mondal P., Mukherjee N., Ghosh A. Ghosh S., Dey S., Chakrabarty J., Roy A., Biswas J., Roychoudhury S., Panda C.K. 2013. Overexpression of EGFR in Head and Neck Squamous Cell Carcinoma Is Associated with Inactivation of SH3GL2 and CDC25A Genes. PLOS ONE, 8(5) Article Number: e63440.	**4.244**
54.	Chakraborty P., Goswami S.K., Rajani S., Sharma S., Kabir S.N., Chakravarty B., Jana K. 2013. Recurrent Pregnancy Loss in Polycystic Ovary Syndrome: Role of Hyperhomocysteinemia and Insulin Resistance. PLOS ONE, **8**(5) Article Number: e64446.	**4.244**
55.	Hellen E. H., Dana S. K., Zhurov B., Volkov E. 2013 Electronic Implementation of a Repressilator with Quorum Sensing Feedback. PLOS ONE, 8(5) **Article Number**: e62997.	**4.244**
56.	Roy R., Kumar D., Chakraborty B., Chowdhury C., Das P. 2013. Apoptotic and Autophagic Effects of Sesbania grandiflora Flowers in Human Leukemic Cells. PLOS ONE, **8**(8) Article Number: e71672.	**4.244**
57.	Chakraborti S., Bhattacharya S., Chowdhury R., Chakraborty P. 2013. The Molecular Basis of Inactivation of Metronidazole-Resistant Helicobacter pylori Using Polyethyleneimine Functionalized Zinc Oxide Nanoparticles. PLOS ONE, **8**(8) Article Number: e70776.	**4.244**
58.	Tripathy D., Haobam R., Nair R., Mohanakumar K.P. 2013. Engraftment of Mouse Embryonic Stem Cells Differentiated by Default Leads to Neuroprotection, Behaviour Revival and Astrogliosis in Parkinsonian Rats. PLOS ONE, **8**: e72501	**4.244**
59.	Chakraborty P., Banerjee S., Saha P., Nandi S.S., S harma S., Goswami S.K., Chakravarty B., Kabir S.N. 2013.Aspirin and Low-Molecular Weight Heparin Combination Therapy Effectively Prevents Recurrent Miscarriage in Hyperhomocysteinemic Women.PLOS ONE, **8** : e74155	**4.244**
60.	Datta De D, Datta A, Bhattacharjya S, Roychoudhury S. 2013. NF-kappaB mediated transcriptional repression of acid modifying hormone gastrin. PLOS ONE, **8**: e73409	**4.244**

61.	Banerjee D., Banerjee A., Mookherjee S., Vishal M., Mukhopadhyay A., Sen A., Basu A., Ray K. 2013. Mitochondrial genome analysis of primary open angleglaucoma patients. PLOS ONE, **8** : e70760	**4.244**
62.	Chowdhury S., Guha R., Trivedi R., Kompella U.B., Konar A., Hazra S. 2013. Pirfenidone nanoparticles improve corneal wound healing and prevent scarring following alkaliburn. PLOS ONE, **8**: e70528	**4.244**
63.	Chatterjee R., Halder P. K., Datta S. 2013. Identification and Molecular Characterization of YsaL (Ye3555): A Novel Negative Regulator of YsaN ATPase in Type Three Secretion System of Enteropathogenic Bacteria Yersinia enterocolitica. PLOS ONE, **8**: e75028	**4.244**
64.	Hellen E. H., Dana S. K., Kurths J, Kehler E, Sinha S . 2013. Noise-Aided Logic in an Electronic Analog of Synthetic Genetic Networks. PLOS ONE, **8** : e76032	**4.244**
65.	Kabir, A., Kumar, G.S. 2013. Binding of the Biogenic Polyamines to Deoxyribonucleic Acids of Varying Base Composition: Base Specificity and the Associated Energetics of the Interaction, PLOS ONE, **8**: e70510	**4.244**
66.	Das S., Banerjee B., Hossain M., Thangamuniyandi M., Dasgupta S., Chongdar N., Kumar G.S., Basu G. 2013. Characterization of DNA Binding Property of the HIV-1 Host Factor and Tumor Suppressor Protein Integrase Interactor 1 (INI1/hSNF5). PLOS ONE, **8**: e66581	**4.244**
67.	Sanphui P, Pramanik S.K, Chatterjee N, Moorthi P, Banerji B, Biswas S. C. 2013. Efficacy of Cyclin Dependent Kinase 4 Inhibitors as Potent Neuroprotective Agents against Insults Relevant to Alzheimer's Disease. PLOS ONE, **8** : e78842	**4.244**
68.	Das Abhi., Kumar, G.S. 2013. Binding of the plant alkaloid aristololactam-beta-D-glucoside and antitumor antibiotic daunomycin to single stranded polyribonucleotides. BIOCHIMICA ET BIOPHYSICA ACTA-GENERAL SUBJECTS, **1830**: 4708-4718	**4.204**
69.	Chatterjeee E., Chowdhury, R. 2013. Reduced Virulence of the Vibrio cholerae fadD Mutant Is Due to Induction of the Extracytoplasmic Stress Response. INFECTION AND IMMUNITY , **81**: 3935-3941	**4.062**

