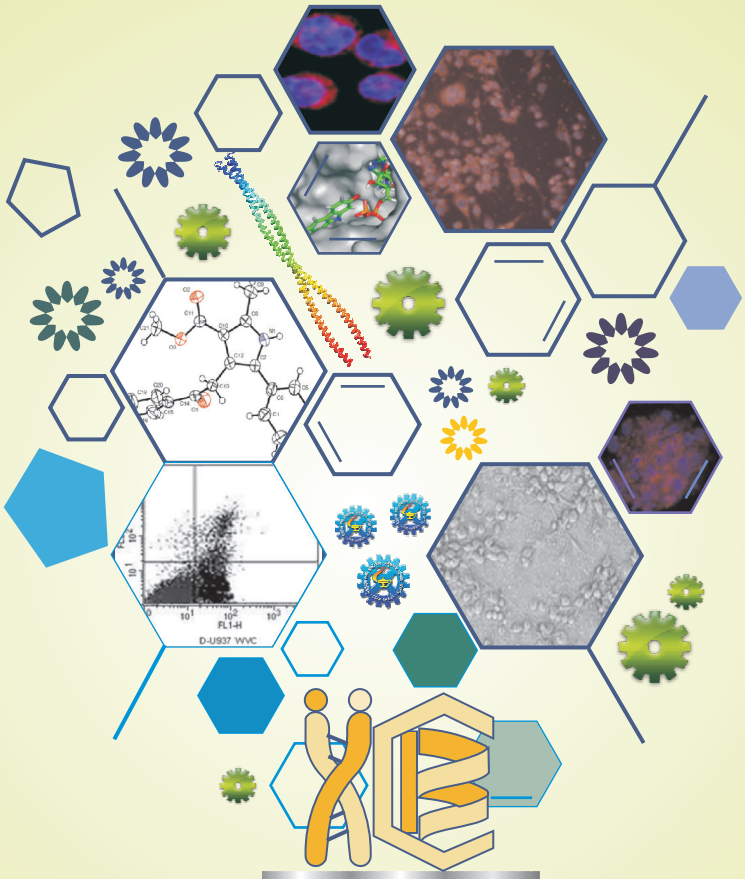
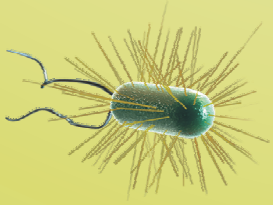


वार्षिक प्रतिवेदन
Annual Report 2012-13



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

वार्षिक प्रतिवेदन

Annual Report

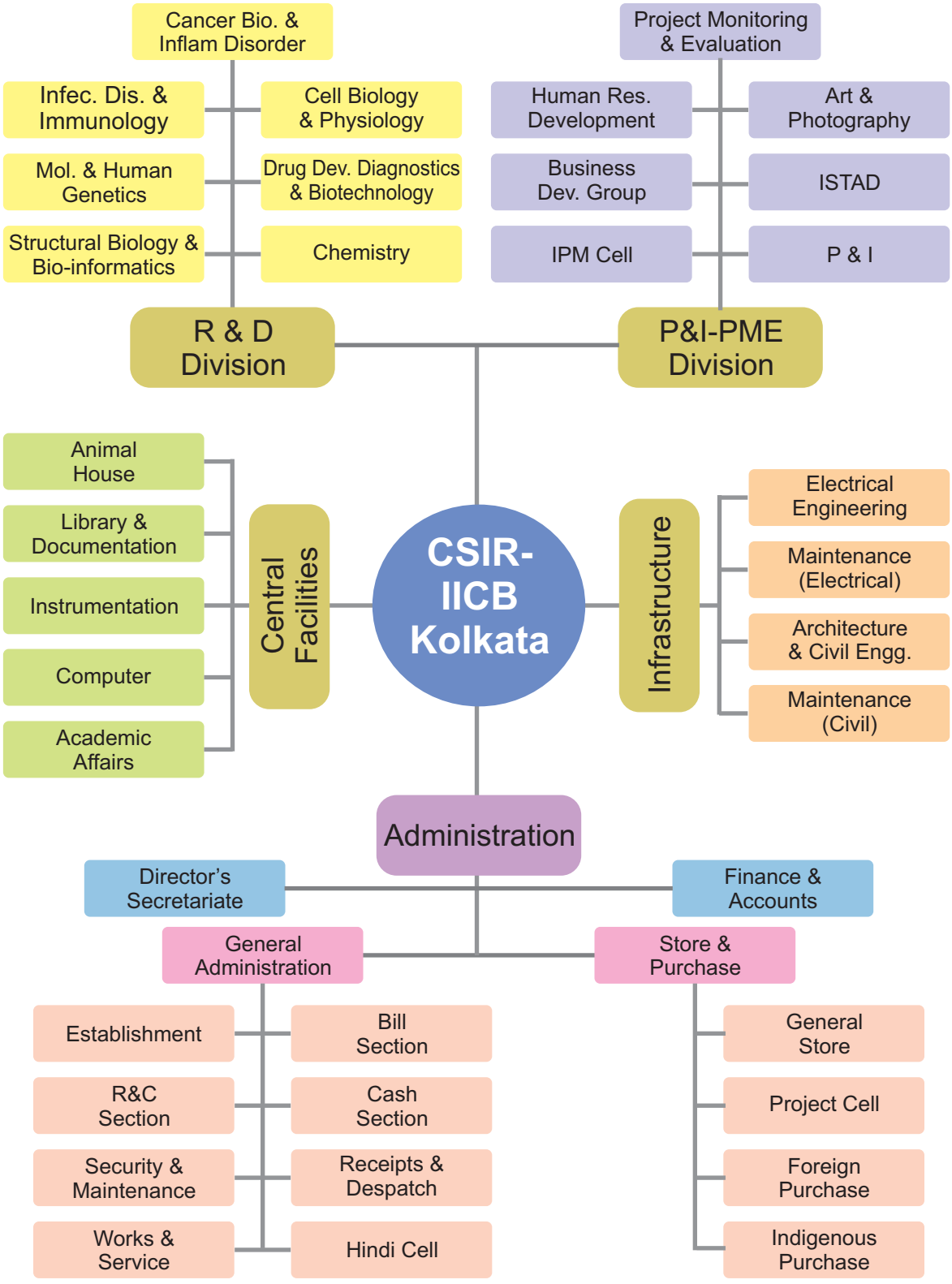
2012-13

सीएसआईआर-भारतीय रासायनिक जीवविज्ञान संस्थान

CSIR-Indian Institute of Chemical Biology

4, राजा एस.सी. मल्लिक रोड, यादवपुर, कोलकाता- 700 032, भारत

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


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
Human Res. Development
Art & Photography
Business Dev. Group
ISTAD
IPM Cell
P & I
Central Facilities
Animal House
Library & Documentation
Instrumentation
Computer
Academic Affairs
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

Contents

Director's Report

It is my proud privilege to present the Annual Report which assembles the major activities of this Institute for the period from April 2012 to March 2013. This report is an indication of our growth and a document of our accountability. 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. While biologists are constantly working on comprehending physiological processes and diseases, chemists are tirelessly making tools to harness and redefine biological phenomena. The progress of CSIR-IICB essentially depends on its R&D activities and like preceding years the institute continued its growth through quality research on diseases of national importance and biological problems of global interest, employing sophisticated state-of-the-art technology in keeping with the rapid and unprecedented momentum that life science research has gained globally over the last 50 years. The role of CSIR-IICB in 'Affordable healthcare through modern science' is well recognized since its early days. 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. An innovation complex involving six Eastern zonal laboratories is planned in the Southern fringe of Kolkata (at Baruipur) in the near future. 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 major laboratory program of the **Cell Biology & Physiology Division** is investigations for understanding the pathophysiology of a number of metabolic and degenerative diseases. The group consists of team of cell biologists, physiologists and molecular biologists. They investigate regulation of sperm motility, pathogenesis of polycystic ovarian disease, cardiac hypertrophy, mechanisms of insulin resistance and diabetes, neurodegenerative disorders, hemolytic and hepatic disorders etc. The investigators are continuing validation of cellular and animal models of the diseases, and their application in target discovery. Specific attention is being paid to cell signaling molecules and their interaction with their receptors, hormone-receptor mediated gene expression, biogenesis and bioenergetics of ion channel regulation, neural development, and signal transduction events.

The major research focus of the **Infectious Diseases & Immunology Division** includes understanding of the pathophysiology of the parasites *Leishmania* and *Plasmodium* and the bacteria *Vibrio cholerae* and *Helicobacter pylori*, and to develop potential therapeutic and prophylactic strategies against the diseases visceral leishmaniasis (VL), malaria and cholera. The group is investigating for macrophage defense signaling by *Leishmania,* liposomal formulations for antileishmanial activity, prophylactic potential of leishmanial vaccine candidates, identification of novel antimalarial drug targets, development of antioxidant antiapoptotic molecules for correcting mitochondrial disorders, development of novel drugs for gastropathy, proteome and phosphoproteome analysis of *V. cholera* adherence to host cells, interaction of *H. pylori* with gastric cell line etc. The experiments will enable a better understanding of the disease process, interaction between host and pathogen, and improvement of existing drugs along with development of novel strategies for combating these diseases.

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 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 Identification of cellular signaling, probable target proteins and signal cross-talking, the significance of role and regulation of p68/p72 ***DEAD Box RNA Helicases*** through EGFR & Wnt signaling in breast and colon cancer along with study of CKII-mediated signalling crosstalk in glioma, understanding the role of intracellular redox threshold in cancer cell signaling and apoptosis along with manipulation of intracellular redox status of cancer cells to overcome drug-resistance cell lines etc. The studies would be helpful for development of anticancer therapy.

Organic synthesis of bioactive natural and other molecules used against various targets and their nucleic acid binding properties, peptidomimetics and self-assembly 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 major research activities of the division is focused on Enantioselective synthesis of biologically active natural products, carbohydrate-based molecules, enzyme inhibitors and a variety of heterocycles of high bioactivity, design, synthesis of very short peptide and peptide conjugates, and their interactions with tubulin and self-assemble in solution forming different morphological structure, synthesis and binding studies of sugar based peptidomimetic macrocycles towards the ion channels, catalyst and drug delivery, Isolation, identification and screening of novel phytomolecules against cancer, **eye problems and cardiovascular diseases** to identify lead molecule(s) and generation of various analogues through synthesis and investigation of general strategies for the recognition of highly structured RNA and DNA molecules in solution by small natural and synthetic potential antitumor agents.

Biotechnological innovation is gaining increased recognition as an important tool for improving health and preventing disease. Despite their significance, very few laboratories in India and abroad are engaged in basic mechanistic approaches to exploit bioactive molecules from natural sources for therapeutic, diagnostic and industrial importance. Bioactive molecules from natural sources are well known for their therapeutic, diagnostic and industrial importance. **Drug Development, Diagnostics & Biotechnology Division** is involved in studies on bioactive compounds for improving health and quality of life, as also for promoting future economic growth through innovation in biotechnology. The breakthroughs in modern biotechnology include our ability to manipulate plant gene for improved production of pharmaceutical/ nutraceuticals, elucidation of biosynthetic pathways using plant secondary metabolites and improve bioprocess technology to purify novel molecules generated by such processes. The investigations are aimed at tackling some of these issues in ensuring health and preventing disease in long run.

The principal objectives of the **Molecular & Human Genetics Division** are to identify

disease-associated genetic variants and their functional relevance; to elucidate 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; and to determine the molecular basis of gene delivery to mitochondria. Genetic variants in open-angle glaucoma, oculocutaneous albinism, wilson's disease, parkinson's disease, hemophilia and oral submucous fibrosis are being studied. Emphasis is given on the determination of the functional consequences of identified mutations. A new area of investigation is on the role of micro RNAs in parasitic disease (leishmaniasis). The investgations are designed to explore the mechanism of uptake and intracellular targeting of the carrier complex and RNA to mitochondria. 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 working to deliver a concerted research effort towards a better understanding of the quality control mechanisms in protein folding. A team of scientists from diverse areas of biological, chemical, physical, mathematical and computational sciences is engaged in probing macromolecular interactions at various levels of biological organization, from intra-molecular to supra-cellular, using integrative, trans-disciplinary approaches. State-of-the-art facilities and technologies, including nuclear magnetic resonance (NMR), fluorescence correlation spectroscopy, cryo-electron microscopy, X-ray crystallography, mass spectrometry, diode array stopped-flow spectrophotometry and other biochemical and biophysical methods are being employed for structural characterization of various biological macromolecules at atomic resolution. The investigations are aimed at having an insight into the molecular/sub-molecular processes involved in protein misfolding, aggregation and amyloid formation; assessing the relative importance of various physicochemical factors in the onset and progress of these processes; elucidating cellular defenses against aberrant protein folding and developing novel strategies for amelioration of protein misfolding disorders. In parallel, attempts are also being made to navigate the native protein folding routes in various pathogenic microbes like *Leishmania, Plasmodium*, *Streptococcus, Helicobacter* etc. The division consists of two distinct, but complementary components: experimental structural biology and mathematical/computational biology. A number of software packages and knowledgebases have been designed and developed for high throughput genome/transcriptome/proteome analysis and systems biology studies.

During the reporting period thirty five (**35**) 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. Several new projects have been sanctioned. Based on the expertise available through scientific endeavour, 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 idea and initiation 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-IICB scientists.

On **2nd April, 2012** CSIR-IICB organized its 56th **Foundation Day** celebration. Prof. R. N. Mukherjee, Director, IISER, Kolkata was present as Guest-in-Chief and Prof. Obaid Siddiqi, National Research Professor, National Centre for Biological Sciences, Bengaluru delivered the 24th JC Ray Memorial Lecture.

On **18th May, 2012 CSIR-IICB Organized Second Convocation of NIPER-Kolkata as mentor Institute.** The convocation was presided over by Sri. Dilsher Singh Kalha, IAS, Secretary, Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, Govt. of India & Chairman, Steering Committee of NIPER-Kolkata and Prof. Goverdhan Mehta, National Research Professor & Lilly-Jubilant Chair, School of Chemistry; Hyderabad was the Guest-in-Chief. Dr. Siddhartha Roy, the Director of CSIR-IICB, the mentor institute & Chairman, Advisory Committee, NIPER-Kolkata administered the exhortation to the recipients of the degrees.

One day outbound training program "Unleash Your Power Within" was organised by CSIR-IICB on **7th June, 2012** for the staff members associated with Purchase, Finance & Accounts and Administrative department. About thirty participants attended this program conducted by 'Centre of personal Transformation', Kolkata.

A Scientific Communication Skill development Workshop was delivered by British Council for the CSIR-IICB PhD Course Work students from **25th June to 6th July, 2012** at CSIR-IICB. About 90 students participated in this programme.

An Orientation Program for newly recruited CSIR-IICB PhD Research Fellows was organized on **4th September, 2012** at CSIR-IICB. About 75 students participated in this program.

The Institute observed **Hindi Week** during **10th -14th September, 2012** by organizing different competitions like debate in Hindi, noting & drafting competitions and a workshop was conducted on Unicode. The Institute also celebrated National Hindi Day on 14th September, 2012. The chief guest of the day was Prof Tanuja Majumdar, Professor, Presidency University, Kolkata.

First International Meet in Cell Signaling Network (CeSiN-2012) was organized on 11th 13th September, 2012. Prof. Indranil Manna, Director, CSIR-CGCRI, graced the occasion as Guest-in- Chief and Swami Tyagarupananda, Principal, Ramakrishna Mission Vidyamandira, Belur was present as the Special Guest.

The Institute observed the 70th **Foundation Day of CSIR** on Tuesday, **September 25, 2012** at its premises. Dr. Samit Adhya, Acting Director, CSIR-IICB presided over the function in which Dr. Saroj Ghose, former Director General, National Council of Science Museums (NCSM) & former President of the International Council of Museums was present as Guest-in chief. Prof. Alok Bhattacharya,

School of Life Sciences, Jawaharlal Nehru University & Vice President, Indian National Science Academy (INSA) delivered the Foundation Day invitation lecture.

During 23rd - 25th November, 2012 CSIR-IICB organized Hundred Years of Antimonials : An International Conference. The inaugural speech was delivered by Guest-in-chief Prof. Samir Kumar Brahmachari, Director-General, CSIR & Secretary, DSIR, Govt of India. Prof Brahmachari also announced the Sir U. N. Brahmachari Award on this occasion.

CSIR-IICB organized International Symposium on Challenges in Chemical Biology, (**ISCCB 2013**) during **27th Jan 29th January, 2013**. Prof. P. Balaram, Director, IISc., Bangalore delivered the inaugural lecture.

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 (FNSc), Fellow of the National Academy of Medical Sciences, India (FNAMSc), Fellow of West Bengal Academy of Science and Technology (WAST), Dr. Y. Subba Rao Memorial Lecture award and Kshanika Oration Award 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 "Preventing Neuronal Loss Using Eye as a Model" by Dr.Kenneth S Shindler, MD University of Pennsylvania, USA**,** visit of Dr. Deva Raj Subramanian, EMBL, Heidelberg, Germany for scientific lecture on "Chemical Biology : applying Chemistry to Biological Questions", visit of Dr. Poolo Soldati, Silicon Biosystems, Italy for a lecture on "Sorting and Recovery of Rare Cells by DEP Array : A unique Platform to enable isolation of Single 100% pure Circulating Tumor Cells and Other Biomedical Research relevant Applications", visit of Dr. Richard Kelly & Dr. Emma Wilson, Royal Society of Chemistry, U.K. for a scientific lecture on "RSC Publishing : How to publish in high impact journals", visit of Mr. Yoichi Iki, Nikon , Tokyo, Japan with a lecture on "Principle of Super-Resolution Microscope and Nikon Advanced Super Resolution Microscope Technology", visit of Prof. Young-Tae Chang, National University of Singapore for a scientific lecture on "New approach for Molecular Imaging by Diversity Oriented Fluorescence Library Approach (DOFLA)", visit of Prof. Asis Datta, NIPGR, New Delhi for a lecture on "Dream to bring science to society", visit of Dr. Gautam Sanyal, AstraZeneca R&D Boston, USA for scientific lecture on "Biophysical approaches to targeting DNA replication enzymes for antibacterial drug discovery" and visit of Mr. Widmer Urs, Bruker Inc. for a lecture on "Latest range of NMR Spectrometers" are most significant. About **133** 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

neighbouring universities and institutes.

During the period our institute participated in some exhibitions all over India which includes **100th Indian Science Congress** "Science Exhibition", **3rd 7th January, 2013 in Kolkata and** the achievements and on going R&D works of CSIR-IICB were presented in popular ways in the CSIR pavilion.

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 2012 the total number of scientific publications increased significantly to **209.** I am proud in finding that the average impact factor of research publications of CSIR-IICB has reached **3.41** this year.

Throughout the reporting period CSIR-IICB has filed four international patents related to synthesis, extraction of bioactive compounds from herbal resources to combat asthma, gastropathy and other common human diseases. Total three patents have been granted abroad.

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 2012-13 around **320** fellows and research associates have worked in this Institute.

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. Siddhartha Roy

PERFORMANCE AT A GLANCE

THE LAURELS

- Dr. Chitra Mandal elected Fellow of The World Academy of Sciences (TWAS)
- Dr. Ashok K. Giri elected Fellow of the Indian National Science Academy, Delhi
- Dr. Kunal Ray elected Fellow of the Indian National Science Academy, Delhi
- Dr. Nahid Ali elected Fellow of National Academy of Sciences, Bangalore
- Dr. Uday Bandopadhyay elected Fellow of National Academy of Sciences, Bangalore
- Dr. Snehasikta Swarnakar elected Fellow of National Academy of Sciences India, Allahabad.
- Dr. Keya Chaudhuri elected Fellow of the National Academy of Medical Sciences (India)
- Dr. Chitra Mandal awarded National Women Bio-scientists Award (Senior) by Department of Biotechnology, India
- Dr. Pijush Kanti Das received Vishwa Nath Memorial Award for outstanding contribution in Biological Sciences by INSA, New Delhi
- Dr Partha Chattopadhyay elected Fellow of West Bengal Academy of Science & Technology
- Dr. S. N. Kabir elected Fellow of West Bengal Academy of Science & Technology
- Dr. Rupak Bhadra elected Fellow of West Bengal Academy of Science & Technology
- Dr. Tushar Chakraborty received Satyendra Purashkar for Best Science Book for the year 2012 from DST, Govt. of West Bengal

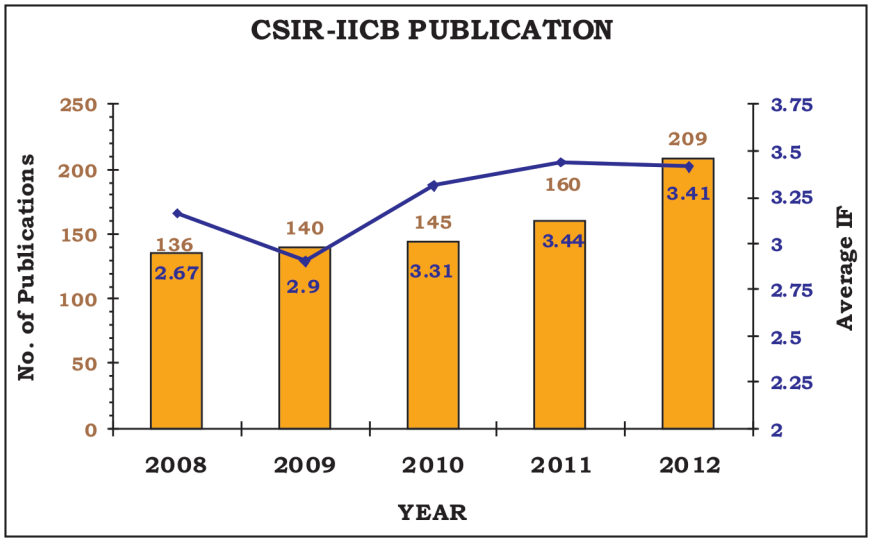
PERFORMANCE AT A GLANCE

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 – 2012			
Total Publications	...	...	209
Non SCI Publications	...	...	05
Research Publications	...	...	204
No. of Papers with IF = 6 < 10			15
No. of Papers with IF = 5 < 6	...	...	16
No. of Papers with IF = 4 < 5	...	...	40
No. of Papers with IF = 3 < 4	...	...	40
No. of Papers with IF = 2 < 3	...	...	44
No. of Papers with IF = 1 < 2	...	...	39
No. of Papers with IF < 1	...	...	10
Total IF	...	...	695.137
IF per Research Publications	...	...	3.407
IF per Scientist	...	...	10.86
Publications per Scientist	...	...	3.26
Total Scientists			64

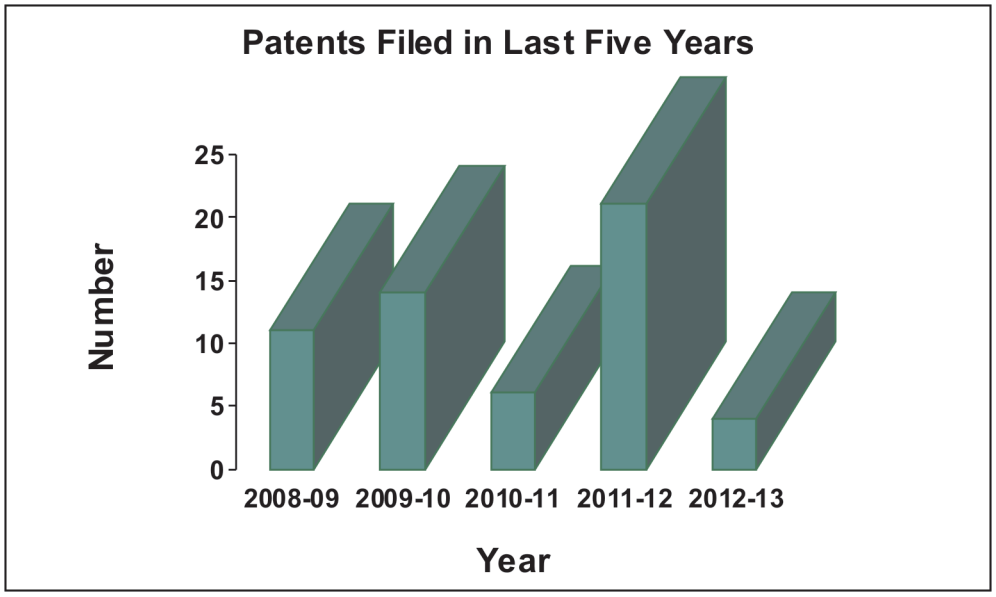
*List of publication highlights for 2012 is provided inside separately

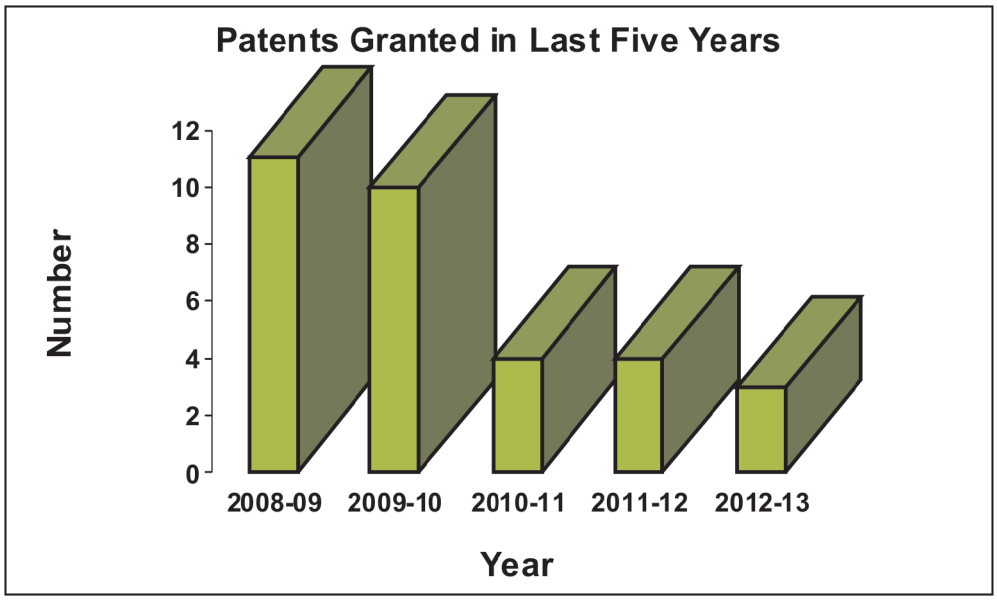


PERFORMANCE AT A GLANCE

PATENTS

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



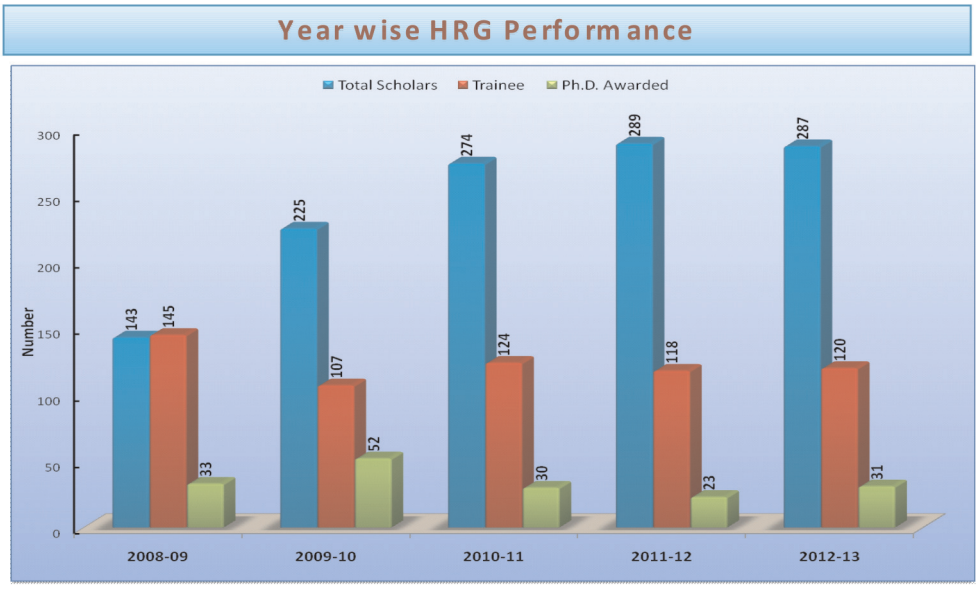


* Detailed list of granted patents in 2012-13 are provided inside separately

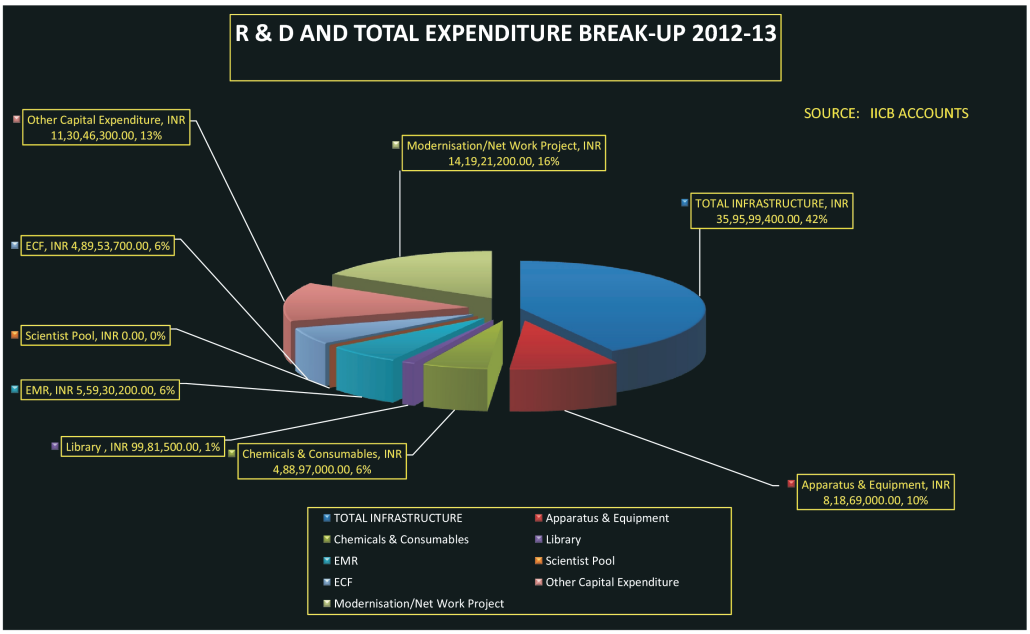
PERFORMANCE AT A GLANCE

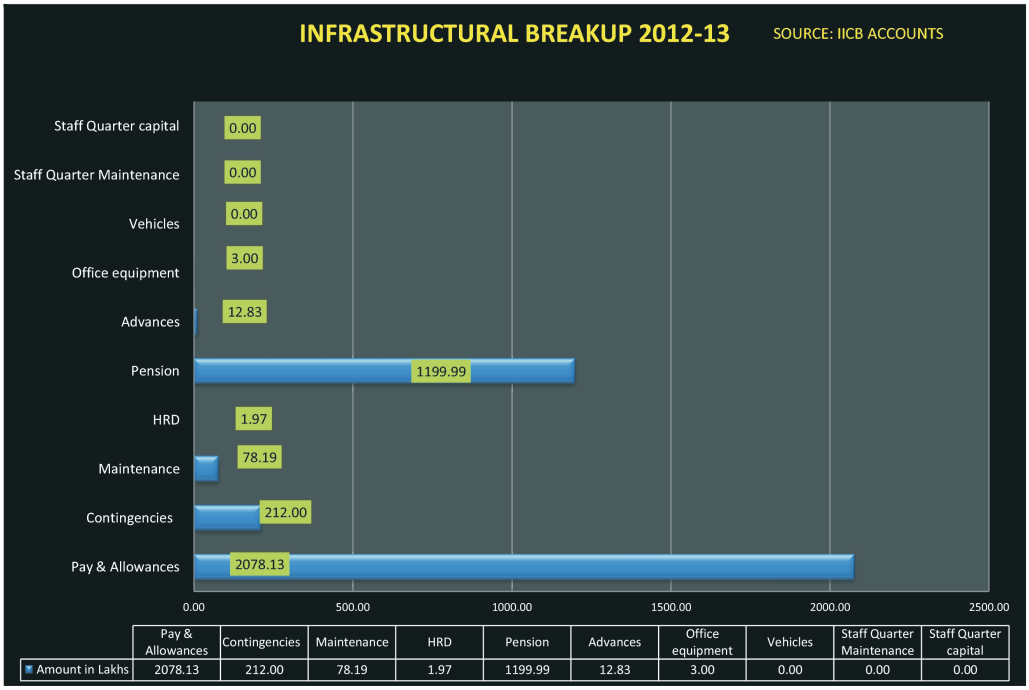
HUMAN RESOURCE DEVELOPMENT

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:



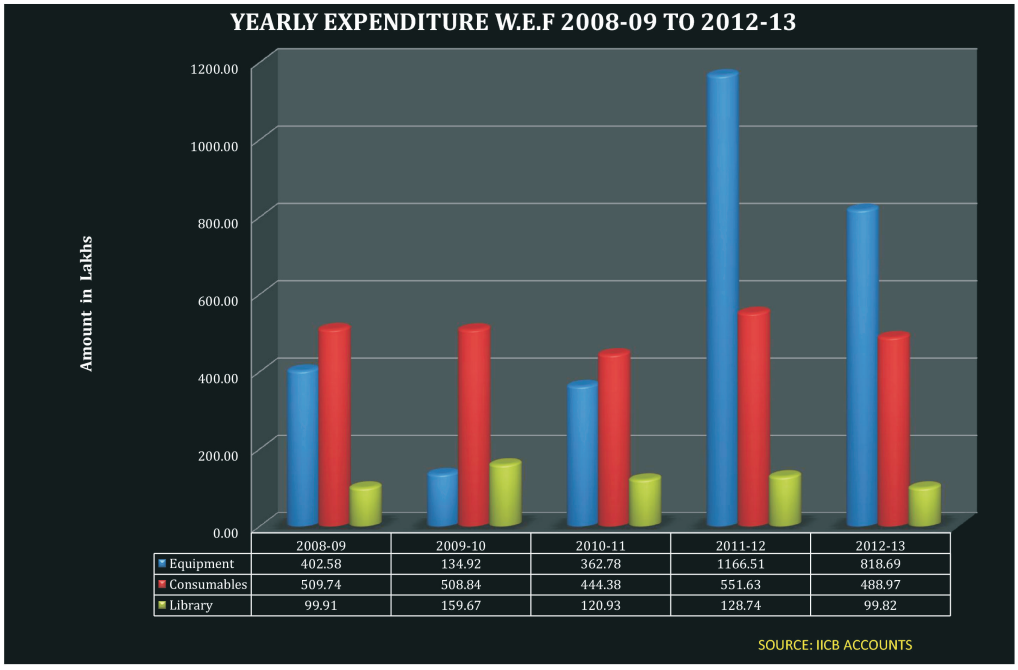
PERFORMANCE AT A GLANCE



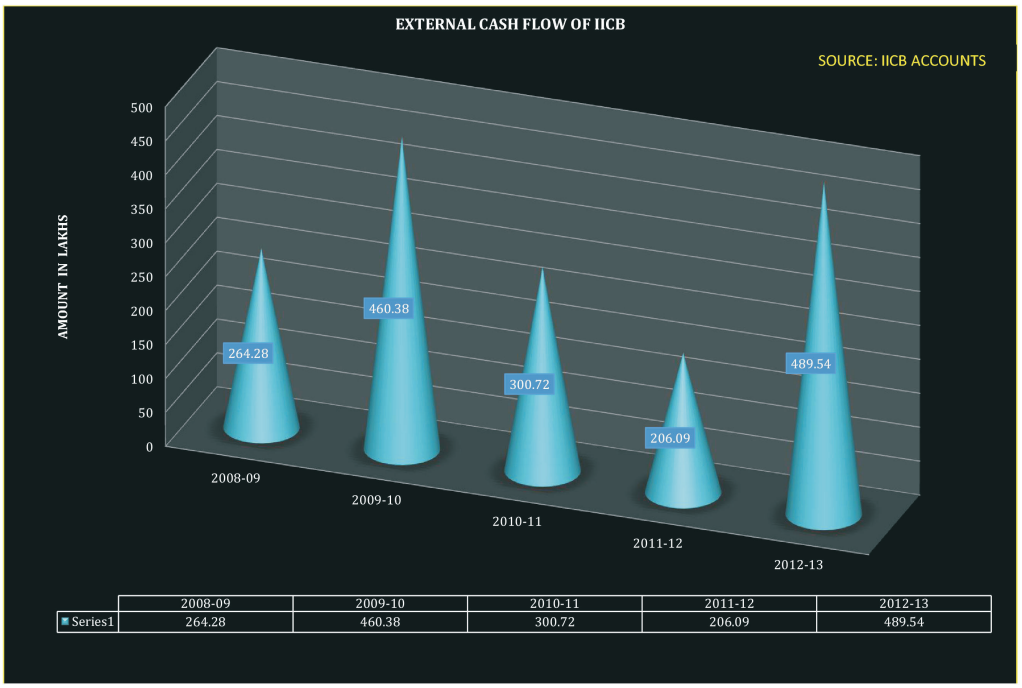


	Pay & Allowances	Contingencies	Maintenance	HRD	Pension	Advances	Office equipment	Vehicles	Staff Quarter Maintenance	Staff Quarter capital
Amount in Lakhs	2078.13	212.00	78.19	1.97	1199.99	12.83	3.00	0.00	0.00	0.00

PERFORMANCE AT A GLANCE

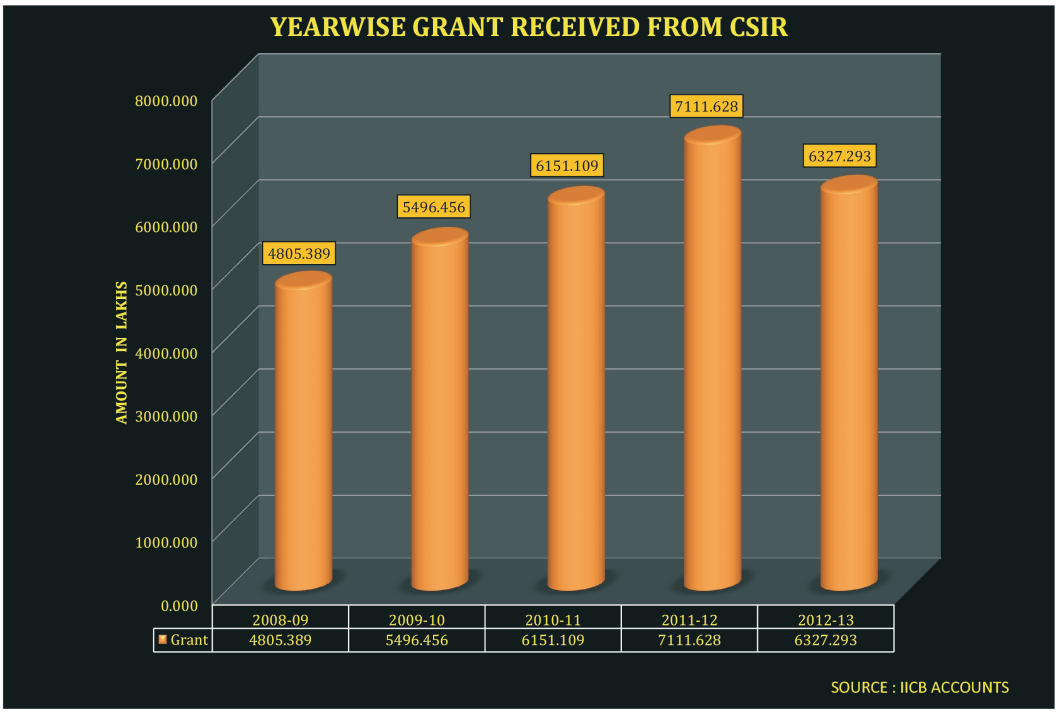


	2008-09	2009-10	2010-11	2011-12	2012-13
Equipment	402.58	134.92	362.78	1166.51	818.69
Consumables	509.74	508.84	444.38	551.63	488.97
Library	99.91	159.67	120.93	128.74	99.82

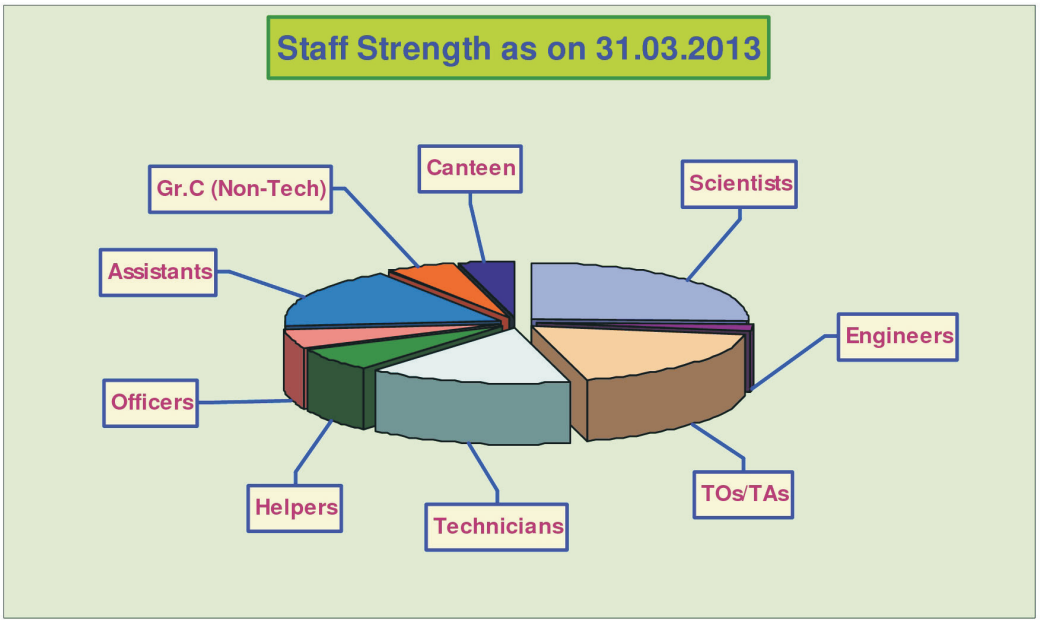


	2008-09	2009-10	2010-11	2011-12	2012-13
Series1	264.28	460.38	300.72	206.09	489.54

PERFORMANCE AT A GLANCE



PERFORMANCE AT A GLANCE



Total Staff-244

S&T Staff **: Scientists-63, Engineers-4, Technical Officers & Assistants-45, Technicians-37, Helpers-17**

Administrative Staff **: Officers-13, Assistants-42, Gr. D-13, Canteen-10**

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

History

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.

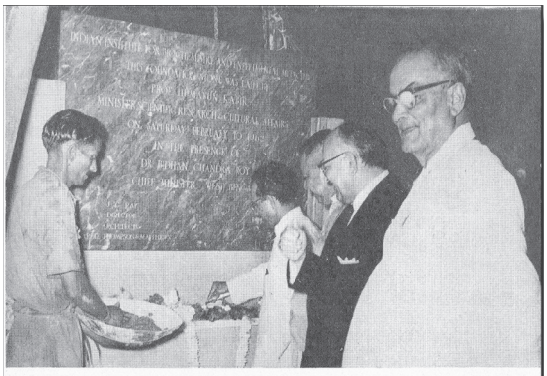
It came under the aegis of CSIR in 1956 and renamed "The Indian Institute for Biochemistry and Experimental Medicine". In 1965, the name was once again altered to "The Indian Institute of Experimental Medicine" (IIEM) and eventually in 1982, the "CSIR-Indian Institute of Chemical Biology "(CSIR-IICB) 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.

I am very glad I have been able to pay a visit to the laboratories of the Indian Institute for Medical Research – when India is free the State will encourage this in every possible way.

June 14. 1937 Jawaharlal Nehru

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 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.



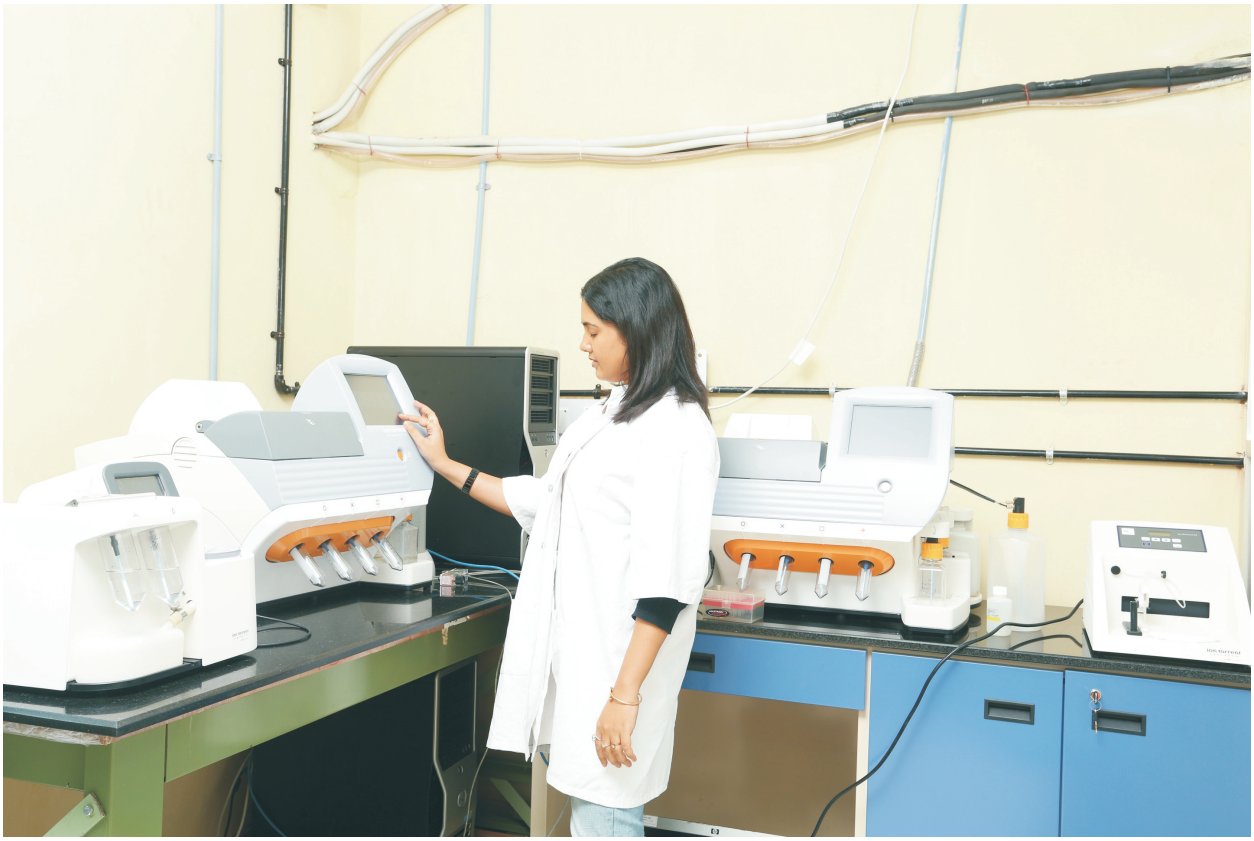
Prof. Humayun Kabir laying the foundation stone of the Institute in presence of Dr. B. C. Roy while Prof. M. S. Thacker and Sri A. K. Bose (Architect) eagerly watch.

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

Infectious Diseases and Immunology Division



Infectious Diseases and Immunology Division

Drs. Pijush K. Das (Head), Syamal Roy, Nahid Ali, Rukhsana Chowdhury, Rupak Bhadra and Uday Bandyopadhyay

Infectious Diseases and Immunology Division is concerned with the molecular pathology of leishmaniasis, cholera, malaria and gastropathy. Current objectives on leishmaniasis are *(i)* deciphering the array of neutralization mechanisms of macrophage defensive machinery by *L. donovani* for establishment of infection*, (ii)* comprehensive assessment of liposome-encapsulated drugs as therapeutic agent in general for visceral leishmaniasis and (iii) comprehensive immunobiology of *L. donovani* antigens for identification of potential vaccine candidates and to design effective cell based vaccine against leishmaniasis. 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 associated systems in *V. cholera* and *(iii) to understand stress related and* epigenetic *gene expressions in V. cholera* and *Helicobacter pylori. Objectives on malaria and gastropathy are (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 & Immunology Division

The work in my laboratory is centered on studying macrophage biology using visceral leishmaniasis as a model disease of macrophage. Macrophages are primary defense cells having well-equipped defensive machineries. Still, Leishmania and many other intracellular pathogens neutralize these and successfully survive and replicate within macrophages. This is a curious paradox of mammalian host defense that is not fully explained. Regarding leishmaniasis there are two aspects, which we are addressing.

1. How Leishmania equip themselves for invasion and survival within macrophages Leishmania Signaling.
2. How macrophage signaling processes culminating in production of defense molecules are hijacked by Leishmania Macrophage signaling

Regarding Leishmania signaling, we first showed that differentiation-coupled induction of resistance of Leishmania parasites to macrophage oxidative damage is associated with increased intracellular cAMP and cAMP-mediated response. Parasites having increased cAMP-response elements were more cytoprotective, having higher levels of antioxidant enzymes and having more free radical scavenging capacity. For comprehensive understanding of cAMP signaling, we then studied all the enzymes associated with cAMP metabolism i.e. the cAMP synthesizing enzyme, adenylate cyclase, the degrading enzyme phosphodiesterase (PDE), the regulatory enzyme pyrophosphatase (PPase) and the functional enzyme, cAMP-dependent protein kinase (PKA). In this period we have shown that another soluble cytosolic isoform of L. donovani LdPDED regulates cAMP-dependent protein kinase A signaling in an unique way. We have cloned and characterized the 2.1 Kb LdPDED which plays important role in cAMP homeostasis and parasite infectivity. Domain characterization suggested the presence of two pseudo-substrate sites similar to the ones present in the regulatory subunit of cAMP dependent protein kinase A (PKA) and a putative PKA phosphorylation site at C-terminus of LdPDED. Deletion constructs and site directed mutagenesis revealed the ability of LdPDED to interact with PKA catalytic subunits (LdPKAC1 and LdPKAC2) resulting in inhibition of kinase activity in one hand and increase of phosphodiesterase activity through PKA mediated phosphorylation of putative phosphorylation site on the other hand. To determine the in vivo consequence of this phosphorylation, parasites over-expressing the phosphorylation site-mutated form of LdPDED were allowed to infect macrophages which revealed a negative correlation between infectivity and PKA-mediated phosphorylation. This study identifies the role of Leishmania phosphodiesterase in inhibiting PKA catalytic activity through non catalytic association and its importance in PKA mediated-phosphorylation, which decreases cytosolic cAMP level facilitating infection.

Regarding macrophage signaling, in this period we showed that curdlan, a naturally occurring β glucan immunomodulator, could completely eliminate liver and spleen parasite burden in a 45-day BALB/c mouse model of visceral leishmaniasis at a dose of 10 mg/kg/day. Our studies suggested the essential role of IL-23 in Th17 differentiation. Although administration of recombinant IL-17 or IL-23 caused

significant suppression of organ parasite burden with marked generation of IFN-γ and nitric oxide, effects were much faster for IL-17. These results documented that although both IL-23 and IL-17 play major roles in the antileishmanial effect of curdlan, the effect of IL-23 may be indirect through the induction of IL-17 generation. One of the mechanisms for establishment of infection employed by intra-macrophage pathogen like Leishmania is inhibition of oxidative burst-mediated macrophage apoptosis in order to protect their niche for survival and replication. We tried to elucidate the underlying mechanism for this by using H_2O_2 for induction of apoptosis. L. donovani-infected macrophages were much more resistant to H_2O_2-mediated apoptosis compared to control. Although infected cells were capable of comparable reactive oxygen species (ROS) production, there was less activation of the downstream cascade consisting of caspases 3, 7 and cleaved poly (ADP)-ribose polymerase (PARP). Suppressors of cytokine signaling (SOCS) 1 and 3 proteins and ROS scavenging enzyme thioredoxin, known to be involved in stabilization of protein tyrosine phosphatases, were found to be induced during infection. Induction of SOCS proteins may be mediated by Egr1 and silencing of SOCS 1 and 3 either alone or in combination resulted in reduced thioredoxin levels, enhanced activation of caspases and increased apoptosis of infected macrophages. SOCS knocked-down cells also displayed decreased parasite survival thus marking reduction in disease progression. Taken together, results suggest that L. donovani may exploit SOCS for subverting macrophage apoptotic machinery towards establishing its replicative niche inside the host.

Publication Details:

Ghosh, K., Sharma, G., Saha, A., Kar, S., **Das, P.K.** and Ukil, A., Successful therapy of visceral leishmaniasis with curdlan involves T-helper 17 cytokines. *J. Infect. Dis*. **207**, 1016-1025 (2013).
Srivastav, S., Basu Ball, W., Gupta, P., Giri, J., Ukil, A., and **Das, P.K.** (2013) *Leishmania donovani* Prevents Oxidative Burst Mediated Apoptosis of Host Macrophages through Selective Induction of Suppressors of Cytokine Signaling (SOCS) Proteins. *J. Biol. Chem*. **289,** 1092-1105.
Sharma, G., Kar, S., Palit, S. and **Das, P.K.** (2012) 18β-Glycyrrhetinic acid (Concur) induces apoptosis through modulation of Akt/FOXO3a/Bim pathway in human breast cancer MCF-7 cells. *J. Cell Physiol*. **227**, 1923-1931.

Invited Lectures:

Delivered four (4) numbers of invited talks at different seminar & symposium in India and one number in abroad as shown below

Topic: From cells to signaling cascades: Manipulation of macrophage defense by *Leishmania* parasites. Role of the deubiquitinating enzyme A20.

Venue: 3rd International Conference on Neglected Tropical Diseases, Dhaka, Bangladesh

Date: September 1-2, 2012

Academic Performance:

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

Acted as Examiner for Ph.D thesis at Jawaharlal University and Delhi University

Abstracts Presented:
No. of Abstracts in National Conference is 4
No. of Abstracts in International Conference is 1

Honors & Awards:

Awarded **Viswanath Memorial Lecture Award** (2012) from Indian National Science Academy (**INSA**) for outstanding contributions in Biological Sciences

Nominated as **Member of the Sectional Committee** (General Biology) of **Indian Academy of** Sciences, Bangalore for 2013-2015.

Nominated as Member of the Sectional Committee X (Cell and Biomolecular Sciences) of Indian National Science Academy (INSA) for 2012-2014

Nominated by INSA as Member of the National committee of IUBMB for 2012-2015

Nominated by INSA as Member in the Subject Committee on Biomedical (Life) Sciences to select candidates for support under INSPIRE Faculty scheme of DST.

Nominated as Member of the Animal Sciences & Biotechnology Research Committee, CSIR

Nominated as Member of the 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, Shreyasi Palit, Amit Viz, Shalini Roy
DST Inspire Faculty: Dr. Arunima Biswas
Summer Trainee(s): Ms. Devika Bodas

Dr. (Mrs.) Nahid Ali
Infectious Diseases & Immunology Division

Diagnostic and vaccination strategies for visceral leishmaniasis and therapeutic approaches for cancer

Early diagnosis of infection is important to combat disease manifestation. We have developed *Leishmani*a promastigote membrane antigen (LAg)-based dipsticks for non invasive, simple and field adaptable diagnosis of visceral leishmaniasis (VL) using urine samples, giving 100% sensitivity and specificity, similar to that with our serum based dipstick assay developed earlier. We are now in the process of identifying specific peptides that would be cloned, expressed and used as a lateral flow immunoassay device for rapid diagnosis of VL.

A safe and efficacious vaccine is needed to control VL. We have shown that subcutaneous vaccination of hamsters with a liposomal cocktail of recombinant cysteine protease A (CPA), cysteine protease B (CPB) and cysteine protease C (CPC) antigens from *L. donovani* along with monophosphoryl lipid A (MPL-TDM) resulted in a strong Th-1 biased immune protection. Furthermore, a novel formulation of the cationic liposomes with intralamellar MPLA has also been developed and its study is underway.

Cancer is the leading death cause worldwide. Despite of favorable advancements, state-of-the art chemotherapy is still not available for many cancers. We found that stearylamine-bearing cationic liposome, composed of phosphatidylcholine (PC) and SA in its 7:2 molar ratio led to a dose-dependent and selective killing of eight different cancer cell lines which expose surface PS but not that of normal cells. The efficacy of PC:SA liposome presents a new strategy for anticancer therapy to trigger the apoptotic mode of cell death in cancer cells through surface exposed PS. Patent application of this work is under process.

Publication Details:

Ejazi, SA and **Ali, N** (2013) Developments in diagnosis and treatment of visceral leishmaniasis during the last decade and future prospects. *Expert Review of Anti-infective Therapy*, **11**, 783-785.

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

Das, A and **Ali, N**(2012)Vaccine development against Leishmania donovani. *Frontiers in Microbial Immunology* , **3**, 99

Invited Lectures:

Delivered four (4) numbers of invited talks at different seminar & symposium in Kolkata and Bangaluru

Academic Performance:

Acted as Teacher, for *course work* at CSIR-IICB, Kolkata
Acted as Reviewer, for *three project proposals*, at CSIR and DBT
Acted as Thesis reviewer, for Department of Biotechnology, Integral University and Birla Institute of Technology and Science respectively
Acted as Papers Reviewer, for *Journal of Clinical Immunology, PLOS ONE, Indian Journal of Medical Research, International Journal of Infectious Diseases, International Journal of Tropical Diseases and Health, Journal of liposome Research, Expert opinion of Drug Delivery, Journal of Microencapsulation, Parasitology, Clinical and Vaccine Immunology, Vaccine, Journal of Clinical Immunology, African Journal of Biotech, Journal of Antimicrobial Chemotherapy, Acta Tropica, PLOS Neglected Tropical Diseases, and Experimental Parasit*

Abstracts Presented:
No. of Abstracts in National Conference is 15

Honors & Awards:
FASc, by I*ndian* A*cademy of Science*, Bangaluru

Human Resource:
R**esearch Fellow(s):** Amrita Das, Roma Sinha, Manjarika De, Pradyot Bhattacharya, Md. Asad, Md. Shadab, Sarfaraz Ahmad Ejazi, Somsubhra Thakur Chowdhury, Rudra Chhajer and Abdus Sabur
R**esearch Associate(s):** Smriti Mondal,
P**roject Assistant(s):** Anirban Bhattacharya,
S**ummer Trainee(s):** Poulami Tapadar, Sahanaz Khatun, Dhruvika Rajan, Poulomi Das, Mudasir Ahmad and wahida Rahman.,

Dr. Rukhsana Chowdhury
Infectious Diseases & Immunology Division

Host cell contact induces expression of virulence factors in *Helicobacter pylori*

Helicobacter pylori, a gram negative bacterium, colonizes the stomach in a majority of the world population. The two major virulence factors of *H. pylori* VacA and CagA, thought to be associated with chronic inflammation and disease, have been extensively studied but the regulation of expression of these virulence genes in *H. pylori* remain poorly understood. We have demonstrated that adherence of *H. pylori* to the gastric epithelial cell line AGS, strongly induces expression of both *cagA* and *vacA*. Our results suggest that Δ*fur* mutant strain has a role in the up-regulation of *cagA* and *vacA* expression specifically in AGS- adhered *H. pylori*. Consistent with these results, microscopic observations revealed that *infection of AGS cells with H. pylori* Δ*fur* mutant strain produced much less damage as compared to that produced by the wild type *H. pylori* strain.

The Molecular Basis of anti- *H. pylori* effect of Polyethyleneimine Functionalized Zinc Oxide Nanoparticles

In view of the world wide prevalence of *Helicobacter pylori* infection, its potentially serious consequences, and the increasing emergence of antibiotic resistant *H. pylori* strains there is an urgent need for the development of alternative strategies to combat the infection. We have demonstrated that polyethyleneimine (PEI) functionalized zinc oxide (ZnO) nanoparticles (NPs) inhibit the growth of a metronidazole-resistant strain of *H. pylori* and the **molecular basis of the anti-bacterial activity of ZnO-PEI NP has been investigated which** indicate severe membrane damage. *I*ntracellular ROS generation increased rapidly following the treatment of *H. pylori* with ZnO-PEI NP and extensive degradation of 16S and 23S rRNA.

Induction of the extracytoplasmic stress response reduces virulence of *Vibrio cholerae*

Vibrio cholerae, an important human intestinal pathogen is responsible for the diarrhoeal disease cholera. The pathogenesis of *V. cholerae* is a highly coordinated process that involves diverse regulatory factors. It has recently been demonstrated the reduced membrane localization of the central virulence regulator TcpP. We have now elucidated the reason for the impaired membrane localization of TcpP in the *fadD* mutant. Our results suggest that extracytoplasmic stress response *per se* reduces virulence of *V. cholerae* by impairing membrane localization of TcpP.

Publication Details:

Dey AK, Bhagat A and **Chowdhury R.** (2013) Host cell contact induces expression of virulence factors and VieA, a cyclic di-GMP phosphodiesterase in *Vibrio cholerae*. J Bacteriol. **195**: 2004-2010.

Pradhan S, Mallick SK and **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)**:e53504

Human Resource:

Technical staff(s): Dr. Kalidas Paul, Mr. Sandip Chakraborty

Research Fellow(s): Mr. Amit K. Baidya, Ms. Epshita Chatterjee, Ms. Subhra Pradhan, Mr. Raghawan, Ms. Sreejana Ray, Mr. Saurabh Bhattacharya, Ms. Chirantana Sengupta

Dr. Rupak Kr. Bhadra
Infectious Diseases & Immunology Division

Evolution of pathogenic clones and molecular basis of stringent response of Vibrio cholerae

Vibrio cholerae, the causative agent of severe diarrhoeal disease cholera, still remains a major public health problem in most developing countries including India. The pathogen has evolved with sophisticated gene regulatory systems to cause large-scale epidemics, pandemics and pathogenesis. Cholera toxin (CT) is the major virulence factor of *V. cholerae*. Interestingly, the *ctxAB* genes, which code for CT, is carried by a filamentous phage called CTX phage. Recent research from this laboratory and also from other laboratories of the world indicates that diverse CTX phages are playing important roles in the evolution of pathogenic clones of *V. cholerae*. Apart from this work our group has also contributed significantly about comparative genome mapping of enteric pathogens especially *Shigella* spp. We have also generated significant knowledge about nutritional stress related bacteria stringent response using *V. cholerae* as a model system. We have functionally characterized several genes involved in the process, for example, *relA*, *spoT, cgtA* and *dksA*. The products of these genes are involved in intracellular metabolism of a small molecule called ppGpp. We have also discovered a novel ppGpp synthetase-coding gene in *V. cholerae*, called *relV*. RelV is small protein may play a critical role under various stress conditions including glucose and fatty acid starvations. Our study indicates that the intracellular signal molecule ppGpp plays very important roles in *V. cholerae*'s physiology including quorum sensing, biofilm formation, virulence, survival and growth. The molecular mechanisms of all these are currently being investigated.

Publication Details:

Pal RR, Bag S, Dasgupta S, Das B and **Bhadra RK.** (2012) Functional characterization of the stringent response regulatory gene dksA of *Vibrio cholerae* and its role in modulation of virulence phenotypes. *Journal of Bacteriology*, **194**, 5638-5648

Pal P, Pal A, Niyogi SK, Ramamurthy T and **Bhadra RK.** (2013) Comparative analysis of the genomes of Shigella dysenteriae type 2 & type 7 isolates. *Indian J Med Res*, **137**, 169-177

Invited Lectures:

Delivered one (1) number of invited talks in Vidyasagar University, Midnapur, West Benga

Academic Performance

Acted as External examiner, for *Ph.D viva voce examination*, at Jadavpur University and as Teacher at NIPER, Kolkata, Presidency University, Kolkata & *Ph.D Course Work*, at CSIR-IICB, Kolkata

Abstracts Presented

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

Honors & Awards:

Elected as Fellow by *West Bengal Academy of Science & Technology*,

Human Resource:

Technical/Administratice Staff(s): Pratap C. Koyal , Shibkumar Sharma
Research Fellow(s): Ritesh Ranjan Pal, Satyabrata Bag, Shreya Dasgupta, Pallabi Basu
Project Assistant(s): Sourav Bhattacharya,
Summer Trainee(s): Gina Karyn Dantes, Promi Das, Ragini Palchoudhury,

Dr. Uday Bandopadhyay
Infectious Diseases & Immunology Division

Translocation of Heme Oxygenase-1 to Mitochondria Is a Novel Cytoprotective Mechanism against Non-steroidal Anti-inflammatory Drug-induced Mitochondrial Oxidative Stress, Apoptosis, and Gastric Mucosal Injury*

The mechanism of action of heme oxygenase-1 (HO-1) in mitochondrial oxidative stress (MOS)-mediated apoptotic tissue injury was investigated. MOS-mediated gastric mucosal apoptosis and injury were introduced in rat by indomethacin, a non-steroidal anti-inflammatory drug. Here, we report that HO-1 was not only induced but also translocated to mitochondria during gastric mucosal injury to favor repair mechanisms. Furthermore, mitochondrial translocation of HO-1 resulted in the prevention of MOS and mitochondrial pathology as evident from the restoration of the complex I-driven mitochondrial respiratory control ratio and transmembrane potential. Mitochondrial translocation of HO-1 also resulted in time-dependent inhibition of apoptosis. We searched for the plausible mechanisms responsible for HO-1 induction and mitochondrial localization. Free heme, the substrate for HO-1, was increased inside mitochondria during gastric injury, and mitochondrial entry of HO-1 decreased intramitochondrial free heme content, suggesting that a purpose of mitochondrial translocation of HO-1 is to detoxify accumulated heme. Heme may activate nuclear translocation of NF-E2-related factor 2 to induce HO-1 through reactive oxygen species generation. Induction and mitochondrial localization of HO-1 are a novel cytoprotective mechanism against MOS-mediated apoptotic tissue injury.

Novel anti-inflammatory activity of epoxyazadiradione against macrophage migration inhibitory factor: Inhibition of tautomerase and pro-inflammatory activities of macrophage migration inhibitory factor.

Macrophage migration inhibitory factor (MIF) is responsible for proinflammatory reactions in various infectious and non-infectious diseases. We have investigated the mechanism of anti-inflammatory activity of epoxyazadiradione, a limonoid purified from neem (*Azadirachta indica*) fruits, against MIF. Epoxyazadiradione inhibited the tautomerase activity of MIF of both human (huMIF) and malaria parasites (*Plasmodium falciparum* (*Pf*MIF) and *Plasmodium yoelii* (*Py*MIF)). Epoxyazadiradione also significantly inhibited MIF (huMIF, *Py*MIF, and *Pf*MIF)-mediated proinflammatory activities in RAW 264.7 cells. It prevented MIF-induced macrophage chemotactic migration, Epoxyazadiradione not only exhibited anti-inflammatory activity *in vitro* but also *in vivo*. We tested the anti-inflammatory activity of epoxyazadiradione *in*

vivo after co-administering LPS and MIF in mice to mimic the disease state of sepsis or bacterial infection. The molecular basis of interaction of epoxyazadiradione with MIFs was explored with the help of computational chemistry tools and a biological knowledgebase. Docking simulation indicated that the binding was highly specific and allosteric in nature. The well known MIF inhibitor (*S*,*R*)-3-(4-hydroxyphenyl)-4,5-dihydro-5-isoxazole acetic acid methyl ester (ISO-1) inhibited huMIF but not MIF of parasitic origin. In contrast, epoxyazadiradione inhibited both huMIF and plasmodial MIF, thus bearing an immense therapeutic potential against proinflammatory reactions induced by MIF of both malaria parasites and human.