DOCTORATES FROM THE INSTITUTE 2013-14

S. No	Recipient's Name	Title of Thesis	University	Supervisor's Name	Division
1.	**Kaushik Bhattacharya**	Signal networking and T regulatory cells in cancer: Role of mahanine as a potential chemotherapeutic agent	CU	Dr. Chitra Mandal	Cancer Biology and Inflammatory Disorder
2.	**Suman Samanta**	A biophysical approach to identify active sites of isolated pure herbal compounds and cell signaling in cancers	CU	Dr. Chitra Mandal	Cancer Biology and Inflammatory Disorder
3.	**Sajal Samanta**	Role of sialoglycoproteins exclusively induced on host's erythrocytes in Indian Visceral Leishmaniasis	CU	Dr. Chitra Mandal	Cancer Biology and Inflammatory Disorder
4.	**Biswajit Khatua**	Status of sialic acids and their role on*Pseudomonas aeruginosa* in host-pathogen interaction	CU	Dr. Chitra Mandal	Cancer Biology and Inflammatory Disorder
5.	**Writoban Basu Ball**	Elucidating the role of uncoupling protein 2 of macrophage-mitochondria in host response to infection by the protozoan parasite, *Leishmania donovani.*	CU	Dr. Pijush K. Das	Infectious Diseases and Immunology
6.	**Gunjan Sharma**	Modulation of host signaling mechanisms by polysaccharide immunomodulator as a novel therapeutic approach against visceral leishmaniasis	CU	Dr. Pijush K. Das	Infectious Diseases and Immunology

7.	**Supriya Srivastav**	Elucidation of the signaling mechanisms involved in the subversion of host immune responses by intracellular parasite *Leishmania donovani*	CU	Dr. Pijush K. Das	Infectious Diseases and Immunology
8.	**Puja Paul**	Biophysical studies on the interaction of phenathiazinium dyes with deoxyribonucleic acids	JU	Dr. G.Suresh Kumar	Chemistry
9.	**Abhi Das**	Biophysical studies on the interaction of aristololactam-beta-D-glucoside and daunomycin with ribonucleic acids	JU	Dr. G.Suresh Kumar	Chemistry
10.	**Anirban Basu**	Synthesis of substituted derivatives of plant alkaloid berberine and studies on their DNA and RNA binding aspects	JU	Dr. G.Suresh Kumar and Dr. P. Jaisankar	Chemistry
11.	**Tulika Mukherjee**	Chemical investigation on bioactive substances isolated from medicinal plants	JU	Dr. P Jaisankar	Chemistry
12.	**June Ghosh**	Mechanism of altered lipid metabolism in *Leishmania donovani* infection and it's implication in disease pathogenesis.	JU	Dr. Syamal Roy and Dr. Suvendra Nath Bhattacharya	Infectious Diseases and Immunology and Molecular Human Genetics
13	**Arindam Maity**	Synthesis of Pyridine and Quinoline based novel N-heterocycles and Targeting activity against Macrophage-associated disease	JU	Dr. Nirup Bikash Mondal	Chemistry
14	**Munmun Sarkar**	In Quest of Drug Targets in Human Pathogens: An *In silico* approach	JU	Dr. Chitra Dutta	Structural Biology & Bioinformatics

15	**Sumit Bag**	Design, Development and Implementation of Novel *In silico* Data Mining, Clustering and Visualization Tools for Comparative Genome and Proteome Analysis	JU	Dr. Chitra Dutta	Structural Biology & Bioinformatics
16.	**Swarupa Ghosh (Nee Biswas)**	Vesicular biologically active compounds in combating mitochondrial oxidative damage in cellular diseases	CU	Dr. Nirmalendu Das and Dr. Sandhya Rekha Dungdung	Cell Biology and Physiology
17.	**Sangeeta Maity**	Microarray Analysis of Gene Expression Profile and Their Functionality in Hypertrophied heart	JU	Dr. Arun Bandyopadhyay	Cell Biology and Physiology
18.	**Ritesh Ranjan Pal**	Molecular and functional characterizations of the stringent response related *dksA* gene of *Vibrio cholerae*	JU	Dr. Rupak K. Bhadra	Infectious Diseases & Immunology Division
19.	**Sudipta Mitra**	Synthetic Studies of Benzannulated and Dibenzannulated Oxa, Aza Heterocycles	CU	Dr. Partha Chattopadhyay	Chemistry
20.	**(Mrs) Moumita Bose**	Biochemical Characterization of pseudoperoxidase from *Leishmania major*	JU	Dr. Subrata Adak	Structural Biology & Bio-informatics
21.	**Supratim Mukherjee**	Characterization of NAD(P)H cytochrome b5 oxidoreductase in *Leishmania major*	JU	Dr. Subrata Adak	Structural Biology & Bio-informatics
22.	**Shyam Sundar Nandi**	Studies on the role of homeodomain transcription factors in regulation of gonadal development and function	JU	Dr. Sib Sankar Roy	Cell Biology and Physiology
23	**Deepak Kumar**	Molecular and Cellular approaches towards understanding the Mechanisms of Narcotic Addiction	JU	Dr. Sumantra Das	Cell Biology and Physiology

24	**Neeladri Sekhar Roy**	Study of Protein-Protein and Protein-Nucleic acid interaction in regulation of gene expression	CU	Prof. Siddhartha Roy	Structural Biology & Bio-informatics
25	**Avishek Majumder**	A Study Of Specificity Of Protein-DNA Interactions Using Synthetic And Natural Transcription Factors	CU	Prof. Siddhartha Roy	Structural Biology & Bio-informatics
26	**Subrata Debnath**	A Study of Mechanism of Transcription	CU	Prof. Siddhartha Roy	Structural Biology & Bio-informatics
27	**Athar Alam**	Identification and charecterization of the enzymetic and immunoregulatory role of plasmodial macrophage migration inhibitory factor in host pathology	JU	Dr. Uday Bandopadhyay	Infectious Diseases & Immunology Division
28	**Samik Bindu**	Studies on the mechanism and signalling pathway for non-steroidal anti inflammatory drugs (NSAID) induced gastric mucosal cell apoptosis and gastropathy	JU	Dr. Uday Bandopadhyay	Infectious Diseases & Immunology Division
29	**Manish Goyal**	Identification and characterization of ALBA family protein from human malaria parasite plasmodium falciparum	JU	Dr. Uday Bandopadhyay	Infectious Diseases & Immunology Division
30	**Sumanta Dey**	Studies on the mechanism of oxidative stress induced hepatocyte apoptosis and liver damage during Malaria infection.	JU	Dr. Uday Bandopadhyay	Infectious Diseases & Immunology Division

31	**Chinmoy Pal**	Design , synthesis and biological evaluation of some novel antioxidant antiapoptotic molecules to protect organ damage due to oxidative stress	JU	Dr. Uday Bandopadhyay	Infectious Diseases & Immunology Division
32	**Ranjan Dhar**	Study on changes in the membrane properties of *Leishmania* infected macrophages and their impact on antigen presentation	JU	Dr. Samyal Roy	Infectious Diseases & Immunology Division
33	**Rajan Guha**	Dissecting the cellular immune response in visceral leishmaniasis	JU	Dr. Samyal Roy	Infectious Diseases & Immunology Division
34	**Shinjinee Sengupta**	Regulation of trehalose-6-phosphate synthase by methylation in yeast	JU	Dr Anil K Ghosh & Dr. Tarun Dhar	Drug Development, Diagnostics & Biotechnology
35	**Sumana Bhattacharjya**	Molecular study of micro RNA mediated regulation of mitosis and it's impact on oral carcinogenesis	CU	Dr. Susanta Roy Choudhury	Cancer Biology and Inflammatory Disorder
36	**Samir Mandal**	Protective effect of terpenoids against alcohol induced hepatotoxicity in rats	CU	Dr. Tuli Biswas	Cell Biology and Physiology
37	**M. Prabu**	In-Silico Studies for Designing Potential Anti- Alzheimer's Disease Drug Candidates using Integrated Approaches	CU	Dr. Nanda Ghoshal	Structural Biology & Bio-informatics

STAFF LIST OF IICB AS ON MARCH 31, 2014

Staff Strength at a Glance

Director	…	…	**1**
Scientist – Gr. IV	…	…	**59**
Engineer	…	…	**4**
Technical – Gr. III	…	…	**43**
Technician – Gr. II	…	…	**35**
Helper – Gr. I	…	…	**16**
Officer, Administration	…	…	**13**
Administrative Staff	…	…	**38**
Gr. C (Non-Technical)	…	…	**13**
Canteen Staff	…	…	**10**
TOTAL	…	…	232

Detailed Staff List

Scientific and Technical

Sl. No.	Employee's Name	Emp. ID	Deisgnation
1.	Prof. Siddhartha Ray	489	***Director***
2.	Dr. Samit Adhya	37	*Outstanding Scientist*
3.	Dr. (Mrs.) Chitra Mandal	60	*Outstanding Scientist*
4.	Dr. Pijush K. Das	40	*Chief Scientist*
5.	Dr. K.P. Mohanakumar	77	*Do*
6.	Dr. Syamal Roy	93	*Do*
7.	Dr. Sumantra Das	87	*Do*
8.	Dr. Santu Bandyopadhyay	97	*Do*
9.	Dr. Partha Chattopadhyay	81	*Do*
10.	Dr. (Mrs.) Chitra Dutta	95	*Do*
11.	Dr. (Mrs.) Nahid Ali	103	*Do*
12.	Dr. Susanta Roychowdhury	98	*Do*
13.	Dr. S.N. Kabir	90	*Do*
14.	Dr. Debashish Bhattacharya	96	*Do*
15.	Dr. G. Suresh Kumar	105	*Senior Principal Scientist*
16.	Dr. (Mrs.) Rukhshana Chowdhury	115	*Do*
17.	Dr. Arun Bandyopadhyay	445	*Do*
18.	Dr. P. Jaisankar	112	*Do*
19.	Dr. Rupak Kr. Bhadra	124	*Do*
20.	Dr. Asish Kr. Banerjee	116	*Do*
21.	Dr. Samir Kr. Dutta	111	*Do*
22.	Dr. (Mrs.) Suman Khowala	118	*Do*