Publication Details:

Dey S, Bindu S, Goyal M, Pal C, Alam A, Shameel Iqbal M, Kumar R, Sarkar S and **Bandyopadhyay U.** (2012) Impact of Intravascular Hemolysis in Malaria on Liver Dysfunction: Involvement of Hepatic Free Heme Over-load, NFB Activation and Neutrophil Infiltration. *J. Biol. Chem*, **287**, 26630-26646

Alam A, Haldar S, Thulasiram HV, Kumar R, Goyal M, Iqbal MS, Pal C, Dey S, Bindu S, Sarkar S, Pal U, Maiti NC and **Bandyopadhyay U** (2012) Novel anti-inflammatory activity of epoxyazadiradione against macrophage migration inhibitory factor: inhibition of tautomerase and pro-inflammatory activities of macrophage migration inhibitory factor. *J. Biol. Chem.*, **287**, 24844-24861

Goyal M, Singh P, Alam A, Kumar Das S, Shameel Iqbal M, Dey S, Bindu S, Pal C, Kumar Das S, Panda G and **Bandyopadhyay U** (2012) Aryl aryl methyl thio arenes prevent multidrug-resistant malaria in mouse by promoting oxidative stress in parasites. *Free Radic Biol Med.*, **53**, 129-142

Goyal M, Alam A and **Bandyopadhyay U** (2012) Redox regulation in malaria: current concepts and pharmacotherapeutic implications. *Curr. Med. Chem*, **19**, 1475-1503

Review Details:

Pal C and Bandyopadhyay U (2012) Redox-active antiparasitic drugs. *Antioxid Redox Signal*, **17**, 555-581

Honors & Awards:

Fellow of Indian Academy of Sciences (FASc), 2012 , by *Indian Academy of Sciences , Bangalore*

Human Resource:

Research Fellow(s): Sauvik Sarkar, Somnath Mazumdar, Mhd Sameel Iqbal, Chinmay Banerjee, Ashim Azhar Siddqui, Rudranil Dey

Dr. Mrs. Mita Chatterjee Debnath
Infectious Diseases & Immunology Division

99mTc(CO)3 labeled linear RGD peptides, evaluation of their efficacy as tumor targeting vectors

Technetium-99m is the most widely used radioisotope in diagnostic nuclear medicine owing to its ideal physical characteristics ($t_{1/2}$ 6 h, photon energy 140 KeV, no corpuscular radiation) and commercial availability from $^{99}Mo/^{99m}Tc$ generator. The potential to incorporate this radionuclide into different targeting vectors has been the foremost consideration in developing diagnostic radiopharmaceuticals. In the recent study, we report the synthesis of two tetra peptides viz. Asp-Gly-Arg-His (tetra-Pep1) and Asp-Gly-Arg-Cys (tetra-Pep2) and one hexapeptide Asp-Gly-Arg-D-Tyr-Lys-His (hexa-Pep) and labeled with $^{99m}Tc(CO)_3(H_2O)_3$ precursor via His or Cys residue. In vitro binding studies and internalization studies were performed in Ehrlich ascites carcinoma (EAC) and $\alpha_v\beta_3$-receptor positive B16F10 mouse melanoma cell lines. Bio-distribution and scintigraphic studies were performed in EAT bearing mice model (Fig 1) . The bioreductive pharmacophore attached to the peptide radiolabeled with technetium-99m can be used radiodiagnostic markers of tumor hypoxia. Anticancer drugs by the same approach could reach the target easily and serve the purpose of diagnosis as well as treatment.

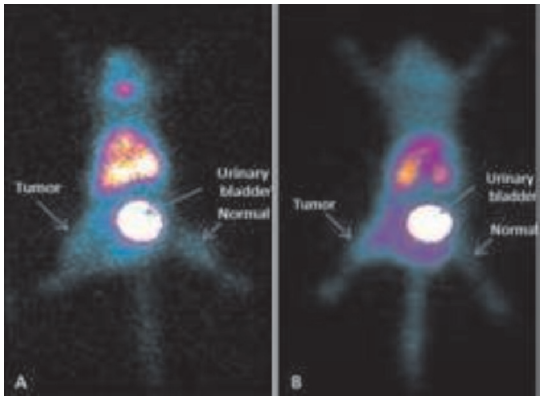


Fig.1: *SPECT images of 99mTc(CO)3 labeled linear RGD hexa(A) and tetra (B) peptides in EAT bearing mice model Cell uptake and internalization curves of radiolabeled peptides in (A) Ehrlich ascites cell line and (B) B16F10 mouse melanoma*

Publication Details:

Nayak DK, Baishya R, Halder KK, Sen T,. Sarkar BR, Ganguly S, Das MK and **Debnath MC** (2012) Evaluation of 99mTc(I)-tricarbonyl complexes of fluoroquinolones for targeting bacterial infection. *Metallomics,* **4**, 1197-1208

Sanyal K and **Debnath MC** (2012) Synthesis of S-thiomethyl DMSA andS-thiomethyl ECD, radiolabelling with. *J. Label Compd. Radiopharm* , **55**, 258263

Sanyal K, Chattopadhyay S and **Debnath MC** (2012) Synthesis of S-thiomethyl MAG3, radiolabelling with technetium-99m and biological evaluation. *J. Label Compd. Radiopharm* , **55**, 377-382

Academic Performance:

Acted as **external examiner** , for *M Pharm Viva voce examination* , at NSHM college of Pharmaceutical Technology, Kolkata

Abstracts Presented:

No. of Abstracts in National Conference is **2**

Students Awarded PhD:

Kamal Krishna Halder

Human Resource:

Research Fellow(s): Rinku Baishya, Dipak K. Nayak, Raghuvir Gaonkar,
Summer Trainee(s): Kazi Julekha,

Cancer Biology & Inflamatory Disorder Division

Cancer Biology & Inflammatory Disorder Division

Drs. Chitra Mandal (Head), Santu Bandyopadhyay, Susanta Roychoudhury, Malini Sen, Mrinal Ghosh and Padma Das

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. Identification of cellular signaling, probable target proteins and signal cross-talking are very important to understand the disease biology and pathogenesis and also it could serve the critical role for development of new generation chemotherapeutics. The significance of role and regulation of p68/p72 DEAD Box RNA Helicases through EGFR & Wnt signaling in breast and colon cancer along with study of CKII-mediated signaling crosstalk in glioma will be addressed. Redox-based therapies are used currently to treat some haematologic malignancies. Therefore, understanding the role of intracellular redox threshold in cancer cell signaling and apoptosis along with manipulation of intracellular redox status of cancer cells to overcome drug-resistance cell lines would be helpful for development of anticancer therapy.

Autophagy allows the degradation of the cytoplasmic contents including unfolded proteins and membranous organelles under certain stress conditions. This serves as a temporary survival mechanism. Oxidative stress, nutrient starvation, misfolded protein accumulation, could induce autophagy. However, autophagy is also a cell death mechanism and is a response to various anti-cancer therapies in varieties of cancers. A strong correlation exists between autophagy and apoptosis. Therefore, delineating the underlying mechansim of various autophagic pathways of cell death will be attempted.

Chromosome instability (CIN) is the hallmark of cancer. Defects in genes involved in chromosome segregation may lead to CIN by causing aneuploidy. Aneuploidy can be both beneficial and detrimental for cellular transformation depending on genetic context. It can result due to defects in Spindle Assembly Checkpoint (SAC), failed Cytokinesis and Centrosome amplification during mitosis. Improper chromosome alignment during metaphase triggers the SAC that arrests initiation of anaphase. An extensive interaction among the SAC proteins and their regulation by phosphorylation and ubiquitination determines whether or not chromosomes will segregate equally into two daughter cells. Recent evidences suggest that altered expression and regulation of SAC genes leads to abnormal mitotic behavior that may result cellular transformation. A clear understanding of the regulation of cellular ploidy might reveal new strategy for anticancer therapy.

Influence of Wnt and WISP in inflammation, oxidative stress and fibrosis is an important topic of investigation both in India and abroad. A clear understanding of the molecular details is lacking. Therefore, understanding the influence of Wnt signaling in macrophage survival / differentiation and inflammation and evaluation of the potential of Wnt-Induced Secreted Protein 3 (WISP-3) in the regulation of oxidative stress and fibrosis that may be associated with inflammation will be explored.

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

The main aim of our work is to understand the mystery of glycosylation of bio-molecules in different disease models. Our glyco-immunological work has provided elegant elucidations to the intelligent encounter between the newly-induced sugar molecules and diseased status. In close-association with clinicians, based on hard medical-data, we have firmly established O-acetylated sialioglycoproteins as novel decisive biomarker on lymphoblasts of children in ALL by using a novel indigenous probe developed in our laboratory.

Regulatory T cells (T_{reg}) act to suppress activation of the immune system and thereby maintain immunological homeostasis and tolerance to self-antigens. The Frequency and suppressing activity of T_{reg} in general are high in different malignancies. Our laboratory wanted to identify the role and regulation of $CD4^+CD25^+FoxP3^+$ T_{reg} cells in B-cell acute lymphoblastic leukemia (B-ALL). Our studies have indicated that the $CD4^+CD25^+FoxP3^+$ T_{reg} played an important role in immunosuppression, which resulting a positive disease-correlation in these patients. This is the first elaborated report about the frequency, regulation and functionality of T_{reg} in B-ALL.

Additionally, our lab is deeply engaged in establishing natural products as important sources of anti-cancer molecules and potential immunomodulator. Recently we have demonstrated the inhibitory effect of mahanine, a carbazole alkaloid, purified fromMurraya koenigii,a well-known edible herb, in pancreatic cancer by restraining the functional activity of Hsp90 through reactive oxygen species (ROS). Mahanine possibly disrupted Hsp90-Cdc37 chaperone complex in addition to inducing ROS generation. Surface plasmon resonance and molecular modeling studies also suggest that mahanine formed hydrogen bonds with Hsp90 and exhibited hydrophobic interactions with several amino acids in the Hsp90-Cdc37 interface (Fig.1). However, mahanine did not impede the ATP binding pocket of Hsp90. Furthermore, it inhibited orthotopic pancreatic cancer in nude mice (Fig.2).

Additionally, we have reported that C-7-OH and 9-NH functional groups of mahanine are responsible for its cytotoxicity and minor groove binding with DNA. We have also demonstrated that mahanine potentially induces apoptosis in micro-satellite instable colorectal cancer cells as single agent and in combination with 5-FU. It synergistically increases the cytotoxic effect of 5-FU and promotes ROS-mediated nuclear accumulation of PTEN along consecutive interaction with p53/p73. We have also observed its cytotoxic activity in glioblastoma multiforme by several molecular avenues. Summarily, our collective observations promote mahanine as a potential chemotherapeutic agent against an array of human cancers.

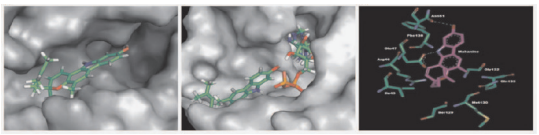


Fig.1: *Molecular modeling studies of Hsp90-mahanine interaction. (a) Binding site of mahanine in Hsp90. Mahanine is displayed in a stick model and Hsp90 in a surface view. (b) Status of mahanine and ATP in Hsp90. Surface representation of Hsp90 with mahanine and ATP in a stick model. (c) Residues involved in the interaction of mahanine with Hsp90. Hsp90 and mahanine are represented in a stick model; the sticks are colored according to the type of atom. Carbon is green in Hsp90 and pink in mahanine.*

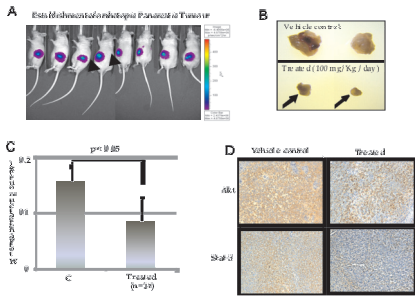


Fig.2: *Mahanine inhibits pancreatic tumors in an orthotopic nude mouse model.* ***A.*** *Luciferase containing MIAPaCa-2 cells were implanted into the pancreas of athymic nude mice to generate pancreatic tumors orthotopically.* ***B.*** *Reduction of tumor mass as reflected by two representative pancreatic tumors excised after 12 days of vehicle (control) and mahanine treatment.* ***C.*** *Pancreatic tumor load represented as the weight of the tumor after excision from the pancreas, in the control and treated groups. The tumor load was significantly lower in the mahanine-treated than the vehicle-treated group.* ***D.*** *The Akt and Stat-3 protein levels were determined by immunohistochemistry staining in the tumor orthograft control and treated tissue samples.*

Publication Details:

Sarkar S, Dutta D, Samanta SK, Bhattacharya K, Pal BC, Li J, Datta K, Mandal CN and Mandal C (2013) Redox sensitive inhibition of Hsp90 coupled with disruption of super-chaperone complex attenuate pancreatic adeno-carcinoma in vitro and in vivo. *Int. J. Cancer*, **132**, 695-706.

Samanta S, Ghoshal A, Bhattacharya K, Saha B, Walden P and Mandal C (2012) Sialoglycosylation of RBC in visceral leishmaniasis leads to enhanced oxidative stress, calpain-induced fragmentation of spectrin and hemolysis.
PLoS ONE , **7**, 1-13.

Kushwaha S, Roy S, Maity R, Mallick A, Sonia VK, Singha PK, Chaurasiya ND, Sangwan R S, Misra-Bhattacharya S and Mandal C (2012) Chemotypical variations in Withania somnifera lead to differentially modulated immune response in BALB/c mice. *Vaccine*, **30**, 1077-1087.

Chapter(s) Details:

Chandan Mandal and Chitra Mandal (2013) Identification and analysis of O-acetylated glycoproteins. In Methods in Molecular Biology. *Human Press, Springer publishing group, USA*, (*Ed.* Dr. John Walker), Vol. 981, pp. 57-93.

Invited Lectures:

Delivered four (4) numbers of invited talks in India & also same numbers in abroad which are shown below:

Topic:	*Oxidative inhibition of Heat Shock Protein 90 in pancreatic adenocarcinoma*
Venue:	San Antonio, Texas USA
Date:	September 10, 2012
Topic:	*Exploration of Indian herbs: A promise for pancreatic cancer*
Venue:	Omaha, Nebraska, USA
Date:	September 13, 2012
Topic:	*Status of sialic acids and their role on Pseudomonas aeruginosa in host-pathogen interaction*
Venue:	San Diego, USA
Date:	September 17, 2012
Topic:	*Update of Clinical, Diagnostic, Chemotherapeutic and Vector Aspects of Leishmaniasis*
Venue:	University of Colombo, Srilanka
Date:	March 23, 2013

Session Chaired:

Chaired one scientific session in the GUHA RESEARCH CONFERENCE at Shillong, Meghalaya, India, on November 28, 2012

Chaired one scientific session in the 3rd International Cancer Research Symposium at Kolkata, India, on December 18, 2012

Chaired one scientific session in the International Symposium on Challenges in Chemical Biology, at Kolkata, India, on January 27, 2013

Academic Performance:

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

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; Banaras Hindu University, Varanasi; CSIR-CDRI, Lucknow; Calcutta University, Kolkata

Deputation Abroad:

Update of Clinical, Diagnostic, Chemotherapeutic and Vector Aspects of Leishmaniasis, at University of Colombo, Srilanka, from March 23- 28, 2013

Second World Congress on Cancer Science and Therapy, at San Antonio, USA, from September 10-12, 2012

Delivered an invited talk at University of Nebraska Medical Center (UNMC), Omaha, Nebraska,

USA, from September 13-14, 2012
Delivered an invited talk at University of California, San Diego (UCSD), CA, USA , from September 17-18, 2012

Abstracts Presented:
No. of Abstracts in National Conference is **6**
No. of Abstracts in International Conference is **3**

Conference/Workshop/Symposia Organized:
Chairperson of the committee for the Theme Pavilion of CSIR at 100th Science Congress, India .

Honors & Awards:
Fellow of The World Academy of Sciences , by *The World Academy of Sciences* , Recognition of the outstanding contribution to science and its promotion in the developing world
Awarded 'National Woman Bio-scientist Award (Senior Category), by *Department of Biotechnology, Govt. of India* , Recognition of the outstanding contribution to Bio-science

Human Resource:
Technical/Administrative Staff(s): Mr. Asish Mallick, Rita Maity, Karu Ravi Das,
Research Fellow(s): Samarpan Maity, Saptrashi Roy, Arup K Bag, Kaushik Bhattacharya , Suman Samanta , Biswajit Khatua , Ranjita Das, Devawati Dutta
Research Associate(s): Dr. Manjusha Chakrabarty,
Pool Officer(s): Dr. Chandan Mandal
Project Assistant(s): Sayantani Sarkar
Summer Trainee(s): Shiladitya Nag, Sharmistha Ghosh, Devi Nandana, Sashi Bhushan,

Dr. Santu Bandopadhyay
Cancer Biology & Inflammatory Disorder

Redox manipulation for cancer cell apoptosis

Usually, cancer cells have higher threshold of intracellular reactive oxygen species (ROS) compared to their normal counterparts. We attempted to manipulate intracelluar ROS threshold by combining different molecules having known anticancer activity. In the first instance, we combined non-apoptotic doses of hydroxychavicol (HCH), a constituent of Piper betle leaves with glutathione (GSH) synthesis inhibitor, buthionine sulfoximine (BSO). Co-administration of these two molecules leads to synergistic apoptosis of chronic myeloid leukemic cells via activation of apoptosis inducing factor (AIF) and GSH-ROS-JNK-ERK-iNOS pathway.

In the second instance, combination of HCH with curcumin, another anticancer molecule, leads to activation of mTOR-eIF4E-Bax route to induce enhanced apoptosis in leukemic cells. Our data suggest that mTOR and MAPK pathways converge at eIF4E in HCH plus curcumin-induced enhanced apoptosis and provide mechanistic insight for the role of mTOR activation in apoptosis.

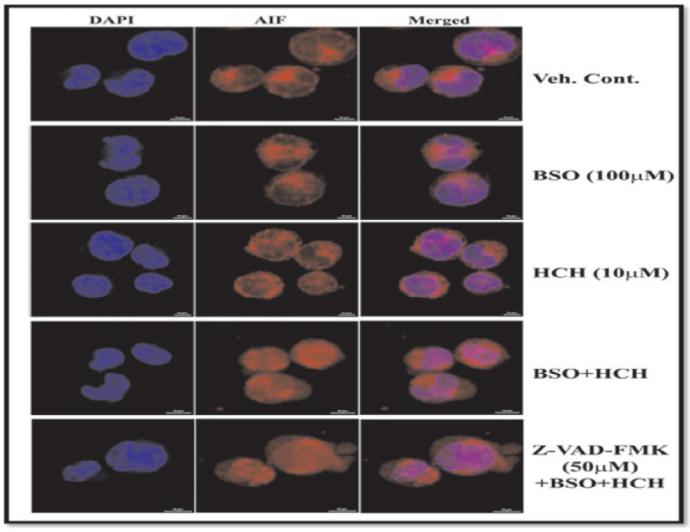


Fig.: *Combination of BSO and HCH induces AIF translocation in caspase-independent manner*

Publication Details:

Chowdhury, AA., Chaudhuri, J., Biswas, N., Manna, A., Chatterjee, S., Mahato, SK., 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

Manna, PP., Hira, SK., Das, AA., **Bandyopadhyay, S.** and Gupta, KK. (2013) IL-15 activated human peripheral blood dendritic cell kill allogeneic and xenogeneic endothelial cells via apoptosis.. *Cytokine*, **61**, 118-126

Bhattacharjya, S., Nath, S., Ghose, J., Maiti, GP., Biswas, N., **Bandyopadhyay, S.**, Panda, CK., Bhattacharyya, NP. and Roychoudhury, S. (2012) miR-125b promotes cell death by targeting spindle assembly checkpoint gene MAD1 and modulating mitotic progression. *Cell Death Differ.*,**20**, 430-442

Students Awarded PhD:

Nabendu Biswas *for thesis entitled "*Redox manipulation: An approach for preferential killing of cancer cells by oxidative stress inducers*", registered at Jadavpur University awarded on December 24, 2012*

Human Resource

Technical/Administratice Staff(s): Anirban Manna
Research Fellow(s): Avik Acharya Chowdhury, Jaydeep Chaudhuri,

Dr Susanta Roychowdhury
Cancer Biology & Inflammatory Disorder Division

Chromosomal instability and genetic susceptibility in cancer and human fetal development

Spontaneous loss of clinically established intra-uterian pregnancy is the most frequent (10% - 15%) complication of a pregnancy. Fetal chromosomal abnormalities have been observed in half of the spontaneous miscarriages. We observed germline transmission of exonic deletion of mitotic checkpoint gene Mad2 in two families leading to loss of Mad2 expression in the aborted fetal tissues. We proposed that exonic deletion of *MAD2* is possibly associated with its loss of expression resulting in abnormal SAC function, subsequent aneuploidy and pregnancy loss.

Altered microRNA (miRNA) expressions are frequently associated with tumorigenesis. Numerous reports suggest the role of miRNAs in cell cycle control. The spindle assembly checkpoint (SAC) monitors the fidelity of chromosome segregation. A defective SAC often results in various chromosomal instabilities (CIN). We show that miRNA 125b specifically targets the core SAC protein Mad1. We demonstrated that miRNA mediated downregulation of Mad1 leads to severe chromosomal abnormality in cancer cells followed by apoptotic death. We hypothesized that an optimum Mad1 level and thus, a properly scheduled SAC is maintained partly by miR-125b.

The role of common genetic variation in determining the range of individual susceptibility to cancer within the population is increasingly recognized. The rs12515548 of *MSH3* showed significant association with oral cancer (discovery P-value: 1.43E-05, replication P-value: 4.84E-03). Leukoplakia specific association was observed for two SNPs (rs12360870 of MRE11A, P-value: 2.37E-07 and rs7003908 of PRKDC, P-value: 7.99E-05). The study reveals a synergism between associated SNPs and lifestyle factors in predisposition to OSCC and leukoplakia.

Publication Details:

Mitra S, Mazumder-Indra D, Mondal RK, Basu PS, Roy A, Roychoudhury S and Panda CK (2012) Inactivation of SLIT2-ROBO1/2 Pathway in Premalignant Lesions of Uterine Cervix: Clinical and Prognostic Significances; *PLoS One*, **7**, 1-11

Ghosh A, Ghosh S, Maiti GP, Mukherjee S, Mukherjee N, Chakraborty J, Roy A, Roychoudhury S and Panda CK (2012) Association of FANCC and PTCH1 with the Development of Early Dysplastic Lesions of the Head and Neck; *Ann Surg Oncol*, **19**, 528-538.

Nath S, Moghe M, Chowdhury A, Godbole K, Godbole G, Doiphode M and Roychoudhury S (2012) Is Germline transmission of MAD2 gene deletion associated with human foetal loss? . *Mol Hum Reprod*, **18**, 554.

Maiti GP, Ghosh A, Chatterjee R, Roy A, Sharp TV, Roychoudhury S and Panda CK (2012) Reduced expression of limd1 in ulcerative oral epithelium associated with tobacco and areca nut. *Asian Pac J Cancer Prev*, **13**, 4341-4346.

Basu M, Das T, Ghosh A, Majumder S, Maji AK, Datta Kanjilal S, Mukhopadhyay I, Roychowdhury S, Banerjee S and Sengupta S (2012) Gene-Gene Interaction and Functional Impact of Polymorphisms on Innate Immune Genes in Controlling Plasmodium falciparum Blood Infection Level; *PLoS ONE* , **7**, 1- 18.

Bhattacharya N, Mukherjee N, Singh RK, Sinha S, Alam N, Roy A, Roychoudhury S and Panda CK (2012) Frequent Alterations of MCPH1 and ATM are Associated with Primary Breast Carcinoma: Clinical and Prognostic Implications; *Ann Surg Oncol*, **20**, 424-432.

Bhattacharjya S, Nath S, Ghose J, Maiti GP, Panda CK, Bhattacharyya NP and Roychoudhury S (2013) miR-125b promotes cell death by targeting Spindle Assembly Checkpoint gene MAD1 and modulating mitotic progression; *Cell Death and Differentiation*, **20**, 430-442.

Mondal P, Datta S, Maiti GP, Baral A, Jha GN, Panda CK, Chowdhury S, Ghosh S, Roy B and Roychoudhury S (2013) Comprehensive SNP scan of DNA repair and DNA damage response genes reveal multiple susceptibility lo]ci conferring risk to tobacco associated leukoplakia and oral cancer; *PLOS ONE* , **8**, 1-10

Invited Lectures:
Delivered two (2) numbers of invited talks in Delhi University & Ram Manohar Lohia Hospital, New Delhi

Academic Performance:
Acted as **Teacher**, for Cell Biology course in M. Sc. (Biophysics, Molecular Biology & Genetics), Calcutta University; Cancer Genetics course in M.Sc. (Biotechnology), Calcutta University; Cancer Genetics course in WBUT, Kolkata; Course work for Ph.D. students of CSIR-IICB, Kolkata; M.S. students of NIPER, Kolkata.

Abstracts Presented:
No. of Abstracts in National Conference is **4**
No. of Abstracts in International Conference is **3**

Conference/Workshop/Symposia Organized:
Convener: at the Guha Research Conference, during 2012 in Shillong

Students Awarded PhD:

Somsubhra Nath, for thesis titled "*Studies on the regulation of spindle assembly checkpoint gene UBCH10 and its role in genomic instability in human cancer*", registered at Calcutta University awarded on May 1, 2012

Human Resource:

Technical/Administratice Staff(s): Mr. Bhaskar Basu,

Research Fellow(s): Dr. Somsubhra Nath, Mr. Pinaki Mondal, 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,and Mr. Kumar Singha Roy,

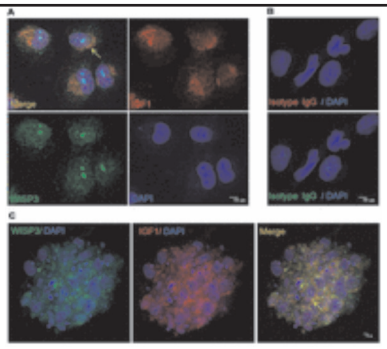
Research Associate(s): Dr. Sanjib Dey, Dr. (Mrs) Ruma Dey Ghosh

Summer Trainee(s): Raikamal Paul, Debottam Sinha, Subham Basu, Moutrisha Ray, Anagh Ray,Moumita Chakraborty,

Dr. Malini Sen
Cancer Biology & Inflammatory Disorder Division

WISP3-IGF1 interaction regulates chondrocyte hypertrophy

WISP3 (Wnt induced secreted protein 3) is a multi-domain protein of mesenchymal origin. Mutations in several domains of WISP3 cause PPRD (progressive pseudo rheumatoid dysplasia), which is associated with cartilage loss and restricted skeletal development. Despite several studies focusing on the functional characterization of WISP3, the molecular details underlying the course of PPRD remain unresolved. We are interested in analyzing the function of WISP3 in the context of cartilage integrity. The current study demonstrates that WISP3 binds to insulin-like growth factor 1 (IGF1) and inhibits IGF1 secretion. Additionally, WISP3 curbs IGF1-mediated collagen X expression, accumulation of reactive oxygen species (ROS) and alkaline phosphatase activity, all of which are associated with the induction of chondrocyte hypertrophy. Interestingly, both IGF1 and ROS in turn trigger an increase in WISP3 expression. Together, our results are indicative of an operational WISP3IGF1 regulatory loop whereby WISP3 preserves cartilage integrity by restricting IGF1-mediated hypertrophic changes in chondrocytes, at least partly, upon interaction with IGF1.



Endogenous WISP3 co-localizes with endogenous IGF1 Cell nuclei are shown with DAPI (blue). Scale bar: 10 μm.

Publication Details:

Repudi S.R., Patra M., Sen M. 2013. WISP3-IGF1 interaction regulates chondrocyte hypertrophy. JOURNAL OF CELL SCIENCE, **126**(7) : 1650-1658

Human Resource:

Research Fellow(s): Repudi Srinivasarao, Debdut Naskar, George Maiti Milan Patra, Arijit Chakraborty, Indira Guha

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

Novel herbal compounds induce apoptosis and autophagy associated effect in human leukemia cells

We have investigated that herbal extract initiates both autophagic and apoptotic cell death in human leukemic cells suggests that they have potential for anti cancer therapy. *Sesbania grandiflora* fraction induced cytotoxicity involved phosphatidylserine exposure, enhanced ROS generation leading to altered mitochondrial bioenergetics and apoptotic protein expressions. This culminated in caspase activation and DNA fragmentation. Fraction was able to induce autophagy as evidenced by autophagosome formation, LC3 conversion and altered Atg protein expressions.

In another project, we have demonstrated that Andrographolide analogue induced apoptosis and autophagy in U937 cells. Our lab has been focusing on regulation of PI3K/Akt/mTOR signaling pathway. Our data implies that Andrographolide analogue mediated autophagy and apoptosis correlates with suppression of PI3K/Akt/mTOR pathway.

Publication Details:

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

Human Resource:

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

Mrs. Dr. Krishna Das Saha
Cancer Biology & Inflammatory Disorder Division

Sphingolipids, isolated and separated from leishmania species are found to show potent anticancer activity against melanoma, hepatocellular carcinoma and sarcoma. The bioactive leishmanial sphingolipids also show anti-inflammatory effects towards murine model of arthritis, endotoxemia, melanoma etc.
One leishmanial membrane protein stimulates innate immunity with enhancement of non-specific host defense against leishmanial and bacterial infection. This protein has anticancer activity towards murine melanoma, and sarcoma.

Some pure herbal compounds, their nano-formulations, various synthetic compounds and metal complexes are being examined for their anticancer endotoxemia and anti-inflammatory activity in diseased model.

P***ublication Details:***

Pramanik M, Chatterjee N, Das S, Saha KD and Bhaumik A (2013) Anthracene-bisphosphonate based novel fluorescent organic nanoparticles explored as apoptosis inducers of cancer cells. *Chem. Commun.*, **49**, 9461-9463.

Dey SK, Bose D, Hazra A, Naskar S, Nandy A, Munda RN, Das S, Chatterjee N, Mondal NB, Banerjee S and Saha KD (2013) Cytotoxic activity and apoptosis-inducing potential of di-spiropyrrolidino and di-spiropyrrolizidino oxindole andrographolide derivatives.
PLoS One, **58055**.

Chatterjee N, Das S, Bose D, Banerjee S, Das S, Chattopadhyay D, Saha KD (2012) Exploring the anti-inflammatory activity of a novel 2-phenylquinazoline analog with protection against inflammatory injury. *Toxicol. Appl. Pharmacol*, **264**, 182-191.

A***bstracts Presented:***

No. of Abstracts in National Conference is **2**
No. of Abstracts in International Conference is **4**

Human Resource
Research Fellow(s):
Abhisek Nandy, Subhadip Das, Debasree Ghosh, Sumit Dey , Dipayan Bose , Somnath Banerjee, Nabanita Chatterjee, Sujata Das

Dr. Mrinal K. Ghosh
Cancer Biology & Inflammatory Disorder Division

Studying the role of EGFR-β-catenin crosstalk on cancer cell proliferation and survival and reporting a novel synthetic inhibitor of EGFR pathway:

EGFR and Wnt/β catenin pathways are often aberrantly activated in human cancers. The role of possible cross talk between these signaling networks in inducing cell proliferation, survival and tumorigenesis was investigated. In prostate cancer cell line, β-catenin is activated and induces transcriptional activation of target genes that includes EGFR. ChIP and promoter analyses confirmed β-catenin occupying EGFR promoter via TCF4 binding sites. Thus, activation of β-catenin signaling is associated with the progression of prostate cancer through signaling cross-talk with EGFR (Fig.1). In parallel research, via *in vitro* screening 2, 2' -diphenyl-3, 3'-diindolylmethane (DPDIM), a synthetic indol derivative, as found to be a potential anti- breast cancer agent. *In silico* studies predicted the binding of DP-DIM on active (ATP binding) site of EGFR, through Lys721 and Asp831. Both i*n vivo* and *in vitro* investigations showed significant inhibition of growth and decreased volume of DP-DIM treated tumors as compared to the controls. The anti-cancer activity of DP-DIM was reported for the first time where it induces apoptosis in breast cancer cells by inhibiting the EGFR pathway.

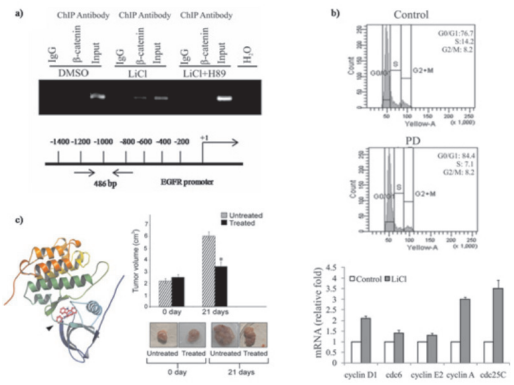


Figure 1: *EGFR-β-catenin crosstalk is involved in tumorigenesis. a) Promoter binding analysis by ChIP showed that β-catenin binds to the EGFR promoter when activated (LiCl treatment) but the binding is removed when PKA is inhibited (LiCl + H89 treatment). b) EGFR-β-catenin crosstalk regulates cell cycle as observed by FACS and quantitative Real Time PCR. c) Structural analysis of DP-DIM binding to EGFR (Left). Representative image of DP-DIM treated and control breast tumors in SD rats (Right).*

Role of Casein Kinase II in Modulation of Cancer Cell Signaling:

Casein kinase II (CK2) is a serine/threonine kinase ubiquitously distributed in eukaryotes and is required for viability, cell cycle progression and serves as a potent suppressor of apoptosis. The pro-oncogenic role of nuclear CK2, especially in the context of PCa was

studied. Tumor suppressor PML has been shown to be a target of functional disruption by CK2. PML, an essential component of PML-nuclear bodies (PML-NBs) modulates AKT, a potent pro-oncogenic kinase by dephoshorylating active AKT (pAKT) inside the nucleus (FIG.2). One of the immediate consequences, of this inactivation is the stabilization of FOXO3a, a tumor suppressor, inside the nucleus and its downstream activities. Thus a novel signaling axis [CK2(PMLPHLPP2)pAKTFOXO3a] has been proposed, apexed by deregulated CK2, dismantling the association of PML and PHLPP2, ultimately leading to the inactivation and nuclear exclusion of FOXO3a. A second phosphatase isoform (PHLPP2) of AKT has been identified which interacts with PML in PML-NBs.

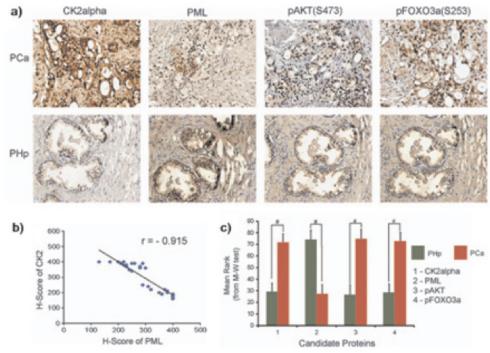


Figure 2: *CK2alpha plays a role in prostate cancer progression via PML. a) Representative immunohistological images of tissue sections from prostate cancer (Pca) and benign prostate hyperplasia (PHp) stained with CK2α. b) Graph represents analysis from correlation studies between H-score of CK2 and PML. c) Bar graphs represent the mean ranks from Mann-Whitney test for CK2α, PML, pAkt and pFOXO3a and compared between PC and PHp.*

Publication Details:

Chatterjee A, Chatterjee U, Ghosh MK*(2013) Activation of Protein Kinase CK2 attenuates FOXO3a functioning in a PML dependent manner: implications in Human Prostate Cancer. *Cell Death & Disease* , **4**, e543.