23.	Dr. S.R. Dungdung	120	*Senior Principal Scientist*
24.	Dr. Tanmoy Mukherjee	125	*Do*
25.	Dr. (Miss) Moonmoon Bhowmik	110	*Principal Scientist*
26.	Dr. Tushar Kanti Chakraborty	99	*Do*
27.	Dr. Sibsankar Ray	443	*Do*
28.	Dr. Aditya Konar	441	*Do*
29.	Dr. Chinmay Chowdhury	520	*Do*
30.	Dr. Rupasri Ain	563	*Do*
31.	Dr. Sucheta Tripathi	570	*Do*
32.	Dr. (Mrs.) Padma Das	117	*Do*
33.	Dr. Soumen Datta	503	*Do*
34.	Dr. Uday Bandopadhyay	521	*Do*
35.	Dr. K.N. Chattopadhyay	523	*Do*
36.	Dr. Mrinal Kanti Ghosh	524	*Do*
37.	Dr. (Mrs) Sarmila Chattopadhyay	447	*Do*
38.	Dr. Subrata Adak	472	*Do*
39.	Dr. (Miss) Snehasikta Swarnakar	473	*Do*
40.	Dr. S.N. Bhattacharyya	530	*Do*
41.	Mrs. N.V.M. Khalko	122	*Do*
42.	Sri U.K. Barua	464	*Senior Scientist*
43.	Dr. (Mrs.) Debjani Mondal	123	*Do*
44.	Dr. (Mrs.) Malini Sen	527	*Do*
45.	Dr. (Mrs.) Jayati Sengupta	532	*Do*
46.	Dr. Biswadip Banerji	540	*Do*
47.	Dr. Subhas Ch. Biswas	547	*Do*
48.	Dr. Nakul Ch. Maiti	551	*Do*
49.	Dr. Partha Chakrabarti	561	*Do*
50.	Dr. Sanjoy Datta	566	*Do*
51.	Dr. Siddhartha Ray	568	*Do*
52.	Dr. Ranjan Jana	571	*Do*
53.	Dr. Arindam Talukdar	572	*Do*
54.	Dr. R. Natarajan	574	*Do*
55.	Dr Sujoy Mukherjee	575	*Do*
56.	Dr. Indu Bhusan Deb	576	*Do*
57.	Dr. Dipyaman Ganguly	577	*Do*
58.	Dr. Amitava Sengupta	578	*Do*
59.	Dr. Saraswati Garai	528	*Scientist*
60.	Dr. Indrajit Das	560	*Scientist*
61.	Dr. (Mrs.) Krishna Das Saha	143	*Principal Technical Officer*
62.	Dr. (Mrs.) S.E. Besra	145	*Do*
63.	Dr. (Mrs) Mita Chatterjee Debnath	432	*Do*
64.	Dr. Siddhartha Majumdar	164	*do*
65.	Sri Chirantan Debdas	535	*Senior Technical Officer (3)*
66.	Dr. Prashanta Kr. Chakraborty	169	*Do*
67.	Dr. Kalidas Paul	168	*Do*
68.	Sri Shekhar Ghosh	467	*Do*

69.	Dr. Ashok Kumar Dasgupta	172	*Do*
70.	Sri Surajit Mohan Roy	166	*Do*
71.	Sri Narayan Ch. Ghosh	499	*Do*
72.	Sri Binayak Pal	448	*Do*
73.	Dr. (Mrs.) Aparna Laskar	449	*Do*
74.	Dr. Sankar Kumar Maitra	174	*Do*
75.	Dr. Ardhendu Kr. Mandal	175	*Do*
76.	Dr. Tapas Sarkar	177	*Do*
77.	Dr. (Miss) Subhagata Ghosh	179	*Do*
78.	Sri Arupesh Majumdar	180	*Do*
79.	Sri Sandip Saha	494	*Supdt. Engineering Gr. III(6)*
80.	Sri Susanta Ray	514	*Asst. Exec. Engineer Gr. III(4)*
81.	Sri B. Jayakumar	517	*Do*
82.	Mrs. Nirali Bage	466	*Asstt. Engineer/ TO*
83.	Sri R.N. Mandi	185	*Senior Technical Officer (2)*
84.	Dr. Ramdhan Majhi	184	*Do*
85.	Sri P. Gangopadhyay	186	*Do*
86.	Sri Asish Mullick	187	*Do*
87.	Mrs. Dipika Roy	188	*Do*
88.	Mrs. Purnima Chatterjee	173	*Do*
89.	Mrs. Banasri Das	176	*Do*
90.	Sri Diptendu Bhattacharya	178	*Do*
91.	Sri Pratap Ch. Kayal	182	*Do*
92.	Sri E. Padmanaban	496	*Do*
93.	Sri Kshudiram Naskar	162	*Senior Technical Officer (1)*
94.	Sri Sandip Chowdhury	411	*Technical Officer*
95.	Mrs. Arti Khetrapaul	463	*Do*
96.	Sri Swapan Kr. Mondal	465	*Do*
97.	Sri Jishu Mandal	495	*Technical Assistant*
98.	Sri Debashis Banik	513	*Do*
99.	Sri Sandip Chakraborty	516	*Do*
100.	Sri T. Muruganandan	539	*Do*
101.	Sri Karri Suresh Kumar	550	*Do*
102.	Sri Vigneshwaran M.	552	*Do*
103.	Sri Santu Paul	556	*Do*
104.	Sri Sandip Kundu	557	*Do*
105.	Ms. Debasree Roy	559	*Do*
106.	Sri Pradeep Sypureddi	569	*Do*
107.	Sri Soumik Laha	579	*Do*
108.	Sri Ajoy Kr. Pramanik	195	*Senior Technician (2)*
109.	Sri Goutam Malik	224	*Do*
110.	Sri P.K. Chanda	236	*Do*
111.	Sri S.C. Das	241	*Do*
112.	Sri S.R. Tudu	251	*Do*
113.	Sri Swapan Kumar Naskar	244	*Do*
114.	Md. Ayub Shah	344	*Do*

115.	Sri Sheo Shankar Verma	242	*Do*
116.	Sri Tapas Chowdhury	246	*Do*
117.	Sri Pradip Mondal	383	*Do*
118.	Sri A.K. Sen	478	
119.	Sri Tarak Prasad Nandi	247	*Do*
120.	Mrs. Sutapa Ganguly	248	*Do*
121.	Sri Sanjib Biswas	249	*Do*
122.	Sri R.P. Gorh	250	*Do*
123.	Sri Sarit K. Sarkhel	245	*Senior Technician (1)*
124.	Sri Nishikanta Naskar	252	*Do*
125.	Sri Pallab Mukherjee	253	*Do*
126.	Sri Ranjit Das	345	*Do*
127.	Sri Abhijit Paul	450	*Do*
128.	Sri Anirban Manna	410	*Do*
129.	Sri Samir Majumder	426	*Technician (2)*
130.	Md. M. Ahmed	360	*Do*
131.	Sri Paresh Sarkar	409	*Do*
132.	Sri Sujit Kr. Majumdar	416	*Do*
133.	Mrs. Mahua Bhattacharjee	419	*Do*
134.	Sri Prabir Kr. Das	418	*Do*
135.	Sri Atanu Maitra	417	*Do*
136.	Sri Tapan Das	460	*Do*
137.	Sri Ujjal Roy	529	*Technician (1)*
138.	Sri Arup Karmakar	534	*Do*
139.	Sri Soumalya Sinha	546	*Do*
140.	Nita Chakraborty Ms	553	*Do*
141.	Akash Gupta Sri	554	*Do*
142.	Samir Thami Sri	555	*Do*
143.	Sri Sunil Nath	272	*Laboratory Assistant*
144.	Sri R.N. Jana	274	*Do*
145.	Sri Prahlad Das	275	*Do*
146.	Sri Bhaskar Basu	440	*Do*
147.	Sri Shyamal Das	279	*Do*
148.	Sri Madan Halder	479	*Do*
149.	Sri Amerika Das	280	*Do*
150.	Sri Nimai Charan Prodhan	282	*Do*
151.	Sri Sambhu Raul	351	*Laboratory Attendant (2)*
152.	Sri Suresh Balmiki	353	*Do*
153.	Sri U.N. Mandi	358	*Do*
154.	Sri Nandalal Routh	352	*Do*
155.	Sri S.K. Banik	361	*Do*
156.	Sri Ashoke Sardar	501	*Laboratory Attendant (1)*
157.	Sri Ram Kumar Sarkar	502	*Do*
158.	Sri Shyamal Nath	519	*Do*

Administration

Sl. No.	Employee's Name	Emp. ID	Deisgnation
1.	Sri U.S. Das	515	*Controller, Stores & Purchase*
2.	Sri Kausik Bhattacharjee	492	*Administrative Officer*
3.	Sri Sudipto Chatterjee	573	*F&A Officer*
4.	Sri Siddhartha Dey	485	*Section Officer (General)*
5.	Mrs. Shampoo Sengupta	525	*Do*
6.	Sri Asok Putatunda	542	*Do*
7.	Sri K.C. Das	302	*Do*
8.	Mrs. Anjana Mandi	308	*Do*
9.	Sri Asim Kr. Jha	518	*Section Officer (F&A)*
10.	Sri Abhimanyu Kr. Tiwary	533	*Do*
11.	Sri Ratan Bage	397	*Section Officer (Stores & Purchase)*
12.	Sri Debdas Guhathakurta	313	*Private Secretary*
13.	Mrs. Ambalika Nag	321	*Hindi Officer*
14.	Sri Sabyasachi Karmakar	567	*Security Officer*
15.	Mrs. Sanhita Ganguly	427	*Assistant (General) Gr. I (MACP)*
16.	Mrs. Monalisa Bhattacharjee	428	*Do*
17.	Miss Lily Das	330	*Do*
18.	Mrs. Indira Kundu	331	*Do*
19.	Sri R.N. Hansda	334	*Assistant (General) Gr. I*
20.	Sri Prem Singh	335	*Do*
21.	Sri D.K. Kisku	340	*Do*
22.	Sri Alok Ray	396	*Do*
23.	Sri Jayanta Pal	510	*Assistant (General) Gr. II*
24.	Sri Tarun Kr. Sinha Roy	508	*Do*
25.	Sri Raju Pal	507	*Do*
26.	Sri Ranjit Debnath	509	*Do*
27.	Sri Saugata Das	511	*Do*
28.	Sri Sukhendu Biswas	512	*Do*
29.	Sri Anirudha Das	565	*Assistant (General) Gr. III*
30.	Sri A.K. Chanda	327	*Assistant (F&A) Gr. I (MACP)*
31.	Mrs. Banani Dutta	476	*Assistant (F&A) Gr. I (MACP)*
32.	Sri Sanjoy Mukhopadhyay	343	*Assistant (F&A) Gr. I (MACP)*
33.	Mrs. P.L. Saha	332	*Assistant (F&A) Gr. I (MACP)*
34.	Sri Asit K. Roy	336	*Assistant (F&A) Gr. II (MACP)*
35.	Sri M.K. Dutta	338	*Do*
36.	Sri Vishal Agarwal	506	*Assistant (F&A) Gr. II*
37.	Sri A.B.S. Roy	328	*Assistant (S&P) Gr. I*
38.	Sri Rajib Ray	536	*Do*
39.	Sri Bisweswar Das	342	*Do*
40.	Mrs. Bula Pal	363	*Do*