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

Guturi KK, Mandal T, Chatterjee A, Sarkar M, Bhattacharya S, Chatterjee U, Ghosh MK* (2012) Mechanism of β-catenin mediated transcriptional regulation of EGFR expression in GSK3β inactivated prostate cancer cells. *J Biol Chem.* , **287**, 18287-18296.

Invited Lectures:

Delivered three (3) numbers of invited talks in Calcutta University, SBC-India & ICRS, Kolkata.

Academic Performance:

Acted as **Teacher**, for M.S. students of NIPER, Kolkata;Course work for Ph.D. students of CSIR-

IICB, Kolkata.
Acted as **Examiner**, for *Biotechnology* and *Biochemistry* at University of Calcutta

Abstracts Presented:
No. of Abstracts in National Conference is **6**
No. of Abstracts in International Conference is **9**

Conference/Workshop/Symposia Organized:

Treasurer: at the CESIN, during 11-09-2012 in CSIR-IICB, Kolkata

Human Resource:
Research Fellow(s): Tapashi Mandal ; Indranil Paul ; Seemana Bhattacharya ; Anirban Chatterjee ; Nilanjana Das ; Moumita Sarkar ; Syed Feroj Ahmed , G. Kiran Kr. Naidu
Project Assistant(s): Arijit Bhowmik ; Satamita Deb
Summer Trainee(s): Shohini Sengupta

Molecular & Human Genetics Division

Molecular & Human Genetics Division

Drs. Samit Adhya (Head), Keya Chaudhuri, Suvendra Nath Bhattacharyya

The aims of this division are to identify disease-associated genetic variants and their functional relevance; to elucidate 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; and to determine the molecular basis of gene delivery to mitochondria. Genetic variants in open-angle glaucoma, oculocutaneous albinism, Wilson's disease, Parkinson's disease, hemophilia and oral submucous fibrosis will be analyzed. Emphasis will be placed on the determination of the functional consequences of identified mutations. A new area of investigation will be the on role of micro RNAs in parasitic disease (leishmaniasis). Previous work led to the development of a novel carrier-based protocol for mitochondrial RNA therapy; in the XII Plan we propose to explore the mechanism of uptake and intracellular targeting of the carrier complex and RNA to mitochondria. Thus a combination of basic and applied approaches will used to study the molecular basis of genetic disease and gene therapy.

Dr. Samit Adhya
Molecular and Human Genetics Division

Acceleration of skeletal myogenesis by mitochondrion-targeted RNA

The major activity during this period in the laboratory was targeted towards the development of a mitochondrial transfection system based on RIC to the correction of mitochondrial dysfunction in cellular and animal models.

There is ample correlation between mitochondrial and cellular dysfunction in various diseases. The method of complex-mediated delivery of RNA to mitochondria makes it feasible to assess the contribution of mitochondrial dysfunction to a specific pathological situation. Skeletal muscle injury is associated with general mitochondrial down-regulation. In a rat model, mitochondrial function in the injured muscle was restored within hours by delivery of functional polycistronic mitochondrial genomic transcripts using a multi-subunit carrier complex derived from RIC. This resulted in marked acceleration of muscle regeneration accompanied by time-resolved regulation of myogenic differentiation factors. Carrier-mediated mitochondrial RNA delivery may be an effective way to boost the function of embryonic or adult stem cells in vivo or in vitro.

Publication Details:

Jash, S. and Adhya, S. (2012) Induction of muscle regeneration by RNA-mediated mitochondrial restoration, FASEB J. **23,** 4187-4197

Invited Lectures:

Delivered two (2) numbers of invited talk in Society for Biological Chemists (India) meeting, Kolkata and symposium on Biology 2012 and Beyond at CCMB, Hyderabad

Academic Performance:

Acted as Lecturer of Calcutta University and CSIR-IICB course work

Students Awarded PhD:

Biraj Mahato for the thesis titled "Delivery of RNA into the mitochondria of mammalian cells" registered at Jadavpur University awarded in 2012

Human Resource:
Technical & other staff (s): Dr. Tapas Chaudhury and Mr. Sambhu K. Chhatui
Research Fellow(s): Biraj Mahato, Sandip Koley, Sukanta Jash, Utpalendu Ghosh, Joyita Mukherjee

Dr. Keya Chaudhuri
Molecular and Human Genetics Division

Molecular analysis of human diseases

Host-Vibrio cholerae interaction:

Acquisition of new genetic elements through genomic islands has played a major role in its evolutionary process of *V. cholerae*. In our study, a hypothetical protein was identified which was present in one of the predicted genomic island regions of the large chromosome of *V. cholerae* O395 showing a strong homology with a conserved phage encoded protein. Homology modeling study indicated it to be an unconventional and atypical serine protease belonging to HtrA protein family. The predicted 3D-model of the hypothetical protein revealed a catalytic centre serine utilizing a single catalytic residue for proteolysis (Fig.1). The active site arrangements of this predicted serine protease homologue with atypical catalytic triad is expected to allow these proteases to work in different environments of the host**.**

Biology of Oral Cancer and precancer:

Genetic predisposition has been a strong contributing factor for susceptibility to habitual tobacco or arecanut associated oral carcinogenesis. In a hospital based study on patients suffering from Oral submucous fibrosis a precancerous lesion, mainly due to areca nut usage and control population were genotyped by PCR-RFLP to determine the risk of the disease. Heterozygous XRCC3 codon 241 [OR 2.07 (1.054.06)], homozygous variant of NAT C481T [OR 2.81 (1.097.21)], and both heterozygous and homozygous variants of NAT codon 268 and 286 [OR 2.31 (1.204.45) and 4.98 (1.8713.14), and 6.12 (2.7513.62) and 2.65 (1.046.72)] individually influenced susceptibility to OSF in the population. Genegene interaction analysis by multifactor dimensionality reduction (MDR) revealed potential combinations of single nucleotide polymorphisms (SNPs) to increase the risk of OSF **(Fig. 2)**.

Chewing betel quid may release chemical carcinogens including xenobiotics resulting in oral malignancy cases preceded by potential malignant lesions and conditions- Oral Submucous Fibrosis (OSF) being one of them. The cytochrome P4501A1 (CYP1A1) enzyme is central to the metabolic activation of these xenobiotics, whereas CYP2E1 metabolizes the nitrosamines and tannins. Our investigated results suggest that polymorphism in CYP1A1 and CYP2E1 may confer an increased risk for Oral Submucous Fibrosis**.**

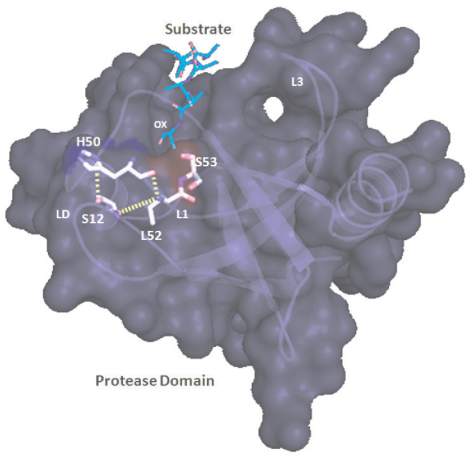


Figure 1: Predicted catalytic triad of model VCO395_1035: *The cartoon and surface representation of model VCO395_1035 showing predicted catalytic triad residue Ser12-His50-Leu52 along with along with substrate (cyan) bound to active site in Oxyanion hole (ox).*

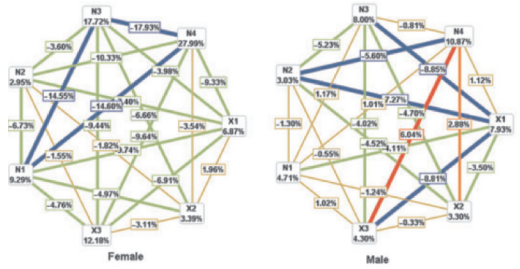


Figure 2: *The MDR interaction model describes percentage of entropy (IG) by each factor or 2-way interaction as calculated by MDRPT v0.4.9 program. In the above picture, all the positive IG values (IG) in the nodes indicate independent main effect of all the markers. Among them, X3 has the largest univariate effect followed by N4, N1, and X2 among population when stratified according to age or sex. Connection between X3 and N4 (IG = 6.04% in red color) presents a highly synergistic interaction among men that jointly explained most of the entropy which explains a non-linear interaction between these*

Publication Details:

Das T, Mukherjee S and **Chaudhuri K***(2012) Effect of quercetin on *Vibrio cholerae* induced nuclear factor-κB activation and interleukin-8 expression in intestinal epithelial cells. ***Microbes and Infection;*** **14**: 690-695.

Sarkar M, Bhowmick S, Casola A and **Chaudhuri K*(**2012) Interleukin-8 gene regulation in epithelial cells by *Vibrio cholerae*: role of multiple promoter elements, adherence and motility of bacteria and host MAPKs. ***FEBS Journal;*** **279**:1464-1473.

Mukherjee S, Bhowmik AD, Roychoudhury P, Mukhopadhyay K, Ray JG and **Chaudhuri K***(2012) Association of XRCC1, XRCC3, and NAT2 polymorphisms with the risk of oral submucous fibrosis among eastern Indian population. *Journal of Oral Pathology and Medicine;* **41**:292-302.

Bhowmick S, Chatterjee D and **Chaudhuri K***(2012) Human epithelial cells stimulated with *Vibrio cholerae* produce thymic stromal lymphopoietin and promote dendritic cell-mediated inflammatory Th2 response. *International Journal of Biochemistry and Cell Biology;* **44**:1779-1790.

Chatterjee A, Dutta S, Mukherjee S, Mukherjee N, Dutta A, Mukherjee A, Sinha S, Panda CK, **Chaudhuri K**, Roy AL and Mukhopadhyay K. (2013). Potential contribution of SIM2 and ETS2

functional polymorphisms in Down syndrome associated malignancies. *BMC Medical Genetics;* **14**: 12.

Chakraborty A, Mukhopadhyay A, Bhattacharyya D, Bose CK, **Chaudhuri K**, Mukhopadhyay S and Basak J. (2013). Frequency of 5382insC mutation of BRCA1 gene among breast cancer patients: an experience from Eastern India. *Familial Cancer* **12(3)**:489-495

Chatterjee D and **Chaudhuri K*.** (2013) *Vibrio cholerae* O395 outer membrane vesicles modulate intestinal epithelial cells in a NOD1 dependent manner and induces dendritic cell-mediated Th2/Th17 responses. *Journal of Biological Chemistry; **288(6)**:4299-4309*

Dutta A, Katarkar A and **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)**: e56725.

Chaudhuri SR, Mukherjee S, Paul RR, Haldar A and **Chaudhuri K***(2013) CYP1AI and CYP2E1 gene polymorphisms may increase susceptibility to Oral Submucous Fibrosis among betel quid chewers of Eastern India. Gene; **513**: 268-271.

Mandal S, Hossain M, Devi P. Sujatha, Kumar GS and **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.

Chapter(s) Details:

Keya Chaudhuri. (2013). Recombinant DNA Technology, The Energy Research Institute (TERI) Press, New Delhi, India,pp. 298, ISBN: 9788179933206

Invited Lectures:

Delivered one (1) number of invited talks in Science & Communication Workshop organized by DBT-Welcome Trust India Alliance at Hyderabad

Session Chaired:

Chaired one scientific session at the 81st Annual Meeting of The Society of Biological Chemists (India) and Symposium on "Chemistry and Biology: Two weapons Against Diseases"., in India, on November 8, 2012

Second National Symposium on Innovative Approaches and Modern Technologies for Crop Productivity, Food Safety and Environmental Sustainability organized by Society for Applied Biotechnology(India) at Kerala on November 19-20, 2012.

CSIR-IICB Annual Research Meet on Gene Regulation & Drug Discovery organized by CSIR-Indian Institute of Chemical Biology at Kolkata on March 6-7, 2013

Abstracts Presented:

No. of Abstracts in National Conference is Five **(5)**

Conference/Workshop/Symposia Organized:

Member, National Advisory Committee of All India Seminar on Risk/Safety and Disaster

Management in Process Industries organized by The Institution of Engineers (India), West Bengal State Centre at Kolkata on March 15-16, 2013

Academic Performance:
Acted as Lecturer and Examiner of NIPER, Kolkata
Acted as Coordinator and Teacher in CSIR-IICB PhD Course Work

Honors & Awards:
Elected Fellow of the ***National Academy of Medical Sciences (India)***, October 2012

Papers Reviewed for Following **Journals**:
Clinical & Vaccine Immunology, American Society for Microbiology Press, USA; Journal of Clinical Microbiology, American Society for Microbiology Press, USA; Carcinogenesis, Oxford University Press, UK; PLoS Neglected Tropical Diseases, Public Library of Science, USA; PLoS One, Public Library of Science, USA; BMC Research Notes, BioMed Central, UK; BMJ Case Reports, BMJ Group, London, UK; Journal of Medical Microbiology, SGM Press, UK; Cell Biochemistry & Biophysics, Springer, Germany; Journal of Cellular Biochemistry, John Wiley & Sons, Inc.; Journal of Oral Pathology & Medicine, John Wiley & Sons, Inc.; Immunology, John Wiley & Sons, Inc.; Microbiological Research, Elsevier, The Netherlands; Microbial Pathogenesis, Elsevier, The Netherlands; Pharmaceutical Biology, Informa Healthcare, Switzerland & UK; Systems Biology & Reproductive Medicine, Informa Healthcare, Switzerland & UK; Environmental Chemistry, CSIRO Publishing, Australia

Human Resource :

Technical/Administratice Staff(s): Ms Mahua Bhattacharya

Research Fellow(s): Pallashri Saha, Debashree Chatterjee, Samir Mondal, Bornita Das, Avirup Dutta, Sanjit Mukherjee, Atul K Katarkar

Research Associate(s): Dr. Tapasi Das

Dr. S. N. Bhattacharya
Molecular and Human Genetics Division

Mechanism of miRNA-mediated gene regulation in mammalian cells

Compartmentalization of miRNA repressed mRNAs between translating polysomes and otherwise translationally inactive RNP granules like RNA processing bodies or P-bodies can regulate gene expression post-transcriptioanally in human cells. Improper compartmenta-lization of mRNAs of growth control related and stress response genes due to absence of specific miRNA(s) or other relevant factors(s) can potentially be linked to abnormal expression of growth regulatory factors. These are often associated with diseases including different forms of cancers and neurological disorders. Our research is focused on identifica-tion of the mechanism of this mRNA compartmentalization process in the cytoplasm of mammalian cells.

Pathogenic parasite by reducing miRNA production controls lipid metabolism in host cells

To explore how pathogenic infection may affect the miRNA activity by altering its availability in the host cell, we used murine model of visceral leishmanisis as our study system. We observed reduction in expression of miR-122 in infected liver. High serum cholesterol causes resistance to *L. donovani* infection and down regulation of liver miR-122 is coupled with low serum cholesterol in Leishmania infected mouse. Leishmanial surface glycoprotein gp63, a Zn-metalloprotease, targets pre-miRNA processor Dicer1 to prevent miRNP formation in *L. donovani* interacting hepatic cells.Conversely, restoration ofmiR-122 or Dicer1 level in Leishmania infected mouse liver increased serum cholesterol and reduced liver parasite burden (Fig.1).

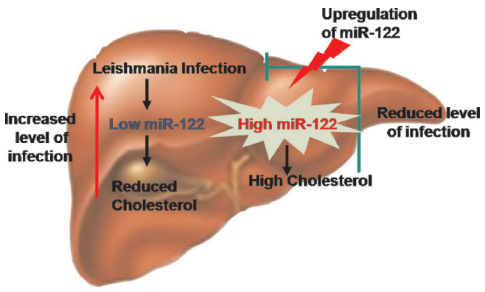


Fig.1: *miR-122 regulates Leishmania donovani infection by altering cholesterol production*

A transient reversal of miRNA-mediated repression controls cytokine expression during macrophage activation

In activated macrophages, several cytokine encoding RNAs are needed to be immune to exiting repressive miRNAs targeting these messages. Our experiments have confirmed a reversal of miRNA-mediated repression during the early phase of inflammatory response in macrophages when Ago2, the key component of miRISC, gets phosphorylated resulting in impaired binding of Ago2 to miRNAs and also to the target mRNAs resulted a weakened inflammatory response and enhanced pathogen invasion.

Publication Details:

Ghosh J, Bose M, Roy S and Bhattacharyya SN*(2013) Leishmani donovani Targets Dicer1. *Cell Host Microbe*, **13**, 277-288

Kundu P, Fabian MR, Sonenberg N, Bhattacharyya SN*, Filipowicz W*(2012) HuR protein attenuates miRNA-mediated repression by promoting miRISC dissociation from the. *Nucleic Acids Res.*, **44**, 588-600

Invited Lectures:

Delivered two (2) numbers of invited talk at NICED and SBC 2012, Kolkata

Deputation Abroad:

EMBO meeting on Complex life of mRNAs at EMBL, Heidelberg, Germany during October 9 -12, 2012

Abstracts Presented:

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

Human Resource:

Research Fellow(s): June Ghosh, Anup Mazumder, Souvik Ghosh, Banhisikha Barman, Kamalika Mukherjee, Somi Patranabis, Yogaditya Chakraborti, Mainak Bose
Research Associate(s): Sudarshana Basu, Rishikesh Sil

Drug Development, Diagnostics & Biotechnology Division

Drug Development, Diagnostics & Biotechnology Division

Drs Suman Khowala(Head), Tarun K. Dhar, Aparna Gomes, Samir Kr. Dutta, Pratap K. Das, Sharmila Chattopadhyay, Snehasikta Swarnakar

The division is driven by multi-disciplinary approach with a vision to conduct targeted basic research for improving health and quality of life, and to promote future economic growth through innovation in biotechnology. 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: to establish the mechanism of gastric ulceration; tissue targeted drug delivery; innovative and faster immunodiagnostic techniques to estimate mycotoxin contaminants from food stuffs; regulatory mechanisms for production and secretion of glycosidase enzymes for biotechnological and biomedical applications; use of medicinal plants for anti-neoplastic, anti-ulcer, anti-oxidant and biopesticidal agents; plant gene manipulation for improved production of pharmaceutical/ nutraceuticals/ biopesticidal molecules.

Dr. Suman Khowala
Drug Development Diagnostics and Biotechnology Division

Formation of a unique Sucrase-Cellobiase co-assembly and Role of sucrase in aggregate formation:

Examined the mode of aggregation of the secreted cellobiase-sucrase coaggregate and its role in stabilization of cellobiase. TEM and DLS of purified co-aggregates revealed reversible concentration driven self-aggregation of the extracellular enzymes to form larger entities

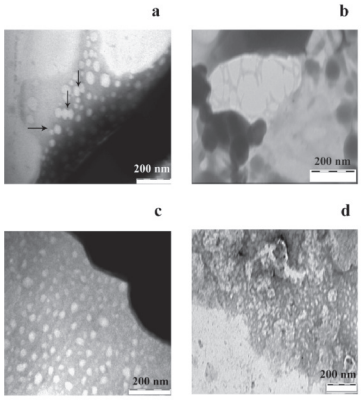


Figure 1: *TEM images of purified extracellular (Fig 3A and 3B) and intracellular (Fig 3C and 3D) cellobiase-sucrase coaggregates. 10 µl aliquots of each of the protein aggregates at two concentrations; (6 µg/ml: Fig 3A & 3C; 60 µg/ml: Fig 3B & 3D) were visualized under 60,000X magnification. Measurement of aggregate size was done with the associated software (TECNAI G2 Version 2.1.5).*

(Fig1). However, the intracellular enzyme aggregates were rigid, non-interacting and possessed a higher percentage of disulphide bonds. The studies are believed to improve the understanding of aggregation of the fungal glycosidases, which remains to be a blackbox, to increase the efficacy of these enzymes.

Sucrase played a pertinent role in shaping the aggregate and determining its size along with other uncharacterized cellular chaperones. The sucrase-cellobiase co-aggregate presented a lucrative model for studying protein-protein interaction and protein aggregation in a wider scientific niche.

Ecofriendly Chromium biosorption by pretreated fungal biomass: Due to pretreatment biosorption of chromium by biomass of *T.clypeatus* in aqueous solutions increased significantly. The bioprocess developed was cheap and ecofriendly as compared to other traditional methods, and involved physical adsorption, ion exchange, complexation and electrostatic attraction to achieve metal removal at wide pH range.

Biotechnology for utilization of low cost biomass of Mustard for biofuel production: Agro residue of mustard obtained as mustard stalk and straw (MSS) was investigated for the first time for production of lignocellulolytic enzymes by *Termitomyces clypeatus* and also for use as substrate for saccharification. MSS with high cellulose and hemicellulose content was utilized as sole source of carbon by the fungus for productions of enzymes such as (CMcase, β-glucosidase, xylanase and β-xylosidase) in submerged fermentation. The results indicated that MSS can be used as a potential and cheap renewable raw material from India for production of bio-ethanol.

Publications:

Swagata Pal, Samudra Prosad Banik, **Suman Khowala**, 2013, Mustard stalk and straw: A new source for production of lignocellulolytic enzymes by the fungus Termitomyces clypeatus and as a substrate for saccharification, Industrial Crops and Products, **41**, 283288.

Samudra P. Banik, S. Pal, S. Ghorai, S. Chowdhury, R. Majumder, S. Mukherjee, **Suman Khowala**, 2012 In situ reversible aggregation of extracellular cellobiase in the filamentous fungus Termitomyces clypeatus, Biotechnology and Bioprocess Engineering, **17**: 925-936.

Lata Ramrakhiani and **Suman Khowala**, 2012. Effect of pretreatment on hexavalent chromium biosorption And multimetal biosorption efficiency of *Termitomyces clypeatus* biomass, International Journal of Integrative sciences, Innovation & Technology, 2012, **1,** 7- 16.

Lata Ramrakhiani and **Suman Khowala**, 2012. Biosorption by biomass of T*ermitomyces clypeatus* i: enhancement of hexavalent chromium removal in aqueous solution by heat pretreatment, International Journal of Integrative sciences, Innovation &Technology, 2012, **1**, 37- 44.

Invited lectures:

Delivered four (4) numbers of invited talks in Patiala University, Dept of Biotechnology, New Delhi & Thiruvalluvar University, Vellore

Academic performance*:*

Acted as Ph.D. Examiner in Agharkar Research Institute, Pune, Biochemistry Department, Acharya Nagarjuna University, Guntur, Anna Malai University, Chidamabaram, Department of Genetics, Madurai Kamraj University, Bidhan Nagar College, Salt Lake, Kolkata, National Institute Interdisciplinary Scinece & Technology, Trivandrum, Guru Nanak Dev University, Amritsar, Indian Institute of Technology, Guwahati

Attended workshop on Work -Life Balance at CSIR-Human Resource Development Center, Ghaziabad, March 20-22, 2013

Abstracts presented:

No. of Abstracts presented in national conference is **1.**

Honours & Award:

Member of Executive Committee of Society of Biological Chemists (India), Kolkata Chapter

Member of management council of the Academic Council of Kalasalingam University, Tamilnadu

General Secretary of The Biotech Research Society, India, Kolkata Chapter of IICB-Jadavpur University

Reviewer of national projects for Funding by DBT, DST and CSIR

Human Resource:

Research Fellow(s): Rajib Majumder, Soumya Mukherjee, Sanjeeta Tamang

Research Associates: Dr. Swagata Pal, Dr Arijit Mondol, Dr Debopam Banerjee

Project Assistants: Siddhartha Mukherjee

Summer Trainees: Rupam Debnath, Sonal Suman

Dr. Samir Kumar Dutta
Drug Development Diagnostics and Biotechnology Division

Plant secondary metabolite derivative as a potential tumoricidal agent

In continuation of our previous work on the development of tumoricidal agent, we designed and developed a 'Co-drug' based on a plant secondary metabolite (PSM). The idea was to utilize the tumoricidal property of the PSM and address its 'water insolubility' problem by coupling it with a more polar tumoricidal molecule. The co-drug was reasonably active against a variety of cancer cell lines without affecting normal cells. The potential of the 'Co-drug' on cancer cells was established employing MTT, FACS, inverted fluorescence microscopy, confocal microscopy, atomic force microscopy, immunoblot analysis and so on. The IC_{50} value of the derivative was much lower than its counter parts. Subsequently, we have verified the potency of the 'Co-drug' through *in vivo* assays (Fig. A).

Plant Protease Inhibitors as anti-fungal and anti-leukemic agent

Ragi bifunctional inhibitor (RBI) of finger millet (*Eleusine coracana* Gaertn.) inhibits both α-amylase and trypsin simultaneously. The *rbi* gene representing RBI has been cloned for the first time by us from *Eleusine coracana* (GPU 28) seeds in pET22b(+) vector, sequenced and submitted with GenBank (Accession No. DQ 494211). Since several seed protease inhibitors are known for their protective as well as curative role against many types of human cancers, we checked the efficacy of RBI purified from finger millet seeds by affinity chromatography followed by FPLC gel filtration. Purified RBI was cytotoxic against K562 chronic myeloid leukemia cells but, not against normal human peripheral blood mononuclear cells.

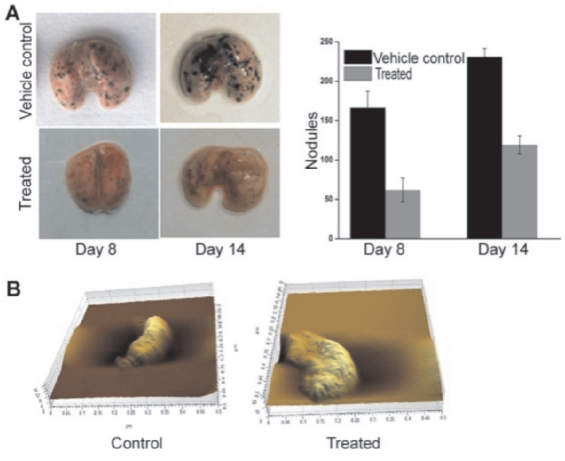


Fig. A: *In vivo and in vitro cytotoxic effect of the 'Co-drug'. (A) Decreased number of nodule count (lower panel) when treated with the 'Co-drug' in comparison to its vehicle treated control (Upper panel). Corresponding bar diagram represents the number of nodules in treated and vehicle treated control. (B) Swelling of B16F10 mitochondria following 'Co-drug' treatment in comparison to that of vehicle control.*

Publication Details:

Sen S and **Dutta SK** *(2012)* Evaluation of Anti-cancer Potential of *Ragi* Bifunctional inhibitor (RBI) from *Eleusine coracana* on Human Chronic Myeloid Leukemia Cell Line. *The European Journal of Plant Science and Biotechnology,* ***6*** *(Special Issue 2), 103-108.*

Invited Lectures:

Delivered one (1) number of invited talk at the Department of Pharmaceutical Technology,Jadavpur University, Kolkata

A***cademic Performance:***

Acted as **Teacher & Examiner** for Calcutta University and NIPER-Kolkata .

Human Resource:

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

Dr.Tarun K. Dhar
Drug Development Diagnostics and Biotechnology Division

Development of a new immunofiltration assay for the determination of aflatoxin B1

We have developed a new immunofiltration assay using highly cost-effective analytical device for the determination of AFB_1 in a large number of samples. The principle of the method is based on separation of pre-immune complexes (formed between antiAFB_1antibody and AFB_1-enzyme conjugate or sample) from the free AFB_1-enzyme conjugate by filtration through the membrane strips spotted with anti- AFB_1 antibody. The selectively bound AFB_1-enzyme conjugate was visualized by super-catalyzed reporter deposition (Super-CARD) signal amplificationmethod (Fig. 1). In absence of AFB_1, the complex passes through the spotted immobilized anti-AFB_1 antibody, whereas with increasing AFB_1 concentration, the free AFB_1-enzyme conjugate binds to the antibody. The measured signal intensity is linearly correlated to the concentration of the AFB_1 in the sample. The data on the analytical parameters indicate that the new format of AFB_1 detection in foodstuffs is reproducible, accurate and specific. The main advantages of this method are: (i) No additional step for the separation of pre-immune complexes is required; (ii) it is user friendly and does not require any costly equipment or a well-equipped laboratory; (iii) the solution applied over membrane is uniformly absorbed without without lateral spreading, (iv) the assay can be completed in very short time to give either visual semi-quantitative estimation or quantitative data by densitometry; (v) the measured signal intensity is directly proportional to the amount of AFB_1 present in the sample (vi) the detection limit (15 pg/ml) and working range were superior than the conventional methods; and (vii) it does not require costly, laborious, and time-consuming sample clean-up and enrichment steps. Thus, the principle of the method may find wide application for on-site detection of many other small molecular weight toxins and environmental pollutants.

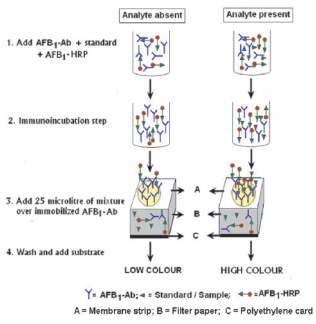


Fig.1: *Principle of immunofiltration assay based on separation of pre-immune complexes in the same immunoassay system*

Publication Details:

Tarun K. Dhar, Subham Dasgupta, Dipika Ray, Meghna Banerjee(2012) A filtration method for rapid preparation of conjugates for immunoassay. *Journal of Immunological Methods*, **385**, 71-78

Debjani Saha, Dipika Roy and **Tarun K. Dhar** (2013) Immuno!ltration assay for a"atoxin B1 based on the separation of pre-immune complexes. *Journal of Immunological Methods*, **392**, 24-28

Invited Lectures:

Delivered two (2) numbers of invited talks at Dept. of Food Technology and Biochemical Engineering, Jadavpur University, Kolkata on Food contaminants monitoring with special reference to mycotoxins I and mycotoxins II

Human Resource:

Technical/Administratice Staff(s): Dr. Ardhendu K. Mandal, Mrs. Dipika Roy, Mr Ashit Mitra,

Dr. (Mrs.) S.E. Besra
Drug Development Diagnostics and Biotechnology Division

Anti-leukemic activity of *Wattakaka volubilis* leaf

The present study was designed to investigate anti-leukemic activity of the crude aqueous methanolic extract and to identify active compounds from the leaves of *Wattakaka volubilis*. The *in vitro* anti-leukemic activities of different extracts of the leaves and isolated compound Kaempferol-3-O-[α-l-rhamnopyranosyl-(1→4)-O-α-l-rhamnopyranosyl-(1→6)-O]-β-d-glucopyranoside (WVP) were studied. The flow-cytometric analysis confirms that the cell cycle arrest occurs at G1 phase in case of U937 and K562 cell lines and G2/M phase in case of HL60 cell lines. Similarly both confocal microsocopic analysis and DNA laddering assay confirm the apoptosis and cell cycle arrests of leukemic cells. The overall results provide evidence for the ethnopharmacological relevance for use of the plant *Wattakaka volubilis* in developing novel agents for the treatment of leukemia.

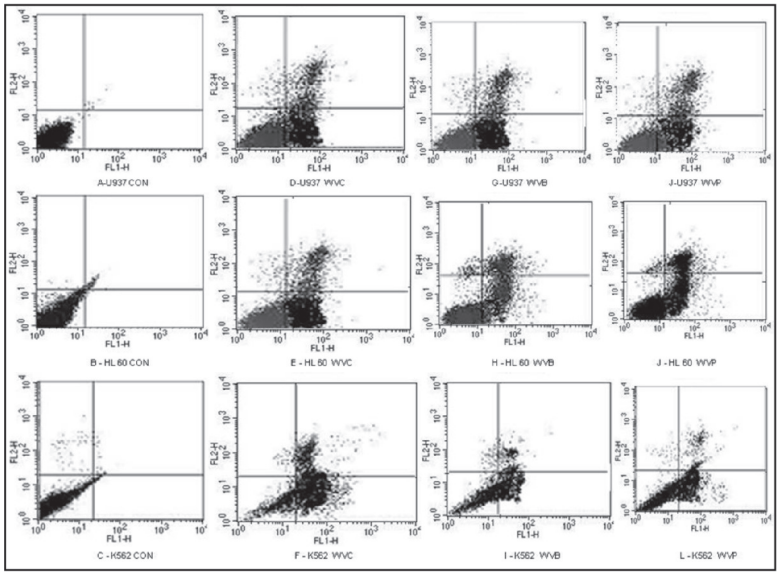


Fig.1: *Flow-cytometric analysis of U937, HL60 and K562, cells by double labeling with annexin-V FITC and PI. Dual parameter dot plot of FITC-fluorescence (x-axis) vs. PI fluorescence (y-axis) shows logarithmic intensity. Quadrants: lower left-live cells; lower right-apoptotic cells and upper right-necrotic cells.*

Publication Details:

Yogesh PB, Bhattacharya S, Das T, Roy M, **Besra SE**, Gomes A, Mondal NB and Banerjee S (2013) Anti-leukemic activity of Sulfonoquinovosyldiacylglyceride (SQDG): a costituent of Azadirachta indica leaves; *Medicinal Chemistry Reserch*, **22**, 22-27

Nandi D, **Besra SE**, Vedasiromoni JR, Giri VS, Rana P, Jaisankar P (2012) Anti-leukemic activity of Wattakaka volubilis leaf extract against human myeloid leukemia cell lines; *Journal of Ethnopharmacology*, **144**, 466-473

Abstracts Presented

No. of Abstracts in National Conference is **8**
No. of Abstracts in International Conference is **2**

Human Resource
Summer Trainee(s): Moumita Ray, Nilanjana Deb, Sayantan Dey, Subhadeep Roy,

Dr. Sarmila Chattopadhyay
Drug Development Diagnostics and Biotechnology Division

Medicinal plant & metabolic engineering:

We performed high throughput transcriptome sequencing of the Indian Mayapple to obtain further understanding on the podophyllotoxin biosynthetic pathway. The Himalayan or Indian Mayapple (*Podophyllum hexandrum* Royle) produces podophyllotoxin, which is used in the production of semisynthetic anticancer drugs viz. etoposide, teniposide and etophos.