41.	Sri Pradipta Sarkar	505	*Assistant (S&P) Gr. II*
42.	Sri Arnab Sen	504	*Do*
43.	Sri Dipak Kr. Guin	318	*Senior Stenographer (ACP & MACP)*
44.	Sri Asim Roy	323	*Do*
45.	Mrs. Pratima Banerjee	324	*Senior Stenographer (MACP)*
46.	Sri Shankar Bhakta	325	*Do*
47.	Sri Rabindranath Das	393	*Do*
48.	Sri Saibal Giri	405	*Do*
49.	Sri Sankar Santra	490	*Senior Stenographer*
50.	Sri Gautam Saha	453	*Do*
51.	Smt Moumita Majumdar	491	*Do*
52.	Sri Ashok Ram	348	*Gr-C (NT) (ACP & MACP)*
53.	Sri Kailash Chandra Nayak	365	*Gr-C (NT) (MACP)*
54.	Mrs. Gita Ghosh	364	*Do*
55.	Mrs Soma Devi Sharma	401	*Do*
56.	Sri Gopal Ch. Mandal	412	*Gr-C (NT) (Upgraded)*
57.	Sri Asit Mitra	413	*Do*
58.	Sri Janmanjoy Midya	431	*Do*
59.	Sri Pasupati Midya	430	*Do*
60.	Sri Shyamal Kr. Ghosal	423	*Do*
61.	Sri P.C. Dehury	414	*Do*
62.	Sri Manoranjan Adhikary	425	*Do*
63.	Sri Tapan Sarkar	424	*Do*
64.	Sri Dinesh Mahali	451	*Do*
65.	Sri Tarun Dutta	367	*Asstt. Manager-cum-Store Keeper*
66.	Sri Amal Dutta	369	*Clerk(MACP)*
67.	Sri Balaram Panda	368	*Halwai-cum-Cook*
68.	Sri Sudhangshu Halder	373	*Tea Maker(MACP)*
69.	Sri Bimal Das	372	*Bearer(MACP)*
70.	Sri Ashok Sadhukhan	371	*Bearer(MACP)*
71.	Sri Badal Haldar	370	*Bearer(MACP)*
72.	Sri Jagabandhu Biswas	374	*Wash Boy(MACP)*
73.	Sri Nirapada Halder	375	*Sweeper*
74.	Sri Mantu Das	376	*Sweeper*

Name of Emeritus Scientists / Prestigious Fellowship Holders

	Dr. Sibabrata Mukhopadhyay	Emeritus Scientist
	Dr. Anil Kr. Ghosh	-do-
	Dr. Nirmalendu Das	-do-
	Dr. A.K. Giri	-do-
	Dr. Prakas R. Maulik	-do-
	Dr. N.B. Mandal	-do-
	Dr. Syamal Dana	-do-
	Dr. Nanda Ghosal	-do-
	Dr. Keya Chaudhuri	-do-
	Prof. Samaresh Mitra	Sr. Scientist (INSA)
	Dr. Alok Kr. Dutta	Sr. Scientist (INSA)
	Dr. HK Majumdar	Raja Ramanna Fellow (DAE)

Retirees from 1st April, 2013 to 31st March, 2014

Dr. Tripti Dey
Principal Scientist
30/04/2013

Dr. Nirup Bikas Mandal
Sr. Principal Scientist
30/04/2013

Dr. Nanda Ghosal
Sr. Principal Scientist
31/07/2013

Dr. Mridula Misra
Principal T.O.
31/07/2013

Mr. Panchanan Naskar
Asst. (SP),Gr.1
31/08/2013

Sri Sailendra N. Mondal
Sr. Technician (2)
31/08/2013

STAFF LIST OF IICB AS ON MARCH 31, 2014

Sri Tapan Kr. Mitra
Section Officer
(SP)07/11/2013

Mr. Samir Kr. Roy
Sr. Tech. Officer(3)
31/12/2013

Mr. Sambhu Kr. Chhatui
Private Secretary
31/12/2013

Dr. Keya Chowdhury
Chief Scientist
31/01/2014

Dr. Tarun Dhar
Chief Scientist
28/02/2014

Dr. U.S Chowdhury
Sr. Principal Scientist
28/02/2014

Mr. Mohan Lal Jana
Sr. Tech. Officer (3)
28/02/2014

Mr. Swapan Basak
Sr. Technician (2)
28/02/2014

New Appointment
from 1st April, 2013 to 31st March, 2014

Dr. Sujoy Mukherjee
Sr. Scientist
28/11/2013

Dr. Indubhusan Deb
Sr. Scientist
07/01/2014

Dr. Dipyaman Ganguly
Sr. Scientist
17/01/2014

Dr. Amitava Sengupta
Sr. Scientist
17/01/2014

Mr. Soumik Laha
Tech. Asst.
21/03/2014

CSIR-IICB Students Organized One Day Seminar FICBNT-June 2013

CSIR- IICB RESEARCH COUNCIL
(*AUGUST 01 2012 - JULY 31 2016*)
CSIR- Indian Institute of Chemical Biology
Kolkata 700 032

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Prof. M. Vijayan	…	Chairman
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Dr. Mammen Chandy	…	External Member
Prof. D. J. Chattopadhyay	…	External Member
Prof. Rentala Madhubala	…	External Member
Dr. G. V. M. Sharma	…	External Member
Prof. Subrata Sinha	…	External Member
Dr. Ch. Mohan Rao	…	DG's Nominee
Dr. Balaram Ghosh	…	Sister Laboratory representative
Dr. P.S. Ahuja	…	Biology Cluster Director
Dr. Sukhdev Sinha	…	Agency Representative
Dr. Sudeep Kumar	…	CSIR PPD
Prof. Siddhartha Roy	…	Director, IICB
Dr. Rukhsana Chowdhury	…	Secretary

Prof. M. Vijayan
INSA Albert Einstein Professor
Molecular Biophysics Unit
Indian Institute of Science
Bangalore-560012

Dr. T. S. Balganesh
CSIR Distinguished Scientist
CSIR- Fourth Paradigm Institute
NAL Belur Campus
Bengaluru- 560037

Prof. D. J. Chattopadhyay
Guha Professor & Pro-VC (Academic)
Calcutta University
Dr. B.C.Guha Centre for Genetic Engg
Department of Biochemistry
University College of Science & Tech
35, Bullygunge Circular Road
Kolkata- 700019

Prof. Rentala Madhubala
Director, AIRF
JC Bose National Fellow
School of Life Sciences
Jawaharlal Nehru University
New Delhi- 110067

Dr. Subrata Sinha
Director
National Brain Research Centre
Near NSG Campus
Manesar- 122050

Dr. G.V.M. Sharma
Deputy Director
Organic Chemistry Division III
Indian Institute of Chemical Technology
Hyderabad-500607

Dr. Mammen Chandy
Director
Tata Medical Centre
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Kolkata- 700156

Dr. Ch. Mohan Rao
Director
CSIR - CCMB
Uppal Road
Hyderabad- 500007

Dr. G. V. M. Sharma
Chief Scientist and Head
Organic & Biomolecular Chemistry Division
CSIR- IICT
Hyderabad- 500607

Dr. Balaram Ghosh
CSIR Outstanding Scientist
CSIR - IGIB, Mall Road
Delhi-110007

Dr. Sukhdev Sinha
Adviser
Department of Biotechnology
Block-2, 7th Floor, CGO Complex
Lodi Road
New Delhi - 110 003

Dr. Sudeep Kumar
Head or his Nominee
Planning & Performance Division (PPD)
Council of Scientific and Industrial Research
Anusandhan Bhawan, 2, Rafi Marg
New Delhi-110001.

Dr. P. S. Ahuja
Director
CSIR - IHBT
Post Box 6, Palampur-176061

Prof. Siddhartha Roy
Director
CSIR Indian Institute of Chemical Biology
4, Raja S. C. Mullick Road, Kolkata 700 032

CSIR-IICB MANAGEMENT COUNCIL
CSIR- Indian Institute of Chemical Biology
Kolkata 700032

MANAGEMENT Council Members

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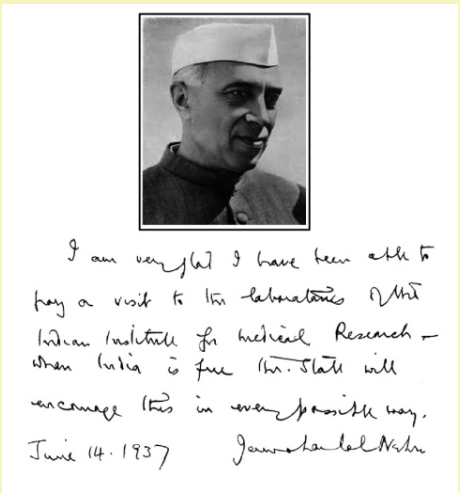
Director, CSIR-CGCRI, Kolkata	Member
Dr. Chitra Mandal, Outstanding Scientist, CSIR-IICB	Member
Dr. K.P. Mohanakumar, Chief Scientist, CSIR-IICB	Member
Dr. G. Suresh Kumar, Sr. Principal Scientist, CSIR-IICB	Member
Dr. Chinmay Chowdhury, Principal Scientist, CSIR-IICB	Member
Dr. K.N. Chattopadhyay, Principal Scientist, CSIR-IICB	Member
Dr. Indrajit Das, Scientist, CSIR-IICB	Member
Dr. Mita Chatterjee Debnath, Principal TO, CSIR-IICB	Member
Mr. Sudipto Chatterjee F& Ac.Officer, CSIR-IICB	Member
Mr. K. Bhattacharya, Administrative Officer, CSIR-IICB	Member-Secretary

History of CSIR-IICB

Long before India became an independent republic, a group of bio-medical scientists propelled by the nationalistic feeling dedicated themselves to the task of tackling problems of tropical diseases prevalent in the country in those days. This simple motivation illuminated the path towards the foundation of the only basic biomedical research centre in the country by Dr J C Ray without any financial assistance from the British Empire and named it "The Indian Institute of Medical Research". It owed its origin to the inspiration of prominent personalities like Rabindranath Tagore, Acharya Prafulla Chandra Roy, Pandit Jawaharlal Nehru and many others. The institute was established in 1935. The avowed objective of the institute was the advancement of the state of human knowledge related to the basic aspect of the causation and prevention of diseases of special concern for our country especially tropical diseases and also nutritional biochemistry and physiology.