Plant defense signalling mechanism:

Plants face a range of environmental stresses on a regular basis which include biotic stresses generated by a plethora of plant pathogens. The elaborate networks and the crosstalk of established signalling molecules viz. SA, JA, ET and GSH play key role in plant defence response. However, the mechanism how GSH is involved in this crosstalk is yet to be known. Here, an approach has been taken to raise transgenic mint over-expressing γ-glutamyl-cysteine synthetase (γ-ECS), the rate-limiting enzyme of GSH biosynthesis, resulted enhanced GSH content and it's in planta expression confers significant tolerance against infection of *Alternaria alternata* and *Rhizoctonia solani*. A 2-DE followed by MALDI TOFTOF MSMS analysis identified the altered abundance of functionally important protein species in control and infected transgenic mint. Additionally, a significant variation in the protein profile of the infected transgenic plant as compared to the wild/control transgenic counterpart was noted (Fig. 1).

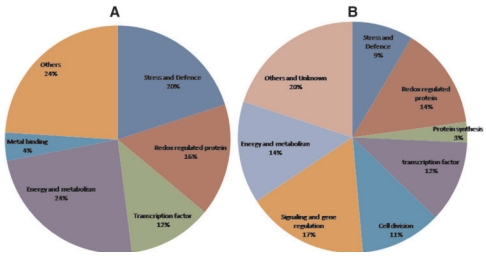


Fig. 1. *Functional classification of identified proteins in transgenic M. arvensis. A pie chart of proteins identified in control (A) and infected (B) conditions.*

Publication Detail:

Ragini Sinha, Dipto Bhattacharyya, Aparupa Bose Mazumdar, Riddhi Datta, Saptarshi Hazra and **Sharmila Chattopadhyay (2013)** Leaf proteome profiling of transgenic mint infected with *Alternaria alternata*. ***Journal of Proteomics*****,** dx.doi.org/10.1016/j.jprot.2013.01.020

Sayan Chowdhury, Tulika Mukherjee, Rupkatha Mukhopadhyay, Budhaditya Mukherjee, Souvik Sengupta, **Sharmila Chattopadhyay**, Parasuraman Jaisankar, Syamal Roy, Hemanta K. Majumder

(**2012)** The lignan niranthin poisons *Leishmania donovani* topoisomerase IB and favours a Th1 immune response in mice. ***EMBO Mol. Med.* 4:1126-1134**

P S Chowdhury*, S. Bhattarjee, A. Dey, **Sharmila Chattopadhyay**, Dipto Bhattacharyya **(2013)** Impact of age of rubber (*Hevea brasiliensis*) plantation on earthworm communities in West Tripura (India). *Jour. of Environ. Biol. 34: 59-65*

Chapter Detail:

Sharmila Chattopadhyay (2012) "Multifaceted role of glutathione in environmental stress management" in the book "Molecular Biology For Plant Abiotic Stress" published by CRC Press/Taylor & Francis Group, LLC., Ed. RK Gaur, pp.374

Invited Lectures:

Delivered two (2) numbers of invited talks in National Symposium on Plant Tissue Culture & Biotechnology and International Conference on Traditional &Alternative Medicine

Session Chaired:

Chaired one scientific session at the International conference on Traditional & Alternative Medicine, in India, on December 9, 2013

Abstracts Presented:

No. of Abstracts in National Conference is **6**
No. of Abstracts in International Conference is **2**

Students Awarded PhD:

Dipto Bhattacharyya for the thesis titled "Evaluation of medicinal plant at genetic level" registered at Jadavpur University awarded in 2012

Human Resource:

Research Associate (s): Dr. Dipto Bhattacharyya
Research Fellow(s): Ragini Sinha, Mehar D Kalim, Aaparupa Bose Mazumder, Riddhi Dutta, Saptarshi Hazra, Deepak Kumar and Ria Mukhopadhyay
Summer Trainee(s): Miss Nikita D Ingale, Miss Madhurima Chatterjee

Dr. (Miss) S. Swarnakar
Drug Development Diagnostics and Biotechnology Division

Exploring the functions of matrix metalloproteinases in gastric and ovarian cancers

Gastric cancer is the fourth most common malignancies in the world and is the leading cause of cancer related death in many Asian countries. Perturbed expression of matrix metalloproteinase's (MMPs), a family of Zinc dependent endopeptidases that degrade a range of extracellular matrix (ECM) components, is found to be involved in the risk of Gastric cancer.

Epithelial ovarian cancer (EOC) is the leading cause of death among gynecological malignancies and is the fifth leading cause of cancer death among US women and in India the trend is alarmingly rising. The high death rate is related to the difficulty of detecting ovarian cancer at an early stage as well as the lack of effective therapies for advanced disease .The epithelial tumors of the ovary account for 90% of ovarian malignancies. Most ovarian cancers arise from the epithelial cells that cover the ovary or the fallopian tube. Undergoing transformation, these cells detach from the basement membrane, metastasizing throughout the peritoneal cavity.CA-125, a high molecular weight glycoprotein, is the most extensively studied tumor marker used in screening for ovarian cancer.

MMPs are essential regulators of the microenvironment of the cell, through their control of extracellular proteolysis of macromolecules making up the ECM and have been implicated in invasion and metastasis of tumor cells**.** Thus MMPs play an important role in cancer development and aggregation including ovarian carcinoma.

However the role of single nucleotide polymorphisms (SNPs) of MMP9 promoter in **gastric cancer** has never been investigated in Eastern Indian population previously. Thus, a hospital based case control study has been conducted to explore the variants of MMP9 promoter SNPs and their genotypes in the development of gastric cancer in the Eastern Indian population.

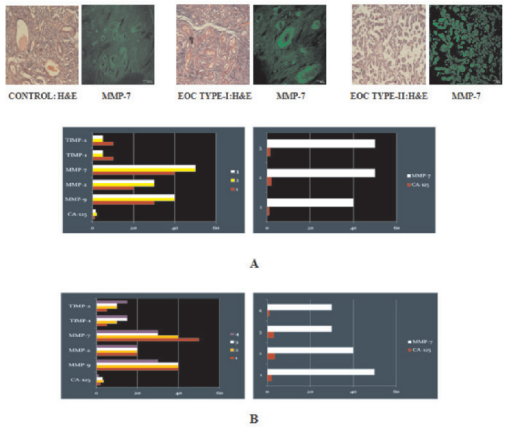


Fig : A. *Composite Graph showing CA-125, MMP-9, -2, -7 & TIMP-1 & -2 in TYPE II High volume disease (in 3 EOC patients) who expired during the course of treatment. B. Composite Graph showing CA-125, MMP-9, -2, -7 & TIMP-1 & -2 in TYPE II High volume disease (in 4 EOC patients) who have disease recurrence during follow-up. CA-125 level was low whereas higher activity of MMP-7 was found. Disease recurrence confirmed by PET-CT Scan.*

In another study for **epithelial ovarian cancer**,we have explored the role of MMP-7, one of few MMPs, over-expressed by carcinoma cells rather than stromal cells. This study was the first step in identifying a pattern of MMP-7 activity in advanced EOC using human blood and tissue samples and mapping the progression over a period of time. The increase in MMP-7 reflects the advanced stage of carcinoma in accordance with the functionality of matrilysin. However when one looks at this cohort longitudinally through the various treatments it does appear that interventions such as chemotherapy or surgery will temporarily reduce the level of MMP7 activity, but still remains higher than the standard marker CA-125 (Fig). Therefore MMP-7 and perhaps other molecular markers be used to map disease virulence and prognosis better than CA-125 and may guide the clinician on the standard modalities of treatment.

Publication Detail:

Dey S, Stalin S, Gupta A, Saha D, Kesh K and **Swarnakar S** (2012) Matrix metalloproteinase-3 gene polymorphisms and their haplotypes are associated with gastric cancer risk in eastern Indian population. *Molecular Carcinogenesis*, **51**, E42-E53

Sharma AV, Ganguly K, Paul S, Maulik N and **Swarnakar S** (2012) Curcumin heals indomethacin-induced gastric ulceration by stimulation of angiogenesis and restitution of collagen fibres via VEGF and MMP-2 mediated. signaling. *Antioxidants & Redox Signaling*, **16**, 351-362

Chakraborty S, Stalin S, Das N, Thakur Choudhury S, Ghosh S, **Swarnakar S** (2012) The use of nano-quercetin to arrest mitochondrial damage and MMP-9 upregulation during prevention of gastric inflammation induced by ethanol in rat. *Biomaterials*, **33**, 29913001

Jana S, Paul S, **Swarnakar S** (2012) Curcumin as anti-endometriotic agent: Implication of MMP-3 and intrinsic apoptotic pathway. *Biochemical Pharmacology*, **83**, 797804

Ganguly K, **Swarnakar S** (2012) Chronic gastric ulceration causes matrix metalloproteinases-9 and -3 augmentation Alleviation by melatonin. *Biochimie*, **94**, 26872698

Chapter Detail:

Chatterjee S, Roy A, Laskar A and **Swarnakar S** (2012) Electron Microscopy in the Perspective of Modern Biology: Ultravision and Ultradimension. In Current microscopy contributions to advances in science and technology. *Formatex*, (*Ed.* A. Mendez-Vilas), Vol. 2, pp. 891-902

Jana S and **Swarnakar S** (2013) Curcumin and cardiovascular diseases. In Cardiovascular Diseases: Nutritional and Therapeutic Interventions. *CRC Press, Taylor and Francis Group*, (*Ed.*Nilanjana Maulik), Vol. 1, pp. 487-500

Invited Lectures:

Delivered three (3) numbers of invited talks in XXXVI All India Cell Biology Conference and International Symposium, 100th Indian Science Congress, Kolkata & International Conference on 'Advances in Free Radicals, Redox Signaling

Session Chaired:

Chaired one scientific session at the 81st Annual Meeting of The Society of Biological Chemists (India) and Symposium on "Chemistry and Biology: Two weapons Against Diseases"., in India, on November 8, 2012

Academic Performance:

Acted as Examiner of M.Sc. for Biochemistry, Environmental Science and Microbiology and as Adjunct faculty, for Environmental Sciences, at University of Calcutta.

Acted as Editorial board member for International Journal of Biomedical Sciences and Board member at SFRR-ASIA.

Acted as Evaluator, for Research Proposals, at CSIR, DST, DBT.

Acted as Convener for Divisional Journal club, at IICB, Kolkata.

Acted as Reviewer, for PhD thesis, at IIT, Madras, Nizam's Institute of Medical Sciences and Sikkim Manipal University.

Abstracts Presented:

No. of Abstracts in National Conference is **4**

Conference/Workshop/Symposia Organized:

Organizing Secretary: at the 1st International Meet on Advanced Studies on Cell Signaling Network (CeSiN-2012), during September 11-13, 2012 at CSIR-IICB, Kolkata, West Bengal, India

Honors & Awards:

Elected Fellow, by National Academy of Science, Allahabad (FNASc) 2012

Elected Fellow, by Nehru-Fulbright Senior Research Fellowship, 2013 (Now, working at Emory University, Atlanta, Georgia, USA).

Human Resourc :

Technical/Administratice Staff(s): Ardhendu Mondal

Research Fellow(s): Koushik Kesh, Nillu Ghosh, Nilanjan Ganguly, Dharmendra Kumar Yadav, Sugreev Verma

Research Associate(s): Susri Roy Choudhury , Sibani Sarkar

Project Assistant(s): Sayantan Jana, Deep Sankar Rudra, Anirban Roy, Kasturi Chatterjee,

Summer Trainee(s): Sayak Manna, Madhumanti Mondal , Papita Ghosh,

Chemistry Division

Chemistry Division

Drs. P. Chattopadhyay , S. B. Mandal, A. K. Sen (Jr.), G. Suresh Kumar, Nirup Bikash Mondal, P. Jaisankar, Asish Kr. Banerjee, Chinmay Chowdhury, Biswadip Banerji, Surajit Ghosh, Indrajit Das

Organic synthesis of bioactive natural and other molecules used against various targets and their nucleic acid binding properties, peptidomimetics and self-assembly are the major areas of research in chemistry division. Besides, isolation of bioactive natural products from medicinal plants in determining their efficacies as well as herbal preparations for treatment of some major ailments is the other area of research of this division. Based on the background our major research activities of the division will focus on the following:

- Enantioselective synthesis of biologically active natural products, carbohydrate-based molecules, enzyme inhibitors and a variety of heterocycles of high bioactivity either by employing known reactions or developing new reactions.
- Design, synthesis of very short peptide and peptide conjugates, and their interactions with tubulin and self-assemble in solution forming different morphological structure.
- Synthesis and binding studies of sugar based peptidomimetic macrocycles towards the ion channels, catalyst, and drug delivery.
- Isolation, identification and screening of novel phytomolecules against cancer, eye problems and cardiovascular diseases to identify lead molecule(s) and generation of various analogues through synthesis.
- Investigation of general strategies for the recognition of highly structured RNA and DNA molecules in solution by small natural and synthetic potential antitumor agents.

Dr. Partha Chattopadhyay
Chemistry Division

Design and Synthesis of Regioisomeric Triazole Based Peptidomimetic Macrocycles and Their Dipole Moment Controlled Self-Assembly

Subproject highlights regioisomeric triazole/amide based peptidomimetic macrocycles consisting of cis-β-furanoid sugar, β-alanine moity and also triazole modification, which can effectively control the polarity of the nanotube due to different orientation of functional groups. This project has formulated to synthesize various kinds of sugar based peptidomimetic macrocycles and observe their conformational controlled self-assembly. The self-assembly of cyclic D,L-α--peptides into nanotubes has been used to produce artificial ion channels in several variations. "Antiparallel" macrocycles that self-assemble into "antiparallel" nanotubes without macrodipole exhibit low dipole moment. Parallel macrocycles that self-assemble into parallel nanotubes with strong macrodipole are capable of larger dipolement. The functional consequences of the proposed macrodipole in β^3-peptide ion channels have not been investigated. We also extended our work to synthesize two stable regioisomaric macrocycles 2a and 2b, in terms of the position of triazole/amide groups (Fig.1 & 2). Both undergo self-assembly in solvents of opposite polarity but in parallel manner ascribed to (β,β) and (β-D, β-L) hydrogen bonding leading to formation of two different unique class of organic nanostructure.

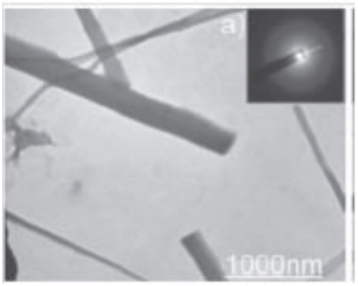


Fig.1: *TEM image of rodlike assemblies of 2a, SAED pattern is shown as inset*

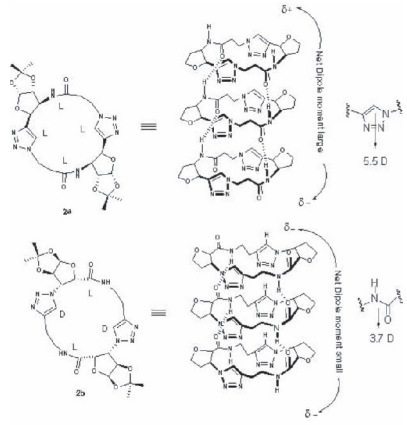


Fig.2: *2a and 2b are two regioisomeric stable rotameric peptidominetic macrocycle undergoing self assembly in solution*

Publication Details:

Mitra, S, Darira, H and **Chattopadhyay, P** (2013) Efficient Synthesis of Imidazole Fused Benzodiazepines Using Palladium-Catalyzed Intramolecular C-N bond formation Reaction. *Synthesis*, **45**, 85-92

Mitra, S, Chattopadhyay, N and **Chattopadhyay, P**(2013) Expeditious Synthetic Approach and Photophysical Properties of Fluorescent Benzimidazo[1,2-d] dibenzo[b,f][1,4]diazepine derivatives. *RSC Advance*, **3**, 1862-70

Ghorai, A, Padmanaban, E, Achari, B, Mukhopadhyay, C and **Chattopadhyay, P** (2012) Design and Synthesis of Regioisomeric Triazole/Amide Peptidomimetic Macrocycles and Their Dipole Moment Controlled Self-Assembly. *Chem Commun.* , **48**, 11975-78

Adhikary, ND and **Chattopadhyay, P** (2012) Design and Synthesis of 1,2,3-Triazole-Fused Chiral Medium Ring Benzo-Heterocycles, Scaffolds Mimicking Benzolactams. *J. Org. Chem.*, **77**, 5399-5405

Kulsi, G, Ghorai, A and **Chattopadhyay, P** (2012) Tandem one pot synthesis of 1, 5-benzodiazocine-2-one by isocyanide based Ugi multicomponent reaction. *Tetrahedron Lett.*, **53**, 3619-22

Invited Lectures:

Delivered one (1) number of invited talk in Sambalpur University

Session Chaired:

Chaired one scientific session at the National seminar on Recent Trends in Chemical Sciences (RETICS-2013),, in India, on March 17, 2013
Chaired one scientific session at the International Symposium on Challenges in Chemical Biology (ISCCB-2013) , in India, on January 29, 2013

Academic Performance:

Acted as Teacher for Scottish Church College, *CSIR-IICB PhD Programme* and NIPER-Kolkata .
Acted as Paper Reviewer for *Journal of Organic Chemistry*, *Tetrahedron Letter*, *Bio-Organic medicinal Chemistry*, *Medicinal Chemistry research*
Acted as Project Reviewer for DST, SERC, Govt. of India
Acted as Member, for *Editorial Board of Referees*, at ARKIVOC, USA
Acted as PhD Thesis Examiner for *Chemistry* at Jawaharlal Nehru Technological University, Hyderabad

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

Honours & Awards:
Fellow, by *West Bengal Academy of Sciences & Technology, India*

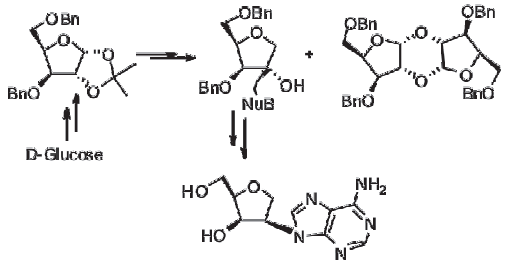
Students Awarded PhD:
Nirmal Das Adhikary, for thesis titled "*Synthesis of Medium Ring Azaheterocycles and Analogues from carbohydrate derivatives* ", registered at Jadavpur University awarded on May 29, 2012

Human Resource:
Technical/Administrative Staff(s): Dr Tapas Sarkar, Mr E Padmanaban, Mr Sandip Kundu
Research Fellow(s): Sudipta Mitra, Avijit Ghorai
Project Assistant(s): Gautam Kulsi

Dr. S. B. Mandal
Chemistry Division

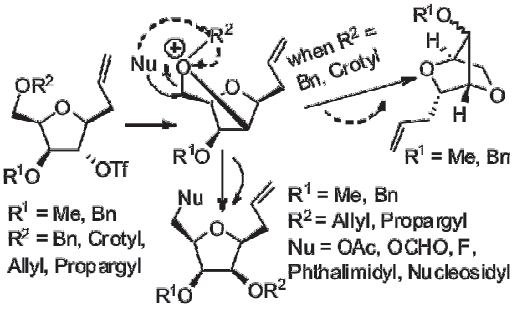
Synthetic approaches to structurally novel heterocycles and nucleoside analogues from D-glucose

The objective of the subproject is to develop synthetic routes to novel heterocycles and their conversion to bioactive nucleoside derivatives. Toward this aim, we have found that Lewis acid-Et_3SiH can induce deoxygenation of anomeric carbon of sugars generates tetrahydrofuran derivatives, accompanied by hitherto unknown dimeric products. If the reagent addition steps are reversed, tetrahydrofuran derivatives are obtained as the sole products, while only the dimeric products are isolated if Et_3SiH is excluded. One of the deoxygenated products has been transformed into a β-isonucleoside (Scheme 1).



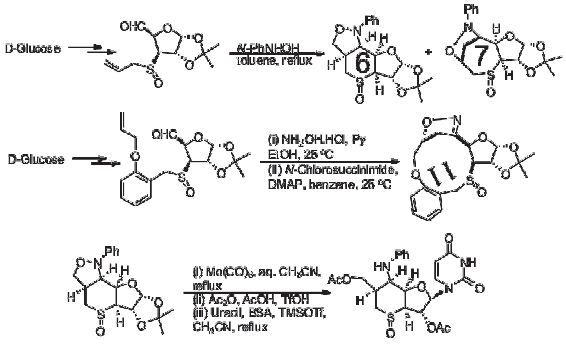
Scheme 1

In 1-deoxy-xylofuranose derivatives possessing a good leaving group at 2-C, participation of allyloxy and propargyloxy substituents at 5-C results in loss of the 2-C substituent and attack of various nucleophiles at 5-C of the oxonium intermediate. Such participation of a benzyloxy or crotyloxy group leads to dioxabicyclo[2.2.1]heptane rings (Scheme 2).



Scheme 2

S-Alkenyl and -alkynyl carbohydrate derivatives were prepared from 1,2:5,6-O-diisopropylidene-α-D-allofuranose. Nitrones and nitrile oxides generated from these derivatives led to the formation of 6, 7, and 11-membered chiral sulfur heterocycles fused to isoxazolidine, isoxazoline and isoxazole rings. Some of these sulfur heterocycles were converted to nucleosides. The 11-memebered sulfur compound was found to gelate hydrocarbon solvents (Scheme 3).



Scheme 3

Publication Details

Deoxygenation/dimerization of sugar derivatives with $BF_3.Et_2O$-Et_3SiH: synthesis of a β-isonucleoside; Mukherjee S , Roy B G , Das S N and **Mandal S B**, *Tetrahedron Lett.* 2012, 53, 4929-4932.

Carbohydrate nitrone and nitrile oxide cycloaddition approach to chiral sulfur heterocycles and nucleosides; Mukherjee S , **Mandal S B** and Bhattacharjya A; *RSC Adv.* 2012, *2*, 8969 8978.

Allyloxy and propargyloxy group migration: role of remote group participation in the synthesis of 5-C-nucleosides and other sugar derivatives; Mukherjee S, Tripathy P N and **Mandal S B** ; *Org. Lett.* 2012, *14*, 4186-4189.

PhD Thesis Awarded

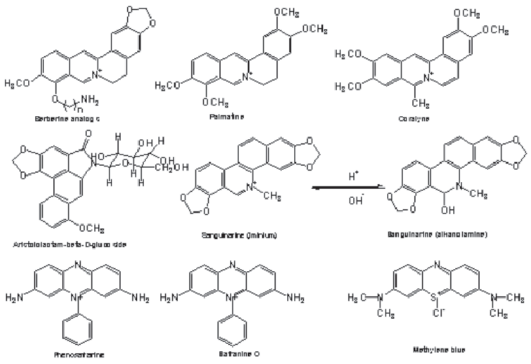
- **Prithwish Kumar Jana** awarded PhD degree of Jadavpur University in 2012 for his thesis entitled, “Synthesis of ether backbone RNA analogues and the development of a method for carbohydrate homologation”.

- **Subhrangshu Mukherjee** awarded PhD degree of Jadavpur University in 2012 for his thesis entitled, “Synthetic studies on the novel chiral heterocycles and nucleosides from carbohydrate derivatives”.

Dr. G.Suresh Kumar
Chemistry Division

Nucleic acid and protein interaction of small molecules and plant alkaloids

Considering the importance of small molecules in chemical biology we studied the interaction of a number of natural alkaloids, their analogs and several planar dyes and biogenic polyamines with biomacromolecules, DNA, RNA and proteins through a number of biophysical techniques. It has been revealed that the 9-O-N-aryl/arylalkyl amino carbonyl methyl substituted analogs of berberines were better binders of DNA and tRNA compared to the parent alkaloid. These compounds also easily induced self-structure in polyadenylic acid. Similarly, another group of synthetic berberine analogs namely 9-O-(ω-amino) alkyl ether analogs stabilized the helical structure of the RNA triplex poly(U)poly(A)$_*$poly(U) much more than the parent alkaloid suggesting the importance of substitution at the 9-position of the isoquinoline chromophore. The charged iminium form of the benzophenanthridine alkaloid sanguinarine also bound strongly to tRNAphe.On the the hand, the alkanolamine form (neutral) bound stronger than iminium to serum albumins. The sugar binding natural alkaloid aristololactam-β-D-glucoside was found to stabilize double stranded RNA structures and single stranded RNAs but was not as effective as the anticancer agent daunomycin. The alkaloids berberine, palmatine and coalyne bound strongly to hemoglobin, bovine serum albumin and human serum albumin. The interaction has been structurally and thermodynamically characterized and the binding sites located from displacement studies. Similarly, structural and thermodynamic characterization of the interaction of a number of phenazinium and phenathaizinium dyes, and biogenic polyamines with various DNA sequences and protein structures have been performed. Overall, these studies bring out the utility of these molecules for development as potential therapeutic agents.



Chemical structure of small molecules studied for DNA and protein interaction

Publication Details:

Hazra, S., Hossain, M. & **Suresh Kumar, G** (2013) Binding of isoquinoline alkaloids berberine, palmatine, and coralyne to hemoglobin. Structural and thermodynamic characterization studies. *Mol. BioSyst.* , **9**, 143-153

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

Ghosh, D., Saha, C., Hossain, M., Dey, S. K. & **Suresh Kumar G.** (2013) Biophysical studies of mutated K562 DNA (erythroleukemic cells) binding to adriamycin and daunomycin reveal that mutations induce structural changes influencing binding behavior. *J. Biomol. Struct. Dyn.*, **31**, 331-341

Kundu, S., Biswas, M. K., Banerjee, A., Bhadra, K., **Suresh Kumar, G.**, Drew, M.G.B.. Bhadra, R. & Ghosh, P. (2013) Cupric ion promoted synthesis of 9-phenyldibenzo[a,c]phenazin-9-ium: A DNA intercalator. *RSC Adv.*, **3**, 3054-3061

Khan,A.Y., Hossain, M. & **Suresh Kumar, G.** (2013) Binding of plant alkaloids berberine and palmatine to serum albumins: A thermodynamic investigation. *Mol. Biol. Rep.*, **40**, 553-566

Kabir,A., Hossain, M. & **Suresh Kumar, G.**, Thermodynamics of the interaction of biogenic polyamines with DNA. *J. Chem. Thermodyn.*, **57**, 445-453 (2013)

Saha, I. & **Suresh Kumar, G.** (2013) Phenazinium dyes methylene violet 3rax and indoine blue binds to DNA by intercalation: Evidence from structural and thermodynamic studies.*Dyes Pigments*, **96**, 81-91

Roy, S., Mandal, M., Pal, C., Giri, P., **Suresh Kumar, G.,** Mukherjee, J. & Jaisankar, P. (2013) Enhancement of the solubility of 3,3'-diindolylmethane derivatives using cyclodextrin inclusion complexes.*J. Mol. Struct.*, **1036**, 1-6

Devi, P.S., Banerjee, S.. Roy Chowdhury, S. & **Suresh Kumar, G.** (2013) In situ synthesis of highly fluorescent gold nanoparticles by chicken eggshell membrane induced bioreduction. *RSC Adv.*, **2**, 11578-11585

Saha, I, Bhatacharyya, J. & **Suresh Kumar, G.** (2013) Thermodynamic investigations of ligand-protein interactions: Binding of the phenazinium dyes phenosafranin and safranin O with human serum albumin. *J. Chem. Thermodyn.* , **56**, 114-122

Pal, S,, Saha, C., Hossain, M., Dey, S.K. & **Suresh Kumar, G.** (2012) Influence of Galloyl moiety in interaction of epicatechin with bovine serum albumin: A spectroscopic and thermodynamic characterization. *PLoS ONE*, **7**, e43321

Basu, A., Jaisankar, P. & **Suresh Kumar G.** (2012) 9-O-N-aryl/arylalkyl amino carbonyl methyl substituted berberine analogs induce self-structure in polyadenylic acid. *RSC Adv.*, **2**, 7714-7723

Das, A. & **Suresh Kumar, G.** (2012) Drug-DNA binding thermodynamics: A comparative study of aristololactam-β-D-glucoside and daunomycin. *J. Chem. Thermodyn.*, **54**, 421-428

Suresh Kumar, G (2012)RNA targeting by small molecules: Binding of protoberberine, benzophenanthridine, and aristolochia alkaloids to various RNA structures. *J. Biosci.*, **37**, 539552

Das, A. & **Suresh Kumar, G.** (2012) Probing the binding of two sugar bearing anticancer agents aristololactam-β-D-glucoside and daunomycin to double stranded RNA polynucleotides: A combined spectroscopic and calorimetric study. *Mol. BioSyst.*, **8**, 1958 -1969

Bhaumik, D., Das, S,, Lily., H, Hossain, M. & **Suresh Kumar, G.** (2012) Biophysical characterization of the strong stabilization of the RNA triplex poly(U)poly(A)*poly(U) by 9-O-(ω-amino) alkyl ether berberine analogs. *PLoS ONE*, **7**, e37939

Basu, A., Jaisankar, P. & **Suresh Kumar, G.** (2012) Synthesis of novel 9-O-N-aryl/aryl-alkyl amino carbonyl methyl berberine analogs and evaluation of DNA binding aspects. *Bioorg. Med. Chem.*, **20**, 2498-2505

Khan A. Y., Hossain, M. & **Suresh Kumar, G.**(2012) Binding of the DNA intercalator and anticancer alkaloid coralyne with serum albumins: Structural and energetic aspects, and effect of site markers. *Chemosphere*, **87**, 775-781

Hossain, M., Khan A. Y. & **Suresh Kumar, G** (2012) Study on the thermodynamics of the binding of iminium and alkanolamine forms of the anticancer agent sanguinarine to human serum albumin. *J. Chem. Thermodyn*, **47**, 90-99

Paul, P. & **Suresh Kumar, G** (2013) Spectroscopic studies on the binding interaction of phenothiazinium dyes toluidine blue O, azure A and azure B to DNA. *Spectrochim. Acta A: Mol. Biomol. Spectroscopy*, **107**, 303-310

Hossain, M., Kabir, A. & **Suresh Kumar, G.** (2012) Binding of the anticancer alkaloid sanguinarine to tRNAPhe: Spectroscopic and calorimetric studies. . *J. Biomol. Struct. Dyn*, **30**, 223-234

Invited Lectures:

Delivered one invited talk at Banaras Hindu University

Academic Performance:

Acted as Guest Faculty for *MS course* at NIPER, Kolkata

Acted as Adjudicator , for *Ph.D thesis* , at Cochin University of Science and Technology, Pune University, University of Delhi & Jadavpur University
Acted as Reviewer, for *manuscripts*, at ACS, RSC and Elsevier, Springer and Bentham journals and also for *Projects*, at CSIR

Abstracts Presented:
No. of Abstracts in National Conference is **22**
No. of Abstracts in International Conference is **4**
Conference/Workshop/Symposia Organized
EC Member and Treasurer: at the International Symposium on Challenges in Chemical Biology (ISCCB 2013) , during Jan 27-29, 2013 in CSIR-Indian Institute of Chemical Biology, Kolkata

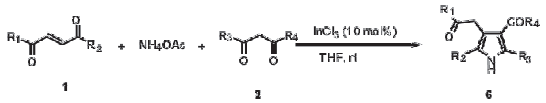
Honours & Awards
Member, Research Advisory Council, by *RK Mission Residential College, Narendrapur, Kolkata*, 2012-14
Council Member, by *West Bengal Academy of Science and Technology*, 2013-2015
Member, National Executive Council, by *Indian Photobiology Society*, 2013-2016
Member and Secretary, by *DNA Society of India*, 2009-2014

Human Resource
Research Fellow(s): Ms. Abhi Das, Ms. Puja Paul, Mr. Anirban Basu, Ms. Asma Yasmeen Khan, Ms. Ayesha Kabir, Ms. Debipreeta Bhowmik, Mr. Soumitra Hazra, Ms. Pritha Basu, Ms. Chandrima Jash
Research Associate(s): Dr. Jhimli Bhattacharyya,

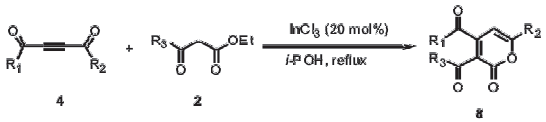
Dr. Parasuraman Jaisankar
Chemistry Division

$InCl_3$ Catalysed One-Pot Synthesis of Substituted Pyrroles and 2-Pyrones:

An efficient $InCl_3$ catalysed one-pot strategy has been developed for the synthesis of tetra-substituted pyrroles and tri-substituted 2-pyrones in very good yields. Tetra-substituted pyrroles were prepared from 1,4-enediones and β-dicarbonyls employing NH_4OAc as a nitrogen source, through a combination of Michael addition and PaalKnorr methods (Scheme 1). Tri-substituted 2-pyrones were synthesized from 1,4-ynediones and appropriate β-dicarbonyls using a sequential Michael addition and 6-*exo-trig* cyclisation (Scheme-2). Structure of these compounds has been unambiguously determined by X-ray crystallography (Figure 1).



Scheme 1: *Synthesis of substituted pyrroles*



Scheme 2: *Synthesis of substituted 2-pyrones*

Design, synthesis and biological implications of 3-substituted indoles:

A series of 3-substituted indoles has been synthesised from indoles with ene diones using $InCl_3$ as Lewis acid catalyst in mild condition followed by cyclisation (Figure 2).

- The notable feature of our synthesised molecules is its ability to specifically function as quorum sensing inhibitor in pulmonary *Pseudomonus aeruginosa* infections and inhibits biofilm production.
- These molecules were found to have potent anti-proliferative activity against human cancer cells of diverse origin. The molecular mechanism for ant-cancer activities of the lead molecule was found to be via selective inhibition of mitochondrial complex III, subunit 3 (MT-CYB) formations.
- 3-substituted indoles were found to be potent molecule against gastric ulceration in mice model. It has been found that the antiulcer efficacy of the lead molecule is due to inhibition of the MMP-9 activity.

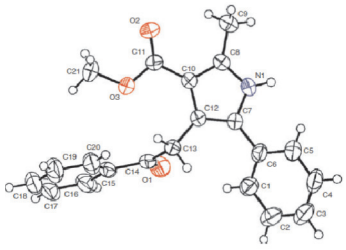


Figure 1: *ORPET diagram of substituted pyrrole* ***6a***

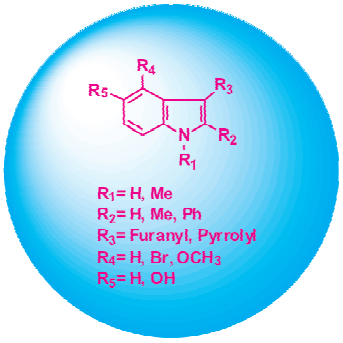


***Figure 2**: Synthetic bioactive 3-substituted indoles*

Publication Details:

Chiranjit Acharya, Dey S, **Jaisankar P** (2012), Indium trichloride catalyzed three component one-pot route to 1-hydroxymethyl-3-aminomethyl indoles, *Tetrahedron Lett.* 53, 5548-51

Mandal M, Chatterjee S and **Jaisankar P** (2012) Woollins Reagent: A Chemoselective Reducing agent for 1,4-enediones and 1,4-ynediones to Saturated 1,4-Diones, *Synlett*. 23, 2615-18

Roy **S**, Mandal M, Pal C, Giri P, Suresh Kumar G , Mukherjee J , **Jaisankar P** (2012) Studies on aqueous solubility of 3,3'-diindolylmethane derivatives using cyclodextrin inclusion complexes, *Journal of Molecular Structure,* 1036, 1-6

Nandi D, Besra S E , Vedasiromoni J R , Giri V S ,Rana P , **Jaisankar P** (2012) Anti-leukemic activity of *Wattakaka volubilis* leaf extract against human myeloid leukemia cell lines, *Journal of Ethnopharmacology*, 144, 466-473

Balwani S, Chaudhuri R , Nandi D, **Jaisankar P** *(2012)* Anurag Agrawal, Balaram Ghosh, Regulation of NF-κB Activation through a Novel PI-3K-Independent and PKA/Akt-Dependent Pathway in Human Umbilical Vein Endothelial Cells, *PLoS ONE* 7(10): e46528

Chowdhury S, Mukherjee T, Mukhopadhyay R, Mukherjee B, Sengupta S, Chattopadhyay S, **Jaisankar P**, Roy S and Majumder H. K. (2012) The Lignan Niranthin poisons *Leishmania donovani* topoisomerase IB and favours a Th1 immune response in mice, *EMBO, Mol. Med.,* 4(10), 1126-43

Kumar D. , Mandal M. , Roy R. , **Jaisankar P**., Das P. *(2012)* Biological Mechanism of Action of Novel −3−(2,5-diphenylfuran-3-yl)−4-methoxy-1H-indole in Human Leukemic Cell Lines, *European Journal of Cancer*, *48 (Supplement 5)*, *Page S219*

Basu A, **Jaisankar P**, Suresh Kumar G(2012) 9-O-N-aryl/arylalkyl amino carbonyl methyl substituted berberine analogues induce self-structure in polyadenylic acid, *RSC Adv.*, DOI: 10.1039/c2ra20841e

Garai S, Garai S, **Jaisankar P**, Singh J. K. , Elango .A, A(2012) Comprehensive study on crude methanolic extract of Ar*temisia pallens* (Asteraceae) and its active component as effective corrosion inhibitors of mild steel in acid solution, *Corrosion Science*, 60, 193-204

Basu A, **Jaisankar P**, G Suresh Kumar(2012) Synthesis of novel 9-O-N-aryl/arylalkyl amino carbonyl methyl substituted berberine analogs and evaluation of DNA binding aspects, *Bioorganic & Medicinal Chemistry*, 20, 2498-2505

Mukherjee T, Sarkar T, Paul P, Chakraborty A.K. , **Jaisankar P.** and Mukhopadhyay S. B. (2012) Putralone, a Novel 10α-Hydroxy-25-nor D: A friedo-oleanane Triterpenoid from *Putranjiva roxburghii*, , *Natural Prod. Commun*. 7, 511-513

Biswas N, Mahato S. K., Acharya ChowdhuryA, Chaudhuri J, Manna A, Vinayagam J, Chatterjee S , **Jaisankar P**, Bandyopadhyay S (2012) ICB3E induces iNOS expression by JNK and ERK activation for apoptosis of leukemic cells: *Apoptosis*, 17, 612-626

Mukherjee T, Chowdhury S, Kumar A,Majumder H. K.,**Jaisankar P** and Mukhopadhyay S (2012) Saracoside: A New Lignan Glycoside from *Saraca indica*, a Potential Inhibitor of DNA Topoisomerase IB: *Natural Prod. Commun*. 7, 767-769

Mahato S. K. , Vinayagam J, Dey S, Timiri A. K. , Chatterjee S and **Jaisankar P** (2013) $InCl_3$ catalysed one-pot synthesis of substituted pyrroles and 2-pyrones, *Aust. Journal of Chemistry* 66, 241-251

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 Chem. Biol. 8(4), 658-661*

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

Pradhan P K, Nandi D, Das Pradhan S, **Jaisankar P** and Giri V. S. (2013) An Unusual Diastereoselective Pictet-Spengler Reaction: Synthesis of Novel Tetrahydro-β-Carboline Glycosides, *Synlett*. 24, 85-89

Roy, S; Mandal, M; Pal, C; Giri, P;Kumar, GS; Mukherjee, J; **Jaisankar, P** (2013) Studies on aqueous solubility of 3,3 '-diindolylmethane derivatives using cyclodextrin inclusion complexes, *JOURNAL OF MOLECULAR STRUCTURE*, 1036, 1-6

Invited Lectures:
Delivered one (1) number of invited talk in International Symposium on Molecular Signaling atViswa Bharati University, Shantiniketan

Session Chaired:
Chaired one scientific session at *International Symposium on Challenges in Chemical Biology (ISCCB)-2013, at CSIR-IICB, Kollkata (India), January 28, 2013*
Academic Performance:
Acted as Teacher for NIPER, Kolkata and Ph. D. Course work of CSIR- IICB, Kolkata

Abstracts Presented:
No. of Abstracts in National Conference is 2
No. of Abstracts in International Conference is 2
Conference/Workshop/Symposia Organized:
Convener: International Symposium on Challenges in Chemical Biology (ISCCB) 2013. During 27-29, January 2013 in Indian Institute of Chemical Biology, Kolkata-700032

Students Awarded PhD:
Sanjit Kumar Mahato, for thesis titled "Development of Novel Catalysts for Synthesis of Heterocycles", registered at Jadavpur University awarded on August 10, 2012
Tulika Mukherjee, for thesis titled "Chemical Investigation on Bioactive Substances Isolated from Medicinal Plants" registered at Jadavpur University awarded on March 12, 2013

Human Resource:
Technical/Administrative Staff(s): Sri Sarit K Sarkhel, Sri Tarun Dutta
Research Fellow(s): Madhumita Mandal, Chiranjit Acharya, Sourav Chatterjee, Rahul Gajabhiye, Tulika Mukherjee, Pinaki Bhatttacharjee, Debleena Bhattacharya,
Research Associate(s): Jayaraman Vunayagam, Dr. Debkumar Nandi
Summer Trainee(s): Joydeep Sarkar, Pramod.Gunwan, Jagadeesh Temburu

Dr. Asish Kr. Banerjee
Chemistry Division

Novel synthetic routes for natural products: enantioselective synthesis of (S)-oxiracetam and (S)-GABOB

Synthetic routes to (*S*)-oxiracetam and (*S*)-GABOB have been developed starting from (*R*)-glyceraldehyde acetonide through its conversion to an appropriate aldehyde intermediate followed by reductive amination using glycinamide hydrochloride/ benzyl amine and subsequent chemical transformations.

Oxiracetam (**1**) (Figure 1) having a β-hydroxy-γ-lactam core structure, is a highly effective nootropic drug used in the treatment of Alzheimer's disease. Clinical findings reveal that it enhances hippocampal synaptic transmission due to the activation of excitatory amino acid receptors and has positive effects on logical performance, attention/concentration, memory and orientation on chronic use.

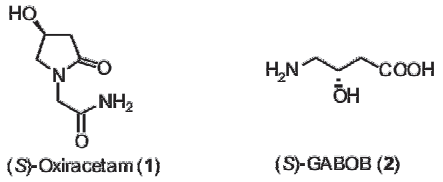
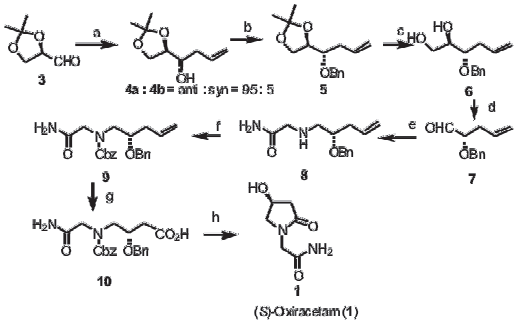
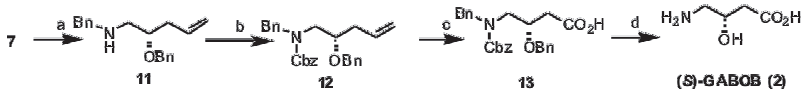


Figure1: *Structure of (S)-Oxiracetam (**1**) and (S)-GABOB (**2**)*

The γ-amino-β-hydroxybutyric acid (GABOB) (**2**) (Figure 1) is an unusual amino acid present in a family of marine cyclic peptides, possessing antitumor and antifungal activity7 and behaves as an agonist of γ-amino-butyric acid (GABA). It functions in the mammalian central nervous system as a neuromodulator having hypotensive and antiepileptic activity. It has also been used as a precursor for some heterocycles, which act as GABA-receptor agonists. Considering the importance of these two drugs, many reports on their synthesis have been reported. Nevertheless, research interest for the synthesis of oxiracetam and GABOB continues unabated due to their biological and pharmacological importance. We report herein, a divergent route towards the stereoselective total synthesis of (*S*)-oxiracetam and (*S*)-GABOB starting from easily available (*R*)-glyceraldehyde acetonide as the chiral synthon (Scheme 1 and 2).



Scheme 1*: Reagents and conditions: (a) Allyl bromide, Zn dust, THF, rt, 4 h, overall yield 84%; (b) BnBr, NaH, DMF, 0 °C-rt, 14 h, 85%; (c) 80% AcOH, rt, 24 h, 90%; (d) $NaIO_4$, MeOH-H_2O (4:1), rt, 2 h, 82%; (e) glycinamideHCl, Et_3N, $NaCNBH_3$, MeOH-Et_2O, 0 °C-rt, 4 h, 80%; (f) CbzCl, $NaHCO_3$, EtOH-H_2O (2:1), 0 °C-rt, 3 h, 90%; (g) (i) OsO_4, NMO, acetone-H_2O (3:1), rt, 14 h; (ii) $NaIO_4$, MeOH-H_2O (4:1), rt, 2 h; (iii) $NaClO_2$, 20% $NaH_2PO_4.2H_2O$, tBuOH, 0 °C-rt, 4 h, (70% over 3 steps); (h) (i) EDC.HCl, pentafluoro phenol, DCM, rt, 14 h; (ii) H_2, 10% Pd/C, MeOH, 12 h, 72%.*



***Scheme 2**: Reagents and conditions: (a) $BnNH_2$, $Na(OAc)_3BH$, $ClCH_2CH_2Cl$, rt, 4 h, 78%; (b) CbzCl, $NaHCO_3$, EtOH-H_2O (2:1), 0 ºC-rt, 3 h, 92%; (c) (i) OsO_4, NMO, acetone-H_2O (3:1), rt, 14 h; (ii) $NaIO_4$, MeOH-H_2O (4:1), rt, 2 h; (iii) $NaClO_2$, 20% $NaH_2PO_4.2H_2O$, tBuOH, 0 ^{0}C-rt, 4 h, (77% over 3 steps). (d) H_2, 80 Mole% of 10% Pd/C, EtOAc, 12h, 87%.*

Publication Details:

Sanyal I, Deb Barman P and **Banerjee A K** (2012) Enantiodivergent Syntheses of Pantolactone and Pantothenic Acid from D-Mannitol. *Synthesis*, **44**, 1102-1108

Session Chaired:

Chaired one scientific session at the International Symposium on Challenges in Chemical Biology, in CSIR-IICB, on January 27, 2013

Academic Performance:

Acted as Reviewer for Journal of Organic Chemistry, Organic Letters , Tetrahedron, Tetrahedron Letters and Synthesis

Acted as Project Director for NIPER-Kolkata

Conference/Workshop/Symposia Organized:

Acted as Convener for the International Symposium on Challenges in Chemical Biology during 27-29 January, 2013 at CSIR-IICB

Honours & Awards

Member, Steering Committee of NIPERs and Committee constituted to formulate rules, service conditions, etc. of NIPER staff constituted by Department of Pharmaceuticals, Ministry of Chemicals & Fertilizers, Govt. of India.

Member, Joint Counseling Committee, NIPER-Mohali

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

Students Awarded PhD:

Iahita Sanyal , for thesis titled "*APPROACHES TO STEREOSELECTIVE SYNTHESIS OF PANTOLACTONE, PANTOTHENIC ACID AND THEIR CLOSELY RELATED HETEROCYCLIC ANALOGUES STARTING FROM CARBOHYDRATE*", registered at Jadavpur University awarded on November 22, 2013

Human Resource:

Technical/Administrative Staff(s): Mr. Santu Paul, Mr. Shekhar Ghosh

Research Fellow(s): Piyali Deb Barman

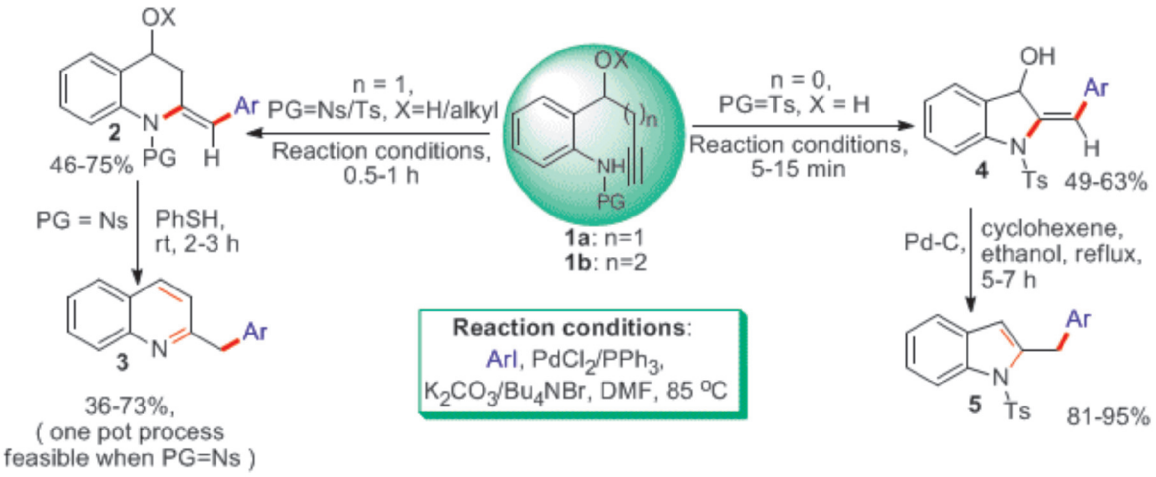
Project Assistant(s): Brajesh Shukla,

Dr. Chinmay Chowdhury
Chemistry Division

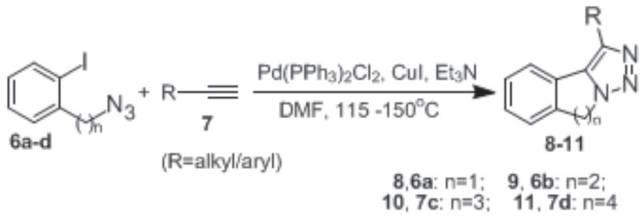
Development of efficient methods for the synthesis of novel heterocycles of biological interests

A facile and efficient method for the synthesis of (*E*)-2-arylmethylidene-*N*-tosyl/nosyl-tetrahydroquinoline **2** has been developed through a palladium catalyzed cyclocondensation of aryl iodides with readily available 1-(2-tosyl/nosylaminophenyl) but-3-yn-1-ol **1a** (Scheme 1). In practice, a range of diversely functionalized (*E*)-2-arylmethylidene-*N*-tosyl/nosyl-tetrahydroquinolines **2** could easily be synthesized within 30-60 minutes only. The reaction was found to be equally effective with both tosyl and nosyl as *N*-protecting group, but acetylenic ethers(**2a**) usually afforded higher yields than the alcohols. Similarly, various functional groups present in the iodides were found to be tolerated under the reaction conditions. We then checked the viability of denosylation of products **2** under one-pot in domino fashion by adding (*in situ*) thiophenol leading to the synthesis 2-arylmethylquinoline **3**. On the other hand, 1-(2-tosylaminophenyl)prop-2-yn-1-ols **1b** also reacted successful with aryl iodides in the presence of palladium catalyst ($PdCl_2/PPh_3$) resulting in the synthesis of (*E*)-2-(arylidene)indolin-3-ols **4** in moderate to good yields. Thereafter, products **4** underwent hydrogenolysis employing Pd/C and cyclohexene in refluxing ethanol to afford 2-arylmethylindoles **5** in excellent yields (81-95%). The identities of all new products were established by spectroscopic and analytical data. Besides, single crystal X-ray diffraction analysis of some of the products established the structure and stereochemistry unambiguously.

In another project, we have described a palladium-copper catalyzed elegant method for the synthesis of 1,2,3-triazoles fused with five-, six-, seven- and eight-membered benzoheterocycles **8-11**, featuring isoindoline, tetrahydroisoquinoline, benzoazepine and benzo-azocine, respectively (Scheme 2). A variety of *o*-iodo-azides **6a-d** and acetylenic substrates **7** were found to react under the reaction conditions affording a diverse array of products with moderate to good yields. The reaction protocol was successfully utilized for the formation of one C-C and two C-N bonds in a one-pot reaction. The broad scope of this reaction was further illustrated by effecting bis-heteroannulations, synthesis of uracil derivatives of biological interests, and employment of acetylene gas as a cheap substrate. The structures of the products **8-11** were determined based on spectral (^1H and ^{13}C NMR, IR and mass) and analytical data. Additionally, unambiguous structural confirmation also came from X-ray diffraction analysis of the representative eight-membered ring product **11**.



Synthesis of (E)-2-arylmethylidene-N-tosyl/nosyltetrahydroquinolines 2 and (E)-2-arylmethylidene-N-tosylindolines 4: access to 2-substituted quinolines 3 and indoles 5



Synthesis of 1,2,3-triazole-fused isoindolines, tetrahydroisoquinolines, benzoazepines and benzo-azocines 8-11

Publication Details:

Chowdhury C., Das B., Mukherjee S., Achari B. (2012) Palladium catalyzed approach for the general synthesis of (E)-2-arylmethylidene-N-tosyl-indolines and (E)-2-arylmethylidene-N-tosyl/nosyl-tetrahydroquinolines: Access to 2-substituted indoles and quinolines. *Journal of Organic Chemistry*, **77**, 5108-5119

Brahma K., Achari B. and **Chowdhury C.** (2013) An efficient, general method for the synthesis of 1,2,3-triazole-fused heterocycles through palladium-catalyzed reactions. *Synthesis*, **45**, 545-555

Das P., Kumar D., Roy R., **Chowdhury C.** and Chatterjee M. (2012) Andrographolide analogue Induces Apoptosis and Autophasy Mediated Cell Death in U937 Cells. *Eur. J. cancer*, **48**, S156

Roy R., Kumar D., **Chowdhury C.**, Das P. (2012) Autophagic and Apoptotic Mechanisms of Death Induced by Sesbania Grandiflora flower in Human Leukemic Cells. *Eur. J. Cancer*, **48**, S27

Academic Performance:

Acted as teacher for coursework at IICB, Kolkata

Acted as reviewer of the journals such as, for *Tetrahedron, Bioorganic and Medicinal Chemistrty Letters, Synthesis etc*

Abstracts Presented

No. of Abstracts in National Conference is **2**

Students Awarded PhD:

Anup Kumar Sasmal, for thesis titled "*Development of Elegant Methods for the Synthesis of Novel Heterocycles*", registered at Jadavpur University awarded on November, 2012

Sanjukta Mukherjee, for thesis titled "*Development of Palladium Catalysed Methods for the Synthesis of Novel Heterocycles*", registered at Jadavpur University awarded on November, 2012

Human Resource

Research Fellow(s): Mr. Kaushik Brahma, Mr. Bimolendu Das, Miss Priyanka Kundu, Mr. Biswajit Chakraborty

Dr. Biswadip Banerji
Chemistry Division

Dipeptide derived from benzylcystine forms unbranched nanotubes in aqueous solution

In this study a short cystine-based dipeptide spontaneously self-associates to form straight, unbranched nanotubes. Such self-assembled nanobiomaterials provide a novel possibility of designing new functional biomaterials with potential applications in nanobiotechnology. The formation of nanotubes in solution state has been demonstrated by atomic force microscopy and scanning electron microscopy. Infrared absorption and circular dichroism demonstrated the intermolecular β-sheet-like backbone hydrogen bonding in juxtaposing and stacking of aromatic side chains.

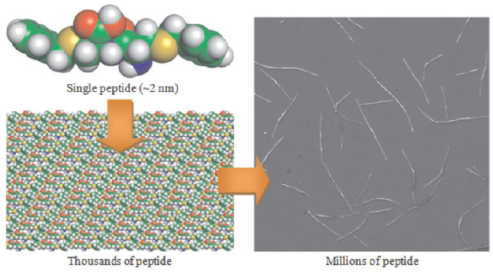


Fig. 1 *Schematic presentation of nanotube formation using cystine dipeptide as template. The peptide is about 2 nm long; tens and hundreds of thousands of individual peptides selfassemble into a nanotubes.*

Efficacy of Cyclin Dependent Kinase 4 Inhibitors as Potent Neuroprotective Agents against Insults Relevant to Alzheimer's Disease

In this study, we tested the efficiency of commercially available Cdk4 specific inhibitors as well as a small library of synthetic molecule inhibitors targeting Cdk4 as neuroprotective agents in cellular models of neuron death. We found that several of these inhibitors significantly protected neuronal cells against death induced by nerve growth factor (NGF) deprivation and oligomeric beta amyloid (Ab) that are implicated in AD. These neuroprotective agents inhibit specifically Cdk4 kinase activity, loss of mitochondrial integrity, induction of pro-apoptotic protein Bim and caspase3 activation in

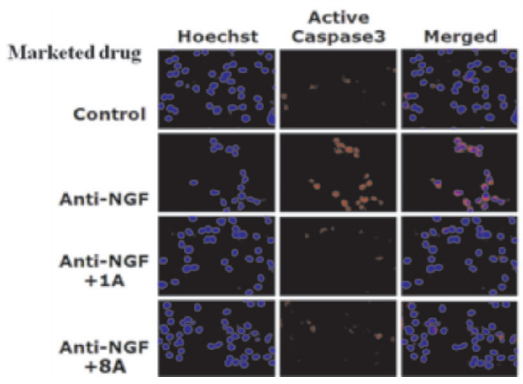


Fig. 3 *Cdk4 inhibitors block elevation of Bim and active caspase3 levels in response to NGF deprivation in neuronal PC12 cells. Result shows Cdk4 inhibitors (Cdk4I1 & 8A)*

response to NGF deprivation. The efficacies of commercial and synthesized inhibitors are comparable. The synthesized molecules are either phenanthrene based or naphthalene based and they are synthesized by using Pschorr reaction and Buchwald coupling respectively as one of the key steps. A number of molecules of both kinds block neurodegeneration effectively. Therefore, we propose that Cdk4 inhibition would be a therapeutic choice for ameliorating neurodegeneration in AD and these synthetic Cdk4 inhibitors could lead to development of effective drugs for AD.

Publication Details:

Banerji, B.; Pramanik, S. K.; Pal, U.; Maiti, N. C., Dipeptide derived from benzylcystine forms unbranched nanotubes in aqueous solution. *Journal of Nanostructure in Chemistry* 2013, ***3*** **(1)**, 12.

Maity, M.; Pramanik, S.; Pal, U.; **Banerji, B.**; Maiti, N., Copper(I) oxide nanoparticle and tryptophan as its biological conjugate: a modulation of cytotoxic effects. *J Nanopart Res* 2013, ***16*** **(1)**, 1-13.

Invited Lectures:

International Workshop on Nanomaterials (IWoN 2012): Engineering Photon and Phonon Transport.

Academic Performance:

Acted as Teacher for NIPER, Kolkata and Course work at CSIR-IICB

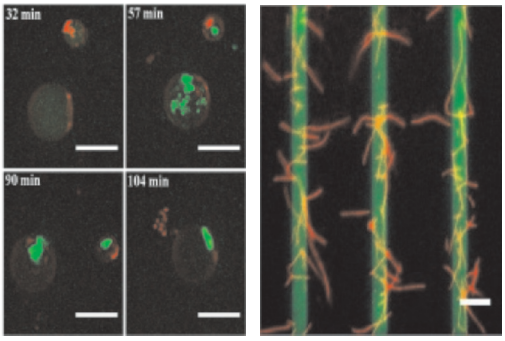
Human Resource:

Research Fellow(s): Moumita Chatterjee, Suvankar Bera, K. Chandrasekhar, Arpita Adhikary, Sunil Kumar Killi, Rupsa Basu, Sumit K. Pramanik, Manoj Kumar, P.Kodenda Rao, R. Srinath, O.Jeevana, Satadru Chatterjee.

Dr. Surajit Ghosh
Chemistry Division

Bio-molecular Assembly in Solution and Interface

Molecular self-assembly plays a crucial role in various cellular functions. Reconstitution of the assembly process in an artificial biological milieu is a challenging task for studying various biological pathways and interactions between biological molecules. The current focus of this group are, to learn the assembly process of important molecules and their interaction with other biomolecules, activity of biological molecules in solution and immobilize condition on the surface, reconstitution of biological events and pathways, development of drug delivery carrier for various diseases. Recently, we have been trying to learn few areas like development of biotin, biotin and Tris-NTA micropattern surface for organization of microtubules and hybridization of DNA, the development of artificial cellular like environment for studying the Aß peptide aggregation and screening of various potential Alzheimer drugs, development of nanomaterial based drug delivery vehicle.



Publication Details:

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

Biswas A., Saha A., Jana B., Kurkute P., Mondal G., **Ghosh S.** 2013. A Biotin Micropatterned Surface Generated by Photodestruction Serves as a Novel Platform for Microtubule Organisation and DNA Hybridisation. CHEMBIOCHEM, **14**(6) : 689-694.

Jana J., Kar R. K., Ghosh A., Biswas A., **Ghosh S.,** Bhunia A., Chatterjee S . 2013. Human cathelicidin peptide LL37 binds telomeric G-quadruplex. MOLECULAR BIOSYSTEMS, **9**: 1833-1836

Jana B., Mondal G., Biswas A., Chakraborty I., **Ghosh S.** 2013. Functionalised TiO2 nanoparticles deliver oligohistidine and avidin tagged biomolecules simultaneously into the cell. RSC ADVANCES, 3(22) : 8215-8219.

Saha A., Chakraborty I., Kraft C., Bhushan S., **Ghosh S.** 2013. Microtubule nucleation from a functionalised SiO2 EM grid. RSC ADVANCES, 3(21) : 7688-7691.

Invited Lectures:
Delivered one (1) number of invited talk at SINP, Kolkata on Reconstitution of prion propagation with minimum components inside the liposome

Academic Performance:
Acted as Teacher for *course work* at CSIR-Indian Institute of Chemical Biology

Deputation Abroad:
Alexander von Humboldt Felow, at University of Wurzburg, Germany, from August 01to October 31, 2012

Abstracts Presented
No. of Abstracts in National Conference is **2**
No. of Abstracts in International Conference is **1**

Conference/Workshop/Symposia Organized:
Member: at the International Symposium on Challenges in Chemical Biology, during 28-30th January in CSIR-IICB Kolkata

Human Resource
Research Fellow(s): Atanu Biswas, Batakrishna Jana, Abhijit Saha, Prashant Kurkute, Prasenjit Mondal, Debmalya Bhunia, Saswat Mohapatra, Anindyasundar Adak

Dr. Indrajit Das
Chemistry Division

An efficient chemoselective general procedure for the synthesis of g-substituted b,g-unsaturated a-ketomethylthioesters from a,b-unsaturated ketones has been achieved through an unprecedented PPh3·HBr-DMSO mediated oxidative bromination and Kornblum oxidation sequence. The newly developed reagent system serves admirably for the synthesis of a-bromoenals from enals. Furthermore, $AuCl_3$-catalyzed efficient access to 3(2H)-furanones from the above intermediates under extremely mild conditions are described.

Academic Performance

Acted as Teacher, for *ADVANCED ORGANIC CHEMISTRY* at CSIR-IICB

Human Resource

Research Fellow(s): Mr. Kanchan Mal,

Structural Biology
&
Bioinformatics Division

Structural Biology & Bioinformatics Division

Drs. Chitra Dutta, Debasish Bhattacharyya, Nanda Ghoshal, Soumen Datta, Subrata Adak, KrishnanandaChattopadhyay, Jayati Sengupta, Nakul Maiti, Saikat Chakraborty, Sujay Mukherjee and Prof. Siddhartha Roy

The Structural Biology & Bioinformatics Division will try to deliver a concerted research effort towards a better understanding of the quality control mechanisms in protein folding. The emerging consensus that aberrant folding and aggregation of proteins underlie some of the most prevalent human degenerative diseases has spurred a surge of interest in the problems of protein folding and aggregation among the biomedical community. The present project aims at having an insight into the molecular/sub-molecular processes involved in protein misfolding, aggregation and amyloid formation; assessing the relative importance of various physicochemical factors in the onset and progress of these processes; elucidating cellular defenses against aberrant protein folding and developing novel strategies for amelioration of protein misfolding disorders. In parallel, attempts will also be made to navigate the native protein folding routes in various pathogenic microbes like *Leishmania, Plasmodium*, *Streptococcus, Helicobacter* etc. The project consists of two distinct, but complementary components experimental structural biology and mathematical/computational biology.

The experimental group will employ X-ray crystallography, NMR, Raman spectroscopy, dynamic light scattering, fluorescence spectroscopy, electron microscopy and other biophysical methods for

- Designing experimentations to study early events of protein aggregation
- Probing the partially unfolded "invisible" states of amyloidogenic proteins at the onset of protein aggregation
- Identification and characterization of small molecule additives that may influence conformation, dynamics and aggregation of a protein
- Understanding the mechanism of small peptide-induced disaggregation of protein aggregates
- Investigating the mechanism of Endoplasmic Reticulum stress mediated misfolding of proteins and its implications in etiology of *Leishmania*

Mathematical modeling and i*n silico* methods will be employed for

- Modeling the process of self-organization in protein misfolding and fibrilization
- Rational designing and modeling of fibrillogenesis / aggregation modulators / inhibitors
- Understanding the folding and flexibility of pathogenic proteins using molecular modeling and dynamics studies
- *In silico* simulated annealing of NMR restraints with a view to obtain lowest energy structures of partially unfolded states of proteins.
- Development of software tools for identification of proteins capable of forming amyloid-like fibrils.

Dr. Chitra Dutta
Structural Biology & Bioinformatics Division

Association of Purine Asymmetry, Strand-biased Gene distribution and PolC within Firmicutes and Beyond

Co-existence of three conspicuous genome features have so far been regarded as a signature of the Firmicutes. These are a marked purine asymmetry (PAS) across two strands of replication, strand-specific bias in gene distribution (SGD) and presence of two isoforms of DNA polymerase III alpha subunit, PolC and DnaE. Through a large-scale compositional analysis of diverse bacterial genomes, we have demonstrated that PAS, SGD and PolC are neither essential, nor exclusive features of the Firmicutes. PolC prevails in four bacterial phyla: Firmicutes, Fusobacteria, Tennericutes and Thermotoga, while purine asymmetry occurs only in a subset of Firmicutes and Fusobacteria. Our analysis showed the presence of five major compositional trends in bacterial genomes: (I) purine asymmetry or G+A-dominance along the leading strand (II) only G-dominance in the leading strand, (III) alternate stretches of purine-rich and pyrimidine-rich sequences, (IV) G+T dominance along the leading strand, and (V) no identifiable patterns. Genomes showing PAS also show a strong bias in gene orientation. Three molecular processes that might incur strand-specific compositional biases in bacterial genomes are DNA replication, transcription coupled repair (TCR) and the process of deamination/ 5-methylation of cytosine. In leading strand genes of a PolC-containing species, the mutational biases at the replication level and at the transcription level act in the same direction and tend to increase their purine-content, while cytosine methylation tends to increase their G+T-content. In the lagging strand genes the replicational and transcriptional biases act in the opposite direction, while the cytosine methylation tends to increase their C+A-content. We propose that in Trend I organisms, the replicational and transcriptional biases might dominate over the bias in deamination/methylation, while in Trend II or Trend IV organisms, the reverse might be true.

Chapter(s) Details:

Dutta C. & Sarkar M. on "Horizontal gene transfer and bacterial diversity" in Encyclopedia of Metagenomics, edited by Karen E. Nelson, Springer, 2013.
(Http://www.springerreference.com/docs/html/chapterdbid/304091.html

Session Chaired:

Chaired one scientific session in the session on Structural Biology & Bioinformatics at 81st Annual Meeting of Society of Biological Chemists (India) at Kolkata, during November 8-11, 2012

Academic Performance:

- Acted as Guest Faculty for University of Calcutta, NIPER, Kolkata & AcSIR Course Work
- Acted as Member, P.G. Board of Studies, Department of Genetics, University of Calcutta & Project Review Committee, DSIR, Ministry of Science & Technology, Govt. of India
- Evaluated projects submitted to DST and DBT, Govt. of India
- Acted as examiner for M.Sc. (Biotechnlogy, Microbiology, Neuroscience) at University of Calcutta
- Evaluated projects submitted to DST and DBT, Govt. of India

Students Awarded PhD:

Sumit K. Bag for the thesis titled "Design, development and implementation of novel *in silico* data mining, clustering and visualization tools for comparative genome and proteome analysis" registered at Jadavpur University awarded in January, 2013.

Munmun Sarkar for the thesis titled "In quest of drug targets in human pathogens: an *in silico* approach" registered at Jadavpur University awarded in January, 2013

Human Resource:

Technical/Administrative Staff(s): Dr. Subhagata Ghosh

Research Fellow(s): Aranyak Goswami, Anindya Roychowdhuri, Sanchari Pradhan, Sanjoy K. Saha, Utpal Bakshi, Vinod Gupta

Summer Trainee(s): G. Soumya, G. N. Bharti, I Suchismita , Panchali Bhowmick, Suvendu Indra,Tulip Chakraborty

Dr Debasish Bhattacharyya
Structural Biology & Bioinformatics Division

Regulation, assembly, stability and aggregation of proteins and enzymes, characterization of venom toxins and medicinal plants, biochemical characterization of the drugs 'Placentrex' and 'Sterodin'

Protein aggregation is one of the major consequences of cellular events. Their accumulation is responsible for many diseases including neuronal degeneration and organ failure. Alzheimer's disease (AD) is an irreversible degeneration of the brain cells that causes dementia. Bromelain (cysteine proteases from pineapple) derived peptides, obtained from extensive digestion by various proteases as par gastrointestinal track, have an anti-aggregation potency to inhibit the growth and destabilize the A aggregate. Our studies indicate the role of bromelain as a phytoceutical against AD.

The flavo-enzyme L-amino acid oxidase (LAAO) is a major toxic component of snake venoms. It catalyzes oxidative deamination of L-amino acids to α-keto acids, hydrogen peroxide and ammonia. LAAO from *Crotalus adamanteus* venom was purified to homogeneity and its interaction with L-propargylglycine (LPG), an inhibitor of other flavo-enzymes, was investigated. Amino acid sequence and overall structures of venom LAAOs being strongly conserved, the crystallographic structure of LAAO from *Calloselasma rhodostoma* was used as a model where the bound substrate was replaced by LPG. Molecular modeling reveals the presence of His_{239} within 3-7Å from C_3 atom of LPG. Such insight into modification by substrate analog and protection by substrate is of great help in designing novel inhibitors to regulate the activity of this cytotoxic enzyme.

The aqueous extract of the roots of *Aristolochia indica* is used as a decoction for the ailment of a number of diseases including snake bite treatment. Though the alcoholic extract of roots is well studied, information on the aqueous extract is limited. We have estimated aristolochic acid content by RP-HPLC, different enzymes, enzyme inhibitors and anti snake venom potency of the root extract. The extract did not show any toxicity in animals and elongated duration of survival of animals after application of the venom. Considering the low aristolochic acid content of the extract, its consumption for a short time does not appear to cause serious toxicity. Strong inhibition of L-amino acid oxidase activity may give partial relief from snake bite after topical application of the extract.

Reverse zymography is applied for identification and semi-quantification of protease inhibitors that are of protein in nature. However, a protein that shows band in reverse zymography against a protease used for digestion need not be an inhibitor; it might be resistant to degradation by the protease. We

demonstrate that in reverse zymography, avidin, streptavidin and the leaf extract of *Catharanthus roseus* behave like inhibitors of proteases like papain, ficin, stem bromelain, leaf bromelain, fruit bromelain and trypsin. But they do not act as inhibitor of those proteases when enzyme assay were done in solution. In reverse zymography, the extract of pineapple crown leaf shows two major inhibitor bands against its own proteases. Identification of these proteins from sequences derived from MALDI TOF MS analysis indicated that they are fruit and stem bromelains. Avidin, streptavidin and bromelains are 'kinetically stable proteins' that are usually resistant to proteolysis. Thus it is recommended that identification of an inhibitor of a protease by reverse zymography should be supported by independent assay methods for confirmation. This explores possibility of designed peptides for clinical applications in Alzheimer's disease.

The drug house project on 'Placentrex', an aqueous extract of human placenta and a product of M/s Albert David Ltd., is continuing in this laboratory since 1999. Major thrust of the project is on identification of bioactive components and their mechanism of actions towards wound healing and immuno- stimulation. Recently we have confirmed that the drug contains ubiquitine-like molecules that exert collagenase activity. At present we are investigating the presence of corticotrophin releasing factor (CRF) in the drug that has a potential role in reducing inflammation. Investigation on the drug 'Sterodin', a product of M/s Union Drugs Ltd., has been initiated. Finger-printing and identification of functional molecules of the drug are the major thrust of the project. Presence of biologically functional NADPH and collagenase activity in the drug has been confirmed.

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

Review Article:

Bhattacharjee, P. and **Bhattacharyya, D.** (2013) Medicinal plants as snake venom antidotes. *J. Expt. Appl. Animal Sci.* **1**, 156-180

Invited Lectures:

Delivered one (1) number of invited talk in 10th Annual Conference of the Society for Bio-Chromatography and Nano-separation at University of Bordeaux II, France on 23rd-26th October, 2012

Deputation abroad:

10th Annual Conference of SBCN, University of Bordeaux II, France on 23rd-26th October, 2012

Academic Performance:
Served as a faculty member of in-house ACSIR Ph.D. program

Served as a guest lecturer of NIPER, Kolkata, Department of Biotechnology, Jadavpur University and Department of Biochemistry, University of Calcutta

Served as a member of Board of Studies of Calcutta University (B. Sc, Biochemistry)

Honors and awards:

Membership of the editorial board of the 'Journal of Chromatography B' has been extended from 2011-2014.

Students Awarded PhD:

Dr Debashree De for the thesis titled 'Solution properties of proteins: Its applications to biological extracts' registered at Jadavpur University awarded in December, 2012.

Human Resource:

Technical/Administrative Staff(s): Mr Samir Roy (also with Dr Syamal Roy)
Research Fellow(s): Ms Debratna Mukherjee, Ms Sangeeta Dutta, Ms Payel Bhattacharjee, Ms Kanika Sharma ,Ms Namrata Singh
Project Assistant(s): Ms Chaitali Mukherjee, Mr Jyotirmoy Mitra

Dr Jayati Sengupta
Structural Biology & Bio-Informatics Division

Structure and function of the macromolecular machine involved in protein synthesis

A. *Role of eukaryotic ribosomes in folding of the nascent polypeptide chain:*

It is known that prokaryotic ribosome has the ability to fold the nascent proteins. However, ribosome-mediated protein folding by eukaryotic ribosomes has not been extensively studied yet.

We have chosen two eukaryotic species for our study: one being *Sachharomyces cerevisiae* (yeast) and the other *being Leishmania donovani*, representing primitive group of eukaryotes. Our Results suggest that yeast ribosome (being a higher eukaryote than leishmnia), can fold a protein much faster.

B. *Experimentally guided computational studies on the structural dynamics of ribosomal components:*

Sordarin class of natural products selectively inhibits fungal protein synthesis by impairing the function of eukaryoticelongation factor-2 (eEF2). Surprisingly, sordarin is not equally effective for all fungal species.

We have been investigating (a) the mechanism of sordarin binding into eEF2 cavity, and (b) minute species-specific differences that most likely play a crucial role in determining the specificity of drug-binding. Further, we are also trying to impart some modifications into sordarin so as to get a derivative having pan-fungal inhibitory action.

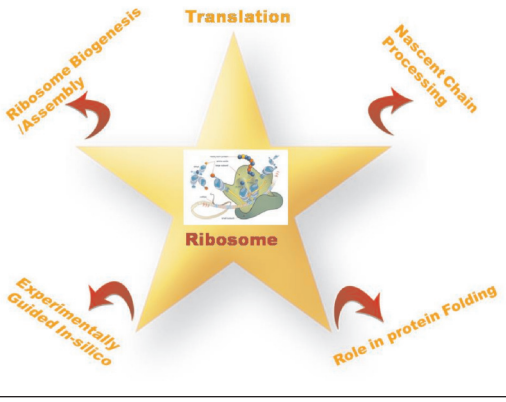


Figure 1: *Different problems in ribosome research that are being addressed in the lab*

Publication Details:

Chakraborty B, Mukherjee R and Sengupta J (2013) Structural insights into the mechanism of translational inhibition by the fungicide sordarin. *J Comput Aided Mol Des.*, **27**, 173-184 ***Academic Performance***

Acted as **one of the external expert**, for *procurement of high resolution TEM machine*, at NIT, Rourkela

Human Resource :

Research Fellow(s):
Mr. Manidip Shasmal, Mr. BipraShekhar Chakraborty, Mr. Sandip De, Ms. Indrani Roy
Project Assistant(s): Mr. Sayan Bhakta,
Summer Trainee(s): Nikunj Sejpal

Dr. Krishnananda Chattopadhyay
Structural Biology & Bioinformatics Division

Studies of protein folding and dynamics using fluorescence correlation spectroscopy and other biophysical methods

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.

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:

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. *Sci. Rep.* **3**, 3525; DOI:10.1038/srep03525

Joshi N, Mukhopadhyay A, Basak S, De G, and **Chattopadhyay** K**. (**2013) Surface Coating Rescues Proteins from Magnetite Nanoparticle Induced Damage. Part. Part. Syst. Charact., **30**, 683694

Sharma S, Pathak N and **Chattopadhyay K**. (2012) Osmolyte induced stabilization of protein molecules: A Brief Review, Journal of Proteins and Proteomics.; **3(2)**:129-139.

Ghosh R, Mukherjee M, **Chattopadhyay K and** Ghosh S.(2012) Unusual optical resolution of all four tryptophan residues in MPT63 protein by phosphorescence spectroscopy: assignment and significance. J Phys Chem B. **116(41)**:12489-500.

Lahiri, S., Basu, A., Sengupta, S., Banerjee, S., Dutta, T., Soren, D., **Chattopadhyay, K. and** Ghosh, A. K. (2012) Purification and characterization of a trehalaseinvertase enzyme with dual activity from Candida utilis Archives of Biochemistry and Biophysics Volume 522, 9099.

Academic Performance:

Acted as a Teacher in the Department of Biochemistry, Calcutta University

Abstracts Presented:

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

Human Resource:

Research Fellow(s): Sunny Sharma , Sujit Basak , Suparna Sarkar , Simanta Sarani , Amrita Kundu , Pallabi Sil , Sumanta Ghosh , Sourav Chowdhury

Project Assistant(s): Nidhi Joshi

Dr. Nakul Ch. Maiti
Structural Biology & Bioinformatics Division

Protein Conformational Diseases and Structure Based Drug Design

Conformational diseases such as Alzheimer's and Parkinson's diseases, amyloidoses, and the prion encephalopathies, arise when a specific protein undergoes a conformational rearrangement that provide it propensity to aggregate and become deposited within tissues or cellular compartments. The unanswered question is how cells respond to the production of these abnormal protein conformers and how these misfolded proteins cause cytotoxicity. We focused on structural and morphological characterization protein oligomers and other aggregate derived from alpha synuclein, abeta and adenosine kinase which are, respectively, implicated in Parkinsons disease, Alzheimer's Diseases and neuronal storage and metabolism of AMP. To detail the origin of the diseases using computational methodologies we derived sequence aspects such as complexity pattern of sequences in human proteins. We have found that amyloidogenic regions (ARs) content in a protein maintained no significant correlation with the protein length and the ARs overlapped with low sequence complexity regions (LCRs). Moreover, the amino acid sequence in the ARs was highly complex and showed mixed conformational adaptability towards helix, β-sheet/strand and coil conformations. Additional research focuses on drug designs, synthesis and structural characterization of nanobiomaterials. We reported formation of cuprous oxide nanoparticles (CuNPs) and their organic conjugate with L-tryptophan (Trp). The golden yellow particles and showed a strong affinity to bind blood carrier proteins albumins. The CuNPs was found to be toxic to different cultured cancerous cells, however, conjugation with Trp attenuated the toxicity. Reduced toxicity also indicated a possible use of the conjugated particle as a drug delivery system.

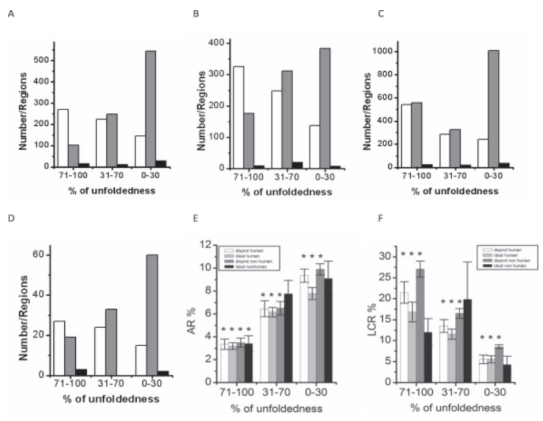


Fig.1: *Content of AR and LCR sequences in different classes of disordered proteins. A: DisProt human, B: IDEAL human, C: DisProt nonhuman & D: IDEAL nonhuman. (White bar signifying the LCR region, gray bar signifying the AR region and black bar signifying the overlapped region of AR and LCR). Percentage of AR (E) and LCR (F) sequences in different group of disorder proteins. Bottom-axis represents the three group of disordered proteins with different degree of disorderness, PDP(0-30% disorder), MDP (31-70% disorder) and LDP (71-100% disorder). In panel E & F, asterisks indicate the statistically significant difference from that of other groups.*

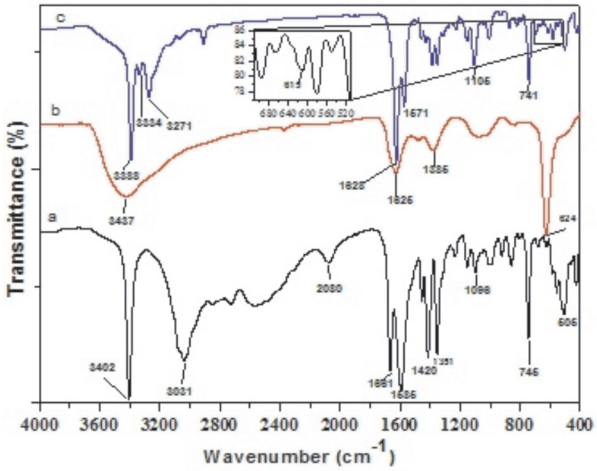


Fig.2: *FT-IR spectra of free tryptophan (a) CuNPs (b), CuNP-Trp (c) in solid state.*

Publication Details:

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

Banerji, B,; Pramanik, S. K,; Pal, U.; **Maiti, N. C.** (2013) Potent Anticancer Activity of Cystinebased Dipeptides and Their Interaction with Serum Albumins. *Chemistry Central Journal*, **7**, 91

Rudra, D. S.; Pal, U.; **Maiti, N. C**.; Jeiter, R. J.; Swarnakar, S, (2013) Melatonin inhibits matrix metalloproteinase-9 activity by binding to its active site . *J. Pineal Res*, **54**, 398-405

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

Maity, M.; **Maiti, N. C.** (2012) Sequence composition of binding sites in nativelyUnfolded human proteins. *J. Proteins and Proteomics*, **3**, 117-125

Alam, A.; Halder, S.; Thulasiram, H. V.; Kumar, R.; Goyal, M.; Iqbal, M. S.; Pal, C.; Dey, S.; Bindu, S.; Sarkar, S.; Pal, U.; **Maiti, N. C.**; Bandyopadhyay, U (2012) ovel Anti-inflammatory Activity of Epoxyazadiradione against Macrophage Migration Inhibitory Factor . *J. Biol. Chem*, **287**, 24844-24861

Invited Lectures:

Delivered four (4) numbers of invited talks in India at different seminars like National fluorescence Workshop, IISC 2012 International Interdisciplinary Science Conference -2012, NATIONAL ORKSHOP on "Protein Folding" and "Molecular Modeling, Dynamics & Simulation,

Academic Performance

Acted as Teacher for course work at CSIR-IICB, Kolkata

Abstracts Presented

No. of Abstracts in National Conference is **6**
No. of Abstracts in International Conference is **1**

Honours & Awards

Raman Fellowship Award, 2012, Visited University of Southern California, Los Angeles June Sept,2012

Human Resource

Research Fellow(s): Uttam Pal, Swagata Das, Mritunjoy Maity, Supriya Das, Anupam Roy, Sudeshna Sen, Sandip Dolui

Summer Trainee(s): Khyati Bagga, Mangaldeep Kundu, Arpita Mrigwani, Paramita Chakrabarti, Joyeeta Bhattacharya, Baisali Bhattacharya, Nitin Khot

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 pathogen mediated disorders. 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. During the last one year we have assembled and curated the intra PPI networks of two very important human pathogen, *Plasmodium falciparum* and *Streptococcus pyogens*.Using network biological approach we have successfully identified several key regulators of these PPI. Their importance will be further investigated by a novel network perturbation method.

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 protein conformational adaptation of *E. coli* Sigma-32 transcription factor under heat-shock condition.Extensive molecular modeling and docking analysis is 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:

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 Performance:

Acted as Teacher for course work at CSIR-IICB and NIPER-Kolkata

Human Resource:

AbhijitChakraborty, Madhumita Bhattacharyya, Aneesha Das, Anindyajit Banerjee, SapanMandloi, Abhishek Das, Shreemoyee DuttaMajumder

Dr. Soumen Datta
Structural Biology & Bio-informatics Division

Functional Roles of Proteins in Bacterial Diseases

Many gram negative pathogenic bacteria use type three secretion systems (TTSS) to inject virulent proteins into the host cells through a specialized device called injectisome. After getting injected, these proteins impair cell's immune system and cytoskeleton; take control of the cell machinery for bacterial survival, replication and dissemination; and at the last promote cell death. These bacterial infestations are manifested by several diseases in animals and plants starting from mild gastroenteritis, dysentery, diarrhea to the acute and life-threatening typhoid fever, bubonic plague, and pneumonia.The structural characterization of these proteins are therefore utmost important to clearly understand their hostile activity in side the host cell. Our laboratory is working to know the functions of protein and protein complexes of T3SS in bacterial virulence.

Here we present, in the following two figures, key research findings involving two sets of important proteins in T3SS; one is PcrG-PcrV, which are the key proteins in translocation of bacterial virulent proteins, and the second one is YsaN-YsaL, a T3SS ATPase and its regulator.

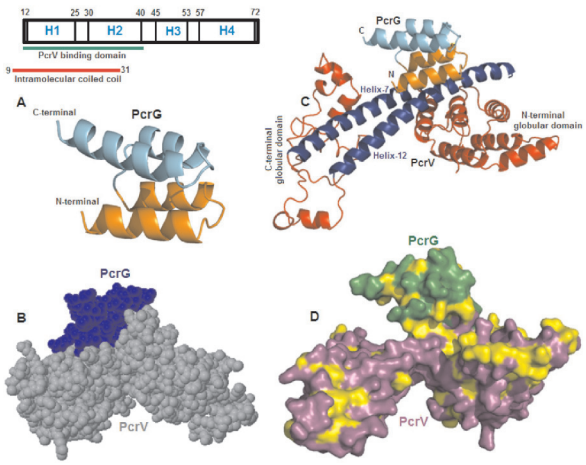


Figure 1: *Molecular docking fits ΔPcrG(13-72) into the groove formed between the two globular domains of PcrV. A. Schematic and Cartoon representation of ΔPcrG(13-72) model, with the first two helices shown in orange colour. B. Spacefill model of PcrG-PcrV complex obtained from molecular docking studies (ΔPcrG(13-72) was shown in blue and PcrV in grey colour), depicts that ΔPcrG(13-72) localizes within a groove formed between the two globular domains of PcrV. C. Cartoon representation of model of ΔPcrG(13-72)-PcrV complex. The interacting regions of the ΔPcrG(13-72) was shown in orange and that of PcrV was shown in blue, as represented in their respective models. D. Surface representation of ΔPcrG(13-72)-PcrV complex, where ΔPcrG(13-72) and PcrV were shown in green and magenta, respectively. The hydrophobic amino acids were coloured in yellow. This model reveals that the interface of interaction between ΔPcrG(13-72) and PcrV is mainly hydrophobic.*

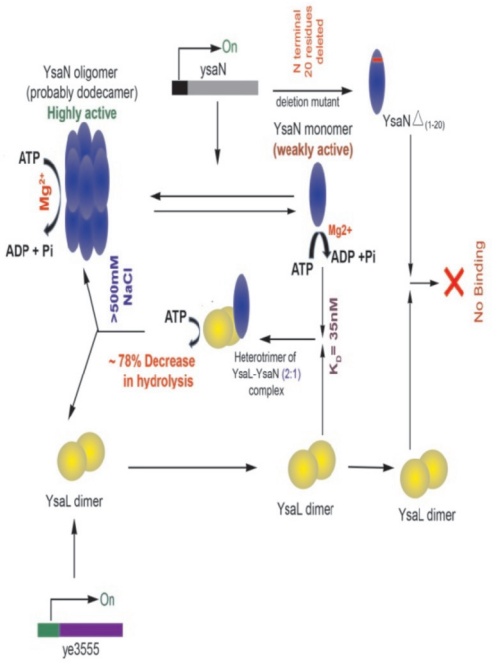


Figure 2: *Schematic representation of functionality of YsaN and its regulation by YsaL: YsaN exists in solution as mixture of monomer and higher order oligomer (dodecamer) and act as Mg2+ dependent ATPase. The oligomeric form of YsaN is highly active compared to monomeric form. Computational studies predicted YsaL as a putative ATPase regulator. YsaL exists as dimer in solution and form stable heterotrimeric complex with monomeric YsaN. This results in significant loss of ATPase activity of YsaN, probably due to the loss of oligomeric state. Furthermore, the N-terminal (1-20) residues of YsaN are involved in YsaN-YsaL interaction, as revealed from interaction studies of deletion mutants.*

Publication Details:

Chatterjee R, Halder PK and **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

Dr. Sucheta Tripathi
Structural Biology & Bio-informatics Division

Dissecting genomes of Cyanobacterial species in exploring novel genes for metabolic pathway re-engineering

In collaboration with Biotechnology Department, Shantiniketan, we are establishing genomics programs of native Cyanobacteria species. Cyanobacteria are the early progenitors of chloroplast in higher plants, responsible for evolution of life on earth. These enigmatic organisms grow in various stressed habitats and produce metabolites of commercial significance. The ease at which these organisms can be manipulated makes them very amenable for genetic manipulation.

Very little is known on the genomic aspects of Cyanobacteria species native to India. We have established cultures of 17 economically important species and have extracted DNA for whole genome shotgun sequencing as well as mate pair sequencing using NGS methods. This will lead to our understanding of the candidate transcripts of economic importance that can be used for genetic modification. We are also looking at pathway modification for over production of bio-energy metabolites.

Massive genome and transcriptome sequencing programs involving 180 Phytophthora species and 360 transcriptomes for lineage tracing in oomycetes

Oomycetes organisms are major pathogens and causal organisms of potao famine in early 20th century. It comprises of a number of major virulent species that pry on both plants and animals. Currently we are looking at evolution of effector and modulatory molecules that compromises a host. We are working in collaboration with several other labs such as Oregon State University, USDA etc. in deciphering genomes of 180 Oomycetes species and 360 transcriptomes using RNAseq.

Developing systems for Annotation of nextgen sequencing data

For any high throughput studies, it is imperative to have computational resources such as databases and visualization tools. Since we are dealing with large scale genomics and transcriptomics of Cyanobacteria and oomycetes systems, our objective is to build a system that can give us easy access to genome data. We had an earlier version of database for this that was based on Genome Unified Schema (GUS). GUS is heavily used for genomics of infectious disease database. However, the problem is the platform dependence of this system. It uses Oracle that is a paid software. We completely re-modeled this to suite the open source platform (based on MYSQL) and started building layers around it for aiding data modeling. We have successfully completed this component and are now working on building intelligence into the browsing facility and subsequently releasing it as a annotation package. We are also developing strategies, pipelines for analyzing and optimizing nextgen sequencing data for understanding their biological roles.

Invited Lectures:

Delivered four (4) numbers of invited talks in India & one in abroad at Asilomar, California, USA

Session Chaired:

Chaired one scientific session in Oomycetes Molecular Genetics Network, Asilomar, CA, 2013

Academic Performance:

Acted as Teacher at AcSIR, Bijayghar college, Kolkata and NIPER, Kolkata

Abstracts Presented:

No. of Abstracts in International Conference is **2**

Human Resource:

Research Fellow(s): Subhadeep Das, Madhu Chandrababu Naidu, Arijit Panda, Deeksha Singh, Akash Gupta, Neha Sanghi

Dr. Sujoy Mukherjee
Structural Biology & Bio-informatics Division

Intermediate states of proteins as reporters of protein structure and function

In between the inactive and active states of protein may lie one or more transiently formed intermediate states that play critical role in the function of the protein. Amyloid forming proteins are one of many such systems where the formation of such intermediate states has been observed. Given the transient nature and low fractional presence of these intermediates, most biophysical techniques are inadequate in providing high resolution picture of these states. Our laboratory uses solution NMR spectroscopy to study protein dynamics and characterize the formation of the intermediate states of protein. Transthyretin is a thyroxine transporter protein that has been found to be responsible for senile systemic amyloidosis whereas its mutants are involved in various familial forms of the disease. We have found that transthyretin exhibits multi-time scale dynamics spanning fast, picosecond (ps) nanosecond (ns) regime mobility mostly confined to the loop regions (Figure 1A) to slower millisecond (ms) time scale motion in its β-strands adjoining the dimer interface (Figure 1C). In the later case, the β-sheet region surrounds the hydrophobic core of the tetramer and is more relevant to protein dissociation, which is known to be a critical step for fibril formation. A 50 ns MD simulation (Figure 1B) has found adequate motion in the loop regions of the protein similar to that obtained in the fast backbone dynamics.

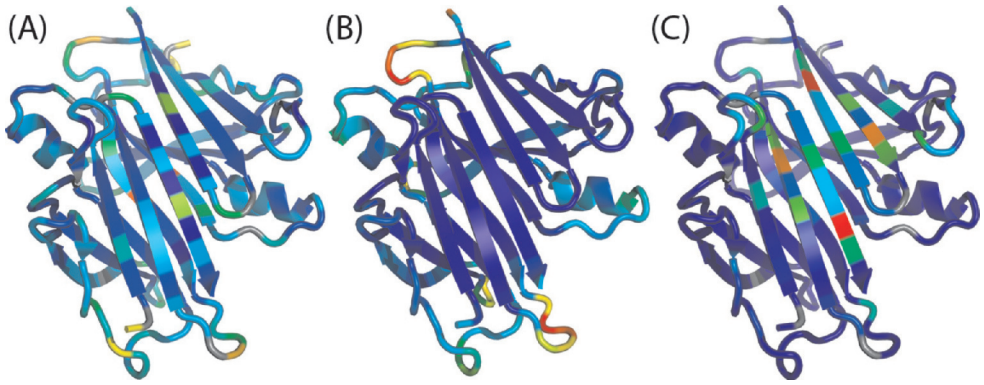


Fig.1: *Results of multiple time scale dynamics of transthyretin backbone with most and least dynamic regions of the protein noted in blue and red, respectively*

Invited Lectures:

Delivered one (1) number of invited talk in Indian Biophysical Society meeting at Mumbai University

Academic Performance

Acted as **Guest lecturer** for NIPER, Kolkata

Dr. Subrata Adak
Structural Biology & Bio-informatics Division

Protection against peroxynitrite by pseudoperoxidase from Leishmania major

Heme proteins share the ability to detoxify reactive nitrogen intermediates (NO and peroxynitrite). But, to date, no heme-containing enzymatic defense against toxic reactive nitrogen intermediates has been discovered in *Leishmania* species. We have cloned, expressed, and characterized a pseudoperoxidase from *Leishmania major* (LmPP) that is capable of detoxifying peroxynitrite ($ONOO^-$). Optical, EPR, and resonance Raman spectral studies demonstrate that $ONOO^-$ can rapidly convert the six-coordinate ferric low-spin to a ferric high-spin form at neutral pH. Western blotting and immunofluorescence studies with anti-LmPP antibody show that the mature enzyme is located at the plasma membrane of amastigotes and is expressed eightfold higher in amastigotes compared to promastigotes. Moreover, to further investigate its exact physiological role in *Leishmania,* we have created LmPP-knockout mutants by gene replacement in *L. major* strains. IC_{50} values for exogenously added H_2O_2 or 3-morpholinosydnonimine (SIN1) show that deletion of LmPP in *L. major* renders the cell more susceptible to SIN1. The null mutant cells exhibit a marked decrease in virulence on infection with activated macrophages as well as inoculation into BALB/c mice. Collectively, these data provide strong evidence that LmPP plays an important role in the enzymatic defense against $ONOO^-$ within macrophages.

In short we can say, *Leishmania major* pseudoperoxidase acts as a scavenger of peroxynitrite. Peroxynitrite reacts with the six-coordinate low-spin heme of this protein to help catalysis. *L. major* pseudoperoxidase is located at the plasma membrane of amastigotes. This protein plays an important role in the virulence of Leishmania.

Publication Details:

Bose, M., Saha, R., Santara, S. S., Mukherjee, S., Roy, J. and Adak, S. (2012) Protection against peroxynitrite by pseudoperoxidase from *Leishmania major*. *Free. Radic. Biol. Med.*, **53**, 18191828

Mukherjee, S., Santara, S. S., Das, S., Bose, M., Roy, J. and Adak, S. (2012) NAD(P)H cytochrome b5 oxidoreductase deficiency in *Leishmania major* results in impaired linoleate synthesis followed by increased oxidative stress and cell death.. *J. Biol. Chem.* , **287**, 34992-35003

Saha, R., Bose, M. and Adak, S. (2013) Mutation of Val90 to His in the pseudoperoxidase from *Leishmania major* enhances peroxidase activity . *Biochim. Biophys. Acta.* , **1834**, 651-657

Abstracts Presented
No. of Abstracts in National Conference is **2**

Honors & Awards
National Bioscience Award for Career Development, by *Dept. of Biotechnology (DBT)*, Government of India, in 2012

Human Resource

Research Fellow(s):
Sumit Sen santara, Jayasree Roy, Aditi Mukherjee, Moumita Bose, Supratim Mukherjee

Research Associate(s): Dr. Rina Saha

Prof. Siddhartha Roy
Structural Biology & Bio-informatics Division

Role of peptide mimic in the functioning of synthetic transcription factors in cellular system

Synthetic transcription factors are important for future cellular engineering and therapeutics. The designing of a conformationally constrained helical peptide mimic may be useful for the development of synthetic transcription factor. A general strategy has been developed to produce helical peptide mimics in which incorporation of α-amino-isobutyric acid (Aib) into the peptide is used to conformationally constrain the peptide. We have developed a synthetic helical peptide mimic of the Cro protein, from bacteriophage λ, that encompasses the DNA recognition elements. The constrained helical peptide monomer shows a moderately reduced dissociation constant compared to the corresponding unsubstituted wild type peptide. The dimeric mimic of the Cro protein binds to its cognate DNA (O_R3) with high affinity and specificity. A Green Fluorescent Protein based reporter assay in vivo (in prokaryotic system) reveals that the peptide dimer binds the target DNA sequences with considerable selectivity and inhibits gene expression. The conjugations of the peptide mimic with transcription activation sequence can selectively up-regulate expression of a specific gene as demonstrated by luciferase expression (in eukaryotic system) whereas it has minimum effect on the whole genome. Peptide mimics designed in this way may provide a future framework for creating effective synthetic transcription factors.

Publication Details:

Debnath S, Roy NS, Bera I, Ghoshal N and Roy S. (2012) Indirect read-out of the promoter DNA by RNA polymerase in the closed complex. Nucleic Acids Res. , 41, 366-377

Saha R, Dasgupta S, Banerjee R, Mitra-Bhattacharyya A, Söll D, Basu G and Roy S., (2012) A functional loop spanning distant domains of glutaminyl-tRNA synthetase also stabilizes a molten globule state. Biochemistry., 51, 4429-4457

Mazumder A, Bandyopadhyay S, Dhar A, Lewis DE, Deb S, Dey S, Chakrabarti P and Roy S., (2012) A genetic network that balances two outcomes utilizes asymmetric recognition of operator sites.. Biophys J, 102, 1580-1589

Mazumder A, Maiti A, Roy K and Roy S., (2012) A synthetic peptide mimic of λ-Cro shows sequence-specific binding in vitro and in vivo. ACS Chem Biol., 7, 1084-1094

Manna AK, Kumar A, Ray U, Das S, Basu G and 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 Res., 97, 223-226

Banerjee S, Arif M, Rakshit T, Roy NS, Kundu TK, Roy S and Mukhopadhyay R., (2012) Structural features of human histone acetyltransferase p300 and its complex with p53. FEBS Lett., 586, 3793-8

Invited Lectures:

Topic: Proteomics
Venue: University of Osaka,Japan
Date: September 01, 2012

Deputation Abroad

Proteomics, at University of Osaka, Japan, from September 01- 30, 2012

Honors & Awards

JC Bose Fellowship Award, by Department of Science & Technology, Govt. of India.

Students Awarded PhD:

Avishek Majumder, for thesis entitled "A Study of Specificity of Protein-DNA Interactions Using Synthetic And Natural Transcription Factors", registered at Calcutta University awarded on September 01, 2012

Subrata Debnath, for thesis entitled "A Study of Mechanism of Transcription", registered at Calcutta University awarded on August 28, 2012

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, Dr. Arunachal Chatterjee,

Pool Officer(s): Dr. Shampa Mallick,

Cell Biology & Physiology Division

Cell Biology & Physiology Division

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

The major laboratory program of the Division is investigations for understanding the pathophysiology of a number of metabolic and degenerative diseases. The group plans to investigate the following:

- Biochemical regulation of sperm motility,
- Pathogenesis of polycystic ovarian disease,
- Development of selective eostrogen receptor modulators (SERM) as emergency contraceptive,
- Molecular cues to ovarian development & function,
- Molecular regulation of trophoblast development and placental morphogenesis,
- Molecular basis of cardiac hypertrophy,
- Molecular mechanisms of insulin resistance and diabetes,
- Cellular signaling in ovarian cancer,
- Role of polyoma virus in kidney and neurodegenerative disorders,
- Molecular basis of narcotic addiction,
- Understanding astrocytes functions in the developing brain,
- Cellular and molecular basis of neural regeneration and protection,
- Micronutrients in brain dysfunction, and
- Development and management of hemolytic and hepatic disorders.
-

One of the areas would be continuing validation of cellular and animal models of the diseases, and their application in target discovery. A number of activities of the past five-year-plan research, such as stem cell biology in relation to carcinogenesis as well as catecholamine and indoleamine metabolism in relation to movement disorders will be continued. Specific attention will be paid to cell signaling molecules and their interaction with their receptors, hormone-receptor mediated gene expression, biogenesis and bioenergetics of ion channel regulation, neural development, and signal transduction events.

Dr. K. P. Mohanakumar
Cell Biology & Physiology Division

Neurodegenerative diseases

The laboratory of clinical & experimental neuroscience undertakes investigations on the pathophysiology of neurodegenerative diseases such as Parkinson's disease (PD), Huntington's disease (HD) and Alzheimer's disease (AD). The lab is equipped with facilities for neurobiological and neurobehavioural analyses. The current focus of interest is bioenergetics of PD and HD, in addition to certain neurodevelopmental disorders such as attention deficit hyperactivity disorders (ADHD), and autism spectrum disorders (ASD). The major aim of the lab is to find innovative ways of treatment for PD, for which a cure is not available.

Ways to reduce the dose of L-DOPA for the treatment of PD

The dopamine precursor, L-3,4-dihydroxyphenylalanine (L-DOPA), is the preferred drug for Parkinson's disease, but long-term treatment results in the drug-induced dyskinesias and other side effects. This study was undertaken to examine whether melatonin could potentiate low dose L-DOPA effects in 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)-induced experimental parkinsonism. Mice were treated with the parkinsonian neurotoxin, MPTP, and different doses of melatonin and low doses of L-DOPA. Behaviour, striatal histology, and dopamine metabolism were evaluated on the 7th day. MPTP-induced striatal dopamine loss was not modified by melatonin administration (10-30 mg/kg; i.p. at 10-hr intervals, 6 times; or at 2-hr intervals, by day). However, low doses of L-DOPA (5 mg/kg, by oral gavage) administered alone or along with melatonin (10 mg/kg, i.p.) twice everyday for 2 days, 10 hr apart, after two doses of MPTP significantly attenuated striatal dopamine loss, changes in the metabolism and its turnover (Fig. 1A-D), and provided improvements in both catalepsy and akinesia (Fig. 2A,B). Additionally, Golgi-impregnated striatal sections showed preservation of the medium spiny neurons, which have been damaged in MPTP-treated mouse (Fig. 3A-E). The results demonstrated that melatonin, but not L-DOPA, restored spine density and spine morphology of medium spiny neurons in the striatum and suggest that melatonin could be an ideal adjuvant to L-DOPA therapy in Parkinson's disease, and by the use of this neurohormone, it is possible to bring down the therapeutic doses of L-DOPA.

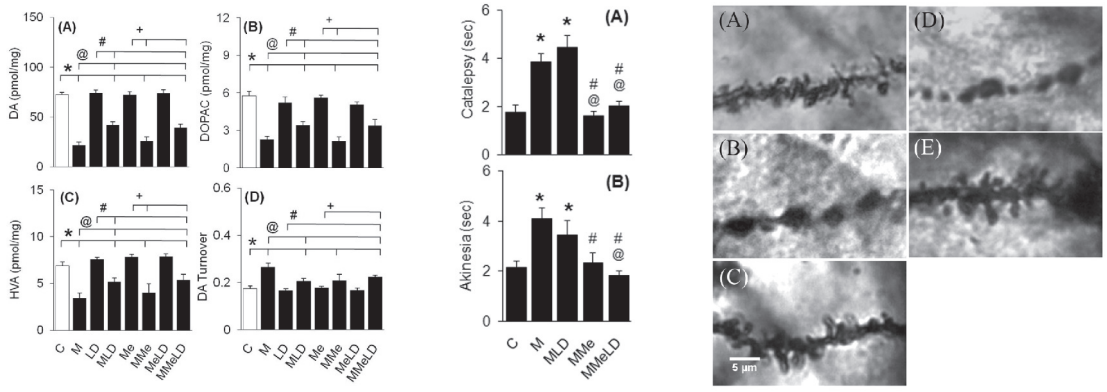


Fig. 1. A-D (Left panel): *Effect of L-DOPA (5 mg/kg, p.o., every 10 hr) and/or melatonin (10 mg/kg, i.p. every 10 hr) on striatal catecholamine content and metabolism in MPTP-induced parkinsonian mice on the 7th day. C control; M MPTP; LD L-DOPA; Me melatonin. Results provided are Mean _ S.E.M. *P ≤ 0.05, $^{@}$P ≤ 0.05, $^{\#}$P ≤ 0.05 and $^{+}$P ≤ 0.05 as compared to control, MPTP, L-DOPA and melatonin group, respectively. n = 47.* ***Fig. 2A,B (Middle panel):*** *Effect of melatonin and/or L-DOPA on MPTP-induced akinesia and catalepsy. Results given are Mean _ S.E.M. *P ≤ 0.05, #P ≤ 0.05, and @P ≤ 0.05, as compared to control, MPTP, and 'L-DOPA plus MPTP' group, respectively.* ***Fig. 3A-E (Left panel):*** *Melatonin treatment restored morphological changes in medium spiny neurons caused by MPTP. Higher magnification images under oil immersion (100X) revealed normal spines in the striatal medium spiny neurons (A), which appeared beaded and distorted following MPTP treatment (B). Melatonin treatment in MPTP intoxicated animals corrected the beaded spines back into normal spine morphology (C), whereas LDOPA treatment in MPTP-treated animals failed to correct the morphology of the spines (D). MPTP-administered animals receiving melatonin and L-DOPA effectively restored the spine morphology (E).*

Publication Details:

Madathil SK, Karuppagounder SS, **Mohanakumar KP**.(2013) Sodium salicylate protects against rotenone-induced parkinsonism in rats. Synapse. **67(8)**:502-14

Karuppagounder SS, Madathil SK, Pandey M, Haobam R, Rajamma U, **Mohanakumar KP**.(2013) Quercetin up-regulates mitochondrial complex-I activity to protect against programmed cell death in rotenone model of Parkinson's disease in rats. Neuroscience;**236**:136-48

Madathil KS, Karuppagounder SS, Haobam R, Varghese M, Rajamma U, **Mohanakumar KP**.(2013) Nitric oxide synthase inhibitors protect against rotenone-induced, oxidative stress mediated parkinsonism in rats. Neurochem Int. **62(5)**:674-83

Borah A, **Mohanakumar KP**. (2012) L-DOPA induced-endogenous 6-hydroxydopamine is the cause of aggravated dopaminergic neurodegeneration in Parkinson's disease patients. Med Hypotheses;**79(2)**:271-273

Invited Lectures:

Delivered five (5) numbers of invited talks at **Central Institute of Medical Sciences, Nagpur;** VIT University, Vellore; North Eastern Hill University, Shillong; 45th Annual Conference of Indian Pharmacologaical Society, Nagpur and 27th Annual meeting of Society for Neurochemistry, India (SNCI), New Delhi

Session Chaired:

Chaired a Session on "Neurological Diseases" at 81st Annual Meeting of the Society of Biological Chemists (India) and Symposium on Chemistry and Biology: Two weapons Against Diseases held at Kolkata from November 8-11, 2012

Chaired a Session at 27th Annual Meeting of Society for Neurochemistry, India (SNCI) and International Conference on "Recent Advances in Molecular Mechanisms of Neurological Disorders" held at New Delhi from 21-23 February, 2013

Chaired "Neurodegenerative Diseases" at NeuroUpdate 2012 held in CSIR-IICB, Kolkata from September 22- 23, 2012

Conference/Workshop/Symposia Organized:

The Cell Biology and Physiology Research Festival (CBPRF) was organized in CSIR-IICB on 30th April 2012

Organized Neuro Update-2012, a national symposium of neurobiologists and neurologists, in collaboration with Calcutta National Medical College, Kolkata during September 22-23, 2012

Organized 'NEUROCON 2013' International Conference on Neurodegenerative and Neurodevelopmental Disorders: Translational Aspects; jointly by Department of Biochemistry, Institute of Post Graduate Medical Education and Research, Kolkata and Cell Biology and Physiology Division, IICB, Kolkata held at CSIR-IICB during January 18-20, 2013

Chairman, One-Day PCSEA Laboratory Animal Use: Workshop & Meeting, April 2012

Deputation Abroad:

Attended the Joint Symposium of 11th Biennial Meeting of the Asia Pacific Society for Neurochemistry and 55th Japaanese Society for Neurochemistry at Kobe, Japan during 29th September to 2nd October, 2012 and also to attend the first yearly council meeting of the International Society for Neurochemistry on the 30th September, 2012

Honors' & Awards:

Elected Fellow West Bengal Academy of Science (WAST)

Editorial Board Member of Neurochemistry International (Elsevier); Neuroscience & Medicine (Scientific Research Publishing, Inc., Irvine, CA, USA); Anatomy & Cell Biology (Korean Association of Anatomists, Incheon, South Korea); Neurochemical Research (Springer Verlag).

Elected Council Member of International Society for Neurochemistry (ISN) 2011-2014

President, Society for Neurochemistry, India 2012-2014

Elected Member of ISN Conference Committee 2011-2014

Coln Coln RN Chopra Memorial Oration - 2012, Indian Pharmacological Society

Member, DBT-Neuroscience Task Force

CPCSEA Main Nominee of Institutional Animal Ethics Committee of twelve institutes in Eastern India

Member, Strategy and Advisory Committee, National Brain Research Centre, Manesar

Human Resource:

Technical/Administrative Staff: *Mr. Debdas Guha Thakurata*

Research Associate: Dr. Emili Banerjee

Research Fellows: Debasmita Tripathy, Joy Chakraborty, Amit Naskar, Raghavendra Singh, Debashis Dutta, Nilufar Ali, Dominic N. Nthenge-Ngumbau, Poonam Verma, Alpana Singh, Meghna Banerjee, Anu Raju and P Ramesh Kumar.

Summer Trainees: D V Krishna Reddy, Sanjeev Kumar, P Ramesh Kumar,Tiyash Parira, Trishita Basak and S. Resiya Beegam

Dr. Sumantra Das
Cell Biology & Physiology Division

Treatment and understanding of addiction

Genetic epidemiology:

Ongoing collaborative projects with a psychiatric clinic, Baulmon, Kolkata as well as Chittaranjan National Medical College, Kolkata are underway to carry out genetic epidemiological studies on opioid addiction by investigating the possible association of specific SNPs of certain candidate genes in addiction using PCR based RFLP as well as DNA sequencing analysis. cAMP response element binding protein (CREB) is a major transcription factor which plays a vital role in a wide variety of cellular aspects. CREB also has a significant contribution in the development of addiction to substance abuse. A study was undertaken to identify the single nucleotide polymorphisms (SNP) at selective areas of CREB1 gene in heroin as well as in alcohol addicts and to compare them with that in the control population. SNPs from several exonic regions were assessed in this study to find an association with addiction. One SNP in exon 3, rs35349697, demonstrated significant association with opioid addiction as well as with alcohol addiction. A novel SNP, also located in exon 3, was identified which showed epistatic interaction with rs35349697 to decrease susceptibility to narcotic addiction in the population. The study is the first to report a role of CREB gene polymorphism with addiction.

Development of opioid analgesic:

Inspite of morphine, a predominantly a μ-opioid receptor agonists, being a drug of choice for the treatment of chronic pain, there has been a continous effort world-wide to identify suitable substitute of morphine since the latter has serious side effects during long-term use such as respiratory depression, tolerance, dependence, withdrawal symptoms, decreased gastric

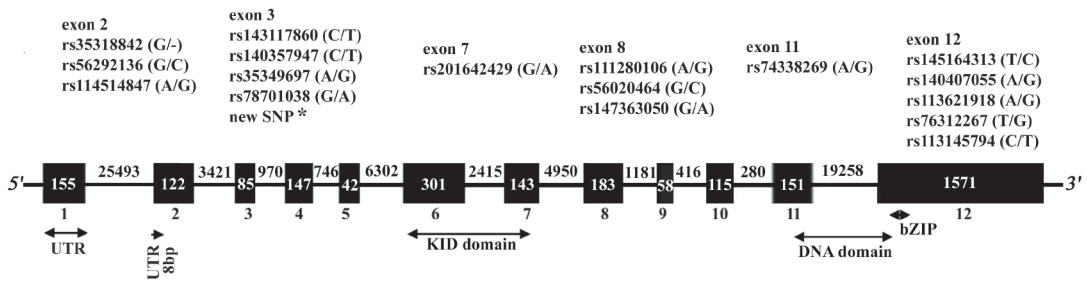
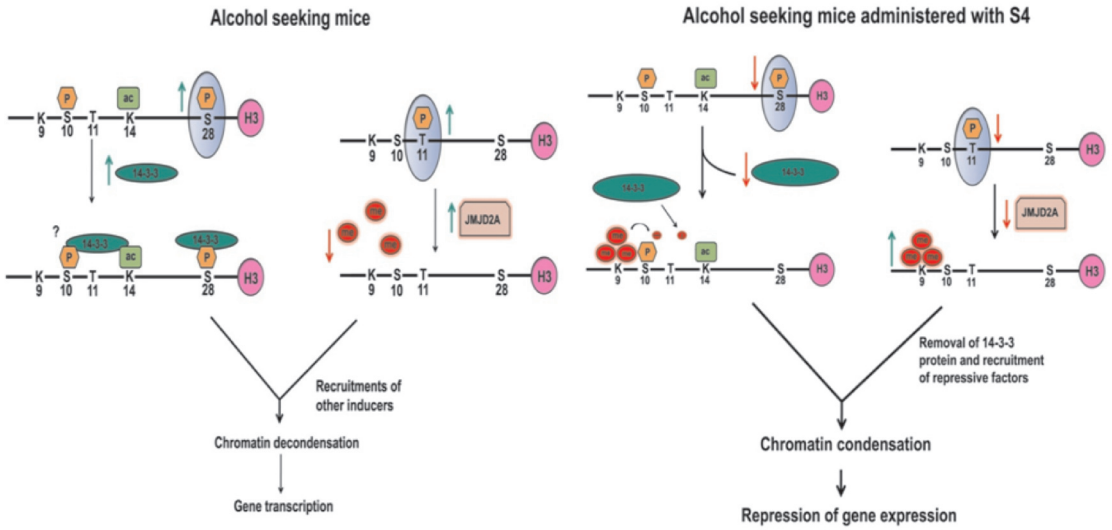


Fig: *Location of SNPs on human CREB 1 gene. The gene contains twelve exons, including an untranslated exon1, and eleven introns. Bases are numbered with respect to the transcription start site. Data were obtained from Gene Card (Weizmann Institute of Science) Homo sapiens. Exons are drawn to scale and have been numbered while introns and UTRs are not drawn to scale. * indicates the novel SNP.*

motility and emesis. Based on specific rationale we have developed, in collaboration with Indian Association for the Cultivation of Science, Kolkata, an opioid agonist have activity at both μ- and κ-opioid receptors which has significant analgesic activity and shows no demonstrable tremorigenic activity. The complex structure mimicking an iboga analogue combines the structural features of a benzofuran ring and a 2-azabicyclo octane ring connected by a methylene chain. The study is the first report, of its kind, of a potential analgesic effects of a novel iboga analogue in animal models.

Mechanism of action of a putative anti-addictive drug:

We had previously reported a quinoline compound S4, to successfully attenuate alcohol seeking (AS) behavior in alcohol dependent mice. The work was in collaboration with Synthetic, Biophysical and Natural Product Chemistry group of the institute. Mechanistic studies showed that chronic ethanol consumption was associated with significant alterations in histone H3 trimethylation at Lys9 in AS mice compared to alcohol abhorring (AA) mice. The histone modifying enzyme, Jumonji domain 2 (JMJD2A), phosphorylated histones H3 at thr11 and the expression of 14-3-3 protein, all of which maintain the trimethylated state of histone H3 at lys9, was significantly altered in the AS animals The quinoline compound S4 effectively alters the epigenetic signature in the AS mice, thus mimicking the epigenetic pattern of AA mice. The study provided a novel mechanistic basis underlying alcohol abuse in humans and describes a compound which could be a safe candidate for development drug against alcoholism/alcohol abuse.



Mechanism of restoration of altered epigenetic signature of the alcohol seeking mice by treatment with S4

Publication Details:

Das RD, Mondal N, **Das S**, Roy Choudhury C (2012) Optimized Electrode Geometry for an Improved Impedance Based Macroporous Silicon Bacteria Detector. *Sensors Journal, IEEE* **12**, 1868-1877.

Pal A, **Das S** (2013) Chronic morphine exposure and its abstinence alters dendritic spine morphology and upregulates Shank1. *Neurochem. Int.* **62**, 956-964.

Academic Performance:

Acted as ***Teacher & Examiner*** *for* M. Sc. students of the Department of Biochemistry & Department of Neuroscience, Calcutta University and also for NIPER, Kolkata

Supervised the project work of one M. Sc. student

Human Resource:

Technical/Administrative Staff: Mr. P. C. Deuri

Research Associate(s) & Fellow(s): Dr. Kusumika Gharami, Mr. Deepak Kumar, Ms. Ayantika Paul, Mr. Tuhin Subhra Banerjee, Ms. Maitreyi Das

Dr. Syed N. Kabir
Cell Biology & Physiology Division

Antioxidant and anti-inflammatory effects of α-dihydroxychalcone-glycoside

Three phenolic glycosides, compounds 1, 2, and 3, isolated from the heartwood of *Pterocarpus marsupium* showed significant free radical and superoxide ion scavenging activity and antioxidant potential at concentrations far below their cytotoxic levels. Compound 3, which was characterized to be α-dihydroxychalcone-glycoside (α-DHC), was the most potent one. Subsequent studies demonstrated that α-DHC effectively reduced nitric oxide and cytokine production by the LPS-stimulated RAW 264.7 mouse macrophage cell line. The compound effectively attenuated the expression of inflammation-mediating enzymes COX-2 and iNOS at the mRNA as well as protein levels in a concentration dependent manner. It prevented phosphorylation of all the three MAPKs (JNK, ERK, p38) and eventually blocked the activation of downstream elements contributing to inflammation. Phosphorylation of IκB-α and subsequent translocation of NF-κB into the nucleus were restricted, while the expression of stress responsive gene HO-1 was up-regulated. α-DHC targeted Keap-1 by modifying its cysteine thiols, dissociating it from Nrf-2 and facilitating nuclear entry of the latter; and this in turn induced HO-1 expression. Thus α-DHC exerts its anti-inflammatory activity in a dual manner: by down regulating MAPKs and restricting nuclear stabilization of NF-κB at one end, and by disrupting Nrf-2-Keap-1complex on the other. The anti-inflammatory potential together with its high therapeutic index envisages α-DHC as a prospective candidate molecule for the development of therapeutic strategy against inflammatory disorders.

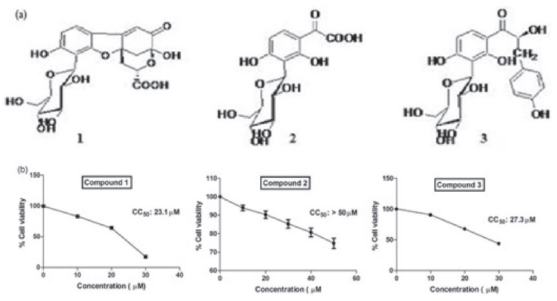


Figure 1: *(a) Structure of the test molecules, compounds **1**, **2**, and **3**, isolated from P. Marsupium. (b) Cytotoxic effects (CC_{50} values based on MTT assay) of the test compounds on PBMCs.*

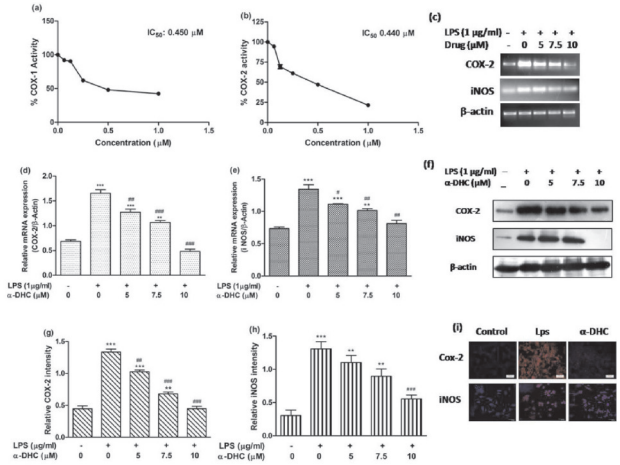


Figure 2: *Inhibitory activity of α-DHC on pro-inflammatory enzymes COX-2 and iNOS. Dose-effect curve for the in vitro inhibition of (a) non-inducible COX-1, and (b) inducible COX-2 by α-DHC. (c) Expression profile of COX-2 and iNOS mRNA in LPS-induced (6 h) RAW 264.7 mouse macrophages pre-treated with α-DHC for 2 h. Quantification of mRNA expression after normalization against β-actin for (d) COX-2 and (e) iNOS. (f) Effect of α-DHC on COX-2 and iNOS levels in RAW 264.7 cells pre-treated with indicated concentrations of α-DHC for 2 h followed by stimulation with LPS (1μg/ml) for 24 h. Protein expression as evaluated by Western blotting; its intensity was calculated and compared after normalization with β-actin for (g) COX-2 and (h) iNOS. (i) Immunocytochemistry studies were done with LPS (1μg/ml) stimulated RAW 264.7 mouse macrophages (24 h) pre-treated with 10μM α-DHC for 2 h.*

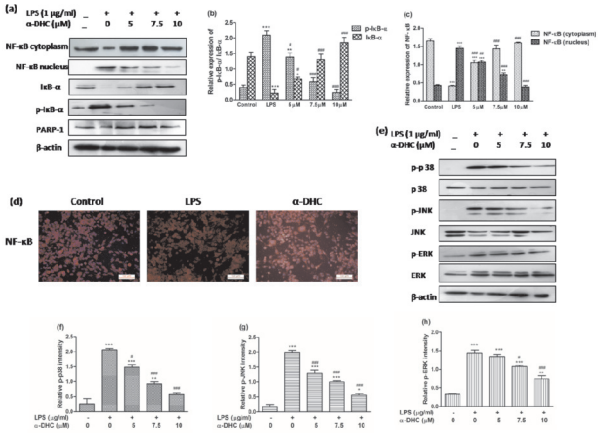


Figure 3: *(a) Expression of nuclear and cytosolic NF-κB, IκB-α and its phosphorylated isoform. (b) Quantification of p-IκB-α and IκB-α expression normalized against β-actin. (c) Quantification of cytoplasmic NF-κB normalized against β-actin and nuclear NF-κB normalized against PARP-1. (d) Immunocytochemical detection of NF-κB in LPS (1μg/ml)-stimulated RAW 264.7 mouse macrophages (1 hr) pre-treated with 10μM α-DHC for 2 hrs. (e) Effect of α-DHC on the expression of MAPKs in RAW 264.7 mouse macrophage cell line. Quantification of relative expression of (f) p-p38/p38 (g) p-JNK/JNK and (h) p-ERK/ERK. The cells were pre-treated with varied concentrations of α-DHC for 2 h followed by stimulation with LPS (1μg/ml) for 15 min and the proteins were detected by Western blot analysis.*

Publication Details:

Chakraborty P, Goswami SK, Rajani S, Sharma S, **Kabir SN**, Jana K (2013). Recurrent pregnancy loss in polycystic ovary syndrome: Role of hyperhomocysteinemia and insulin resistance. *PLoS ONE 8: e64446*

Mondal S, Mukherjee S, Chaudhuri K, **Kabir SN,** Mukhopadhyay PK. (2013) Prevention of arsenic-mediated reproductive toxicity in adult female rats by high protein diet. Pharmaceutical Biology: 51, 1363-1371.

Chakraborty P, Ghosh S, Goswami SK, **Kabir SN**, Chakravarty BN, Jana K. (2013) Altered trace mineral milieu might play an aetiological role in the pathogenesis of polycystic ovary syndrome. Biol Trace Elem Res: 152, 9-15

Chakrabarti J, Chatterjee R, Goswami SK, Chakravarty BN, **Kabir SN** (2012) Overt leptin response to controlled ovarian hyperstimulation negatively correlates with pregnancy outcome in in vitro fertilization--embryo transfer cycle. *J Hum Reprod Sci* 5, 194-99

Invited Lectures:

Delivered five (5) numbers of invited talks at Kuvempu University, Karnataka; World Conference on HIV & AIDS (WCHA - 2012), Kottayam, Kerala; 100th Indian Science Congress, Kolkata; International Conference on Repromics Omics in Reproduction, Thiruvananthapuram, Kerala and J. N. Mukhrjee Memorial Oration, City College, Kolkata

Session Chaired:

Frontiers in Animal Science, Dept of Applied Zoology, Kuvempu University, Karnataka, 9 -10 April, 2012

81st Annual Meeting of Society of Biological Chemists (India), Kolkata, 8-11 November 2012

100th Indian Science Congress, Medical Sciences (including Physiology) section, Kolkata. 3-7 January 2013

International Symposium on Molecular Signaling, Viswa-Bharati, Shantiniketan, 18-21 February 2013

Abstracts Presented:

No. of Abstracts presented in National Conference are **3**

No. of Abstracts presented in International Conference are **4**

Conference/Workshop/Symposia Organized:

Treasurer: 81st Annual Meeting of Society of Biological Chemists (India), Kolkata, 8-11 November 2012

Academic Performance:

Guest Teacher and Examiner of Calcutta University, Vidyasagar University, Serampore College, CU

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

Honors' and Awards:
Elected fellow of West Bengal Academy of Science and Technology

Human Resource:
Technical/Administrative Staff: Ms. Nita Chakraborty
Women Scientist: Mrs. Prarthana Chatterjee
Research Fellows: Ms. Sayani Banerjee, Ms. Ghoongroo Saraswat, Ms. Kalyani Mondal, ,
Project Assistant: Miss Tabasum Khanam

Dr. Arun Bandyopadhyay
Cell Biology & Physiology Division

Cardioprotective Function of Bezafibrate via Mitochondrial Pathway

Bezafibrate, peroxisome proliferator activated receptor alpha (PPARα) agonist is well known for its lipid lowering action. Since cardiac hypertrophy is induced via PPARα pathway we tested whether bezafibrate prevents cardiac dysfunction in hypertrophic condition. Cardiac remodeling, expression of the genes associated with fatty acid oxidation and mitochondrial dynamicity and activity were examined in hyperthyroid induced hypertrophied rat heart. Co-treatment with bezafibrate inhibited thyroid hormone-induced cardiac hypertrophy, atrial and brain -natriuretic peptide expression. Ultrastructure of mitochondria was damaged in thyroid hormone treated rat heart which was prevented by bezafibrate co-administration. Hyperthyroidism induced oxidative stress, reduction in cytochrome C oxidase activity and myocardial ATP concentration were also significantly checked by bezafibrate. Heart function studied at different time-points during the course of thyroid hormone treatment shows an initial improvement and then a gradual but progressive decline with time, which is prevented by bezafibrate co-treatment. Mechanism of fibrate's protective action on hypertrophy was further studied in H9C2 cardiomoyctes. Fenofibrate also prevented down regulation of mitochondrial genes like VDAC-I, COX-IV and mtTFA. Mitochondrial trans-membrane potential ($\Delta\psi_m$), mitochondrial dynamicity and ATP generation were decreased in phenylephrine-treated cardiomyocytes which were also significantly blocked by fenofibrate. In overall, the results suggest that fibrates such as bezafibrate or fenofibrate may have cardioprotecive action by preventing mitochondrial dysfunction in heart.

Publication Details:

Maity S, Kar D, De K, Chander V and Bandyopadhyay A (2013) Hyperthyroidism causes cardiac dysfunction by mitochondrial impairment and energy depletion. *Journal of Endocrinology*, **217**, 215-228

Kundu S, Pramanick K, Paul S, Bandyopadhyay A and Mukherjee D (2012) Expression of LH receptor in nonpregnant mouse endometrium: LH induction of 3β-HSD and de novo synthesis of progesterone. *J. Endocrinol*, **215**, 151-161

Invited Lectures:

Delivered two (2) numbers of invited talks in Visva-Bharati, Santiniketan and PGIMR, Chandigarh

Session Chaired:
Chaired one scientific session at the " Proteomics beyond Ids..." and Fourth Annual Meeting of Proteomics Society (India), in India, on November 21, 2012

Abstracts Presented
No. of Abstracts in National Conference is **5**

Conference/Workshop/Symposia Organized
Secretary: at the Annual Meeting of Society of Biological Chemists, during November 8 in Science City, Kolkata

Human Resource
Research Fellow(s): Dipak Kar, Priyam Banerjee, Vivek Chander, Somaditya Mukherjee, Tanima Banerjee, Apabritya Ayan Das

Dr. (Mrs.) S. R. Dungdung
Cell Biology & Physiology Division

Calibration and Standardization of the recently developed computerized spectrophotometric sperm motility analyzer (SPERMA)

A unique computerized spectrophotometric sperm motility analyzer (SPERMA) has been developed in our laboratory which is capable of positioning the cuvette vertically in four different heights, and thus exposing the spermatozoa solution in four levels of light paths. As a result, it is possible to generate four or more sets of data at a particular time and thus it is capable to determine sperm motility more accurately for the entire spermatozoa sample. The instrument along with the data acquisition and data analysis software is now ready for standardization and calibration. Calibration of SPERMA has been done by applying different species of spermatozoa like goat, hamster, mice, rat and human. Velocity measurements of these species have been compared with the microscopic motility assay. From the data we found that by microscopic assay we cannot judge the quality of sperm cells. SPERMA analyses the quality of sperm cells in a sample and establishes that only microscopic assay cannot find the better cells for fertilization unless further experiments performed. Data generated from this instrumental system is being planed to compare thoroughly with that of other standard sophisticated instrument such as CASA. Effect of different proteins purified from sperm plasma membrane & goat blood serum, reported from our laboratory has been studied on vertical velocity of goat spermatozoa by SPERMA. The data have been compared with microscopic & other spectrophotometric (spectronic spectrophotometer) data.

Publication Details:

Das K., Das S., Bhoumik A., Jaiswal B.S., Majumder G.C. & **Dungdung S.R.** (2012) In vitro initiated sperm forward motility in caput spermatozoa: weak and transient. *Andrologia*, **44**, 807-812.

Bhattacharya S., Ghosh P., De. T., Gomes A., Gomes A., **Dungdung S.R.** (2013) In vivo and in vitro antileishmanial activity of Bungarus caeruleus snake venom through alteration of immunomodulatory activity. *Experimental Parasitology*, **135**, 126-133.

Invited Lectures:

Delivered one (1) number of invited talks in CSIR-IICB Annual Research Meet at Kolkata

Academic Performance:

Acted as **PhD Thesis examiner & External examiner** for Biotechnology, at KIIT University, Bhubaneswar

Acted as Reviewer of a manuscript for Journal of Genetics and CSIR Project funding
Conducted workshop and presented a lecture for "International Workshop on current Trends in Resources on Biomedical Sciences" for the South Asian Association of Physiologists (SAAP), at CSIR-IICB, Kolkata

Abstracts Presented:
No. of Abstracts in National Conference is **2**

Students Awarded PhD:
Swarupa Ghosh for thesis titled "Vesicular biologically active compounds in combating mitochondrial oxidative damage in cellular diseases " registered at Calcutta University awarded on January 17, 2013

Human Resource:
Research Fellow(s): Arpita Bhoumik , Samik Bhattacharya, Swarupa Ghosh
Research Associate(s): Dr. Kaushik Das
Project Assistant(s): Prasanta Ghosh
Summer Trainee(s): Sudeshna Ghosh

Dr. Sibsankar Ray
Cell Biology & Physiology Division

Different aspects of regulatory mechanism in Metabolic Disorders:

Growth factors and their association in ovarian cancer: In the present study, we have identified a growth factor, FGF16 in ovarian cancer cells. The mechanism of Fibroblast Growth Factor-(FGF)-16 mediated invasions in ovarian cancer cells was not reported. Through the activation of FGFR-MAPK-pathway, FGF16 regulates*SNAI1/CDH1/MMP2/-MMP9,* promoting invasion of ovarian cancer cells. Wnt-signaling and PITX2 synergistically regulates *FGF16* expression.

Interaction between Wnt/β-catenin pathway and PITX2 homeodomain protein the proliferation of ovarian cancer cells: Wnt-pathway and homeodomain-proteins are associated with cancer, but their interaction in ovarian cancer cells has not been studied. PITX2 itself and through inducing Wnt-ligands activates canonical Wnt-pathway and cell proliferation. Down-regulation of Frizzled receptors limits further Wnt-activation. PITX2 enhances proliferation of SKOV-3 cells through inducing canonical Wnt-signaling (Fig.1). The existence of both positive and negative feedback loop between PITX2 and Wnt signaling pathway has been established in our study (Fig.2). The present study will help understand the mechanism of proliferation in ovarian cancer cells.

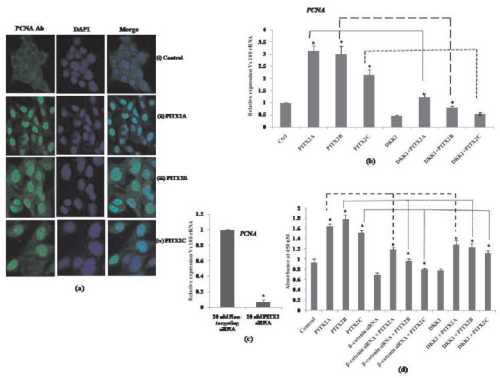


Fig. 1: *PITX2 enhances proliferation in SKOV-3 cells. (a) Confocal staining for PCNA is performed in synchronized cells transiently transfected with either empty vector (i), PITX2A (ii), -B (iii), and - C (iv) expression vectors. The left panel shows the images of cells stained with anti-PCNA antibody followed by anti-rabbit Alexa Fluor-488 (green). The nuclei are stained with DAPI (middle panel) and the right panel shows the merged image. The images are taken at same exposure time. Scale bar: 20 µm. (b) The relative expression of PCNA is measured by Q-PCR in the RNAs extracted from PITX2 over-expressed cells and from cells treated either with human recombinant DKK1 protein alone or in combination with PITX2A, -B and -C expression vectors. (c) Q-PCR is performed with the RNA of non-targeting- and PITX2-siRNA transfected cells using primers of PCNA. The comparative expression of respective gene is shown as relative 'fold' change in Y-axis (mean + S.E.M). (d) Cell growth is assessed by BrdU incorporation assay after transient transfections of PITX2A, -B, -C or in combination with β-catenin siRNA or DKK1. * represents $p < 0.05$.*

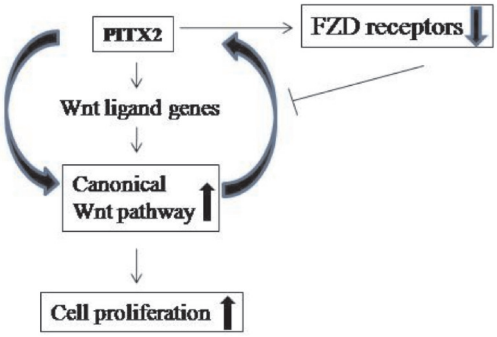


Fig.2: *The existence of both positive and negative feedback loop between PITX2 and Wnt signaling pathway is depicted schematically in this hypothetical model.*

The role of mitochondrial CPT isoforms in fatty acid oxidation of palmitate-treated L6 muscle cells: Excessive lipid deposition in skeletal muscle results in insulin resistance by a poorly defined mechanism called 'lipotoxicity'. However, the molecular mechanisms of the downstream events that lead to insulin resistance in insulin target tissues are not yet understood. Currently we are exploring the impact