It came under the aegis of CSIR in 1956 and renamed "The Indian Institute for Biochemistry and Experimental Medicine". In 1965, the name was once again altered to "The Indian Institute of Experimental Medicine" (IIEM) and eventually in 1982, the "CSIR-Indian Institute of Chemical Biology "(CSIR-IICB) was born. The hard work, generosity and vision of our forefathers sustain and guide the institute to this day, as biologists and chemists work jointly to both understand and prevent common human diseases.



The early years of CSIR-IICB witnessed a surge in research and development. In the 60's, as incidences of cholera wreaked havoc on humankind, pioneering cholera based research gained thrust in this institute and received wide international acclaim. The World Health Organization (WHO) identified the institute as the International Center for Cholera Phage Typing, and it was during that era that one of the world's first oral vaccines against cholera was

History of CSIR-IICB

developed here, using a non-pathogenic strain isolated from river water. Leishmaniasis and malaria were among other tropical diseases that ravaged the nation. Accordingly, research on the protozoan parasites causing these diseases continued in this institute in full swing. By the late 80's, the institute had already earned and established its reputation as a National Center for Leishmania Research with financial support from the United Nations Development Project (UNDP). This international recognition of CSIR-IICB remains unblemished because of the coordinated and integrated research efforts of biologists and chemists.

Prof. Humayun Kabir laying the foundation stone of the Institute in presence of Dr. B. C. Roy while Prof. M. S. Thacker and Sri A. K. Bose (Architect) eagerly watch.

With the major focus resting on cholera and leishmania, chemical biology in the institute gradually embraced several important disciplines pertaining to human health and disease. Research areas focusing on asthma, diabetes, cancer and inflammation came into being reinforcing the potential of the institute to meet the ever increasing challenges of our society. As experimental science progressed, modern concepts of human genetics, structural biology, bioinformatics, proteomics and nanoscience kept contributing to a better understanding of disease pathogenesis and drug development.

The perseverance of CSIR-IICB scientists and their integrated research approach have led to significant achievements that indeed reflect the rich heritage of this institute. All the significant achievements are a culmination of both basic and applied research encompassing several areas of science ranging from cell biology and immunology to natural product chemistry and biotechnology. As a major research center in the heart of Kolkata CSIR-IICB continues to make great strides forward in advancement of science through coordinated research programs. What began as a small research unit at 64, Dharmatala Street in Central Kolkata is now transformed into an extensive organization at Jadavpur, Kolkata. As CSIR-IICB collectively toil to meet the research goals, the vision and insight of the predecessors keep inspiring the scientists to attain ever increasing heights of excellence in serving humankind through applications of modern concepts of chemical biology.

Cholera Vaccine Trial in Early Days

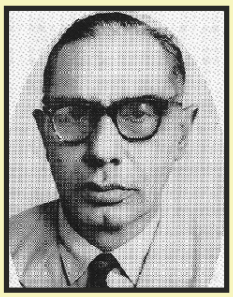
Directors of the Institute

Dr. H.N. Ghosh ,
April 1935 to October, 1935

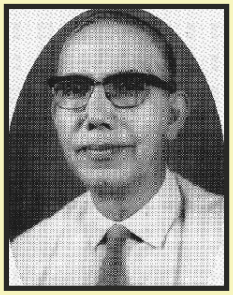
Dr. J.C. Ray
1935 - 1956 - 1964

Dr. S.H. Zaidi
1964 - 1965

Prof. R.B. Arora
1966 - 1967



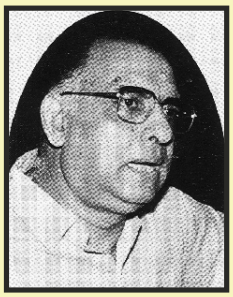
Dr. J.C. Chopra
1967



Dr. S. Mukherjee
1968

Prof. R.N. Chakravarti
1968 - 1976

Prof. B.K. Bachhawat
1976 - 1985



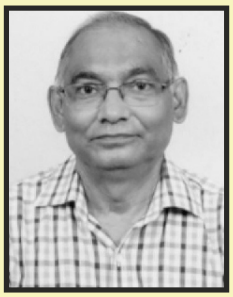
Dr. S.C. Pakrashi
1985 - 1990

Prof. A.N. Bhaduri
1990 - 1995

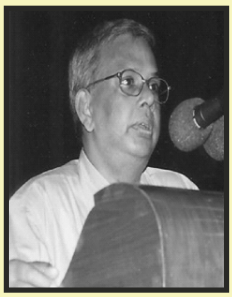
Dr. J. Das
1995 - 1998

Dr. D.K. Ganguly
1998 - 1999 (Acting)

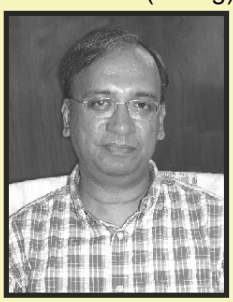
Prof. Samir Bhattacharya
1999 - 2004



Dr.M.Maiti
2004 (Acting)



Dr. S. Sengupta
2004 (Acting)



Prof. S. Roy
2004 - 2014

CSIR-IICB Signs MoU with Narayana Health in October 2013

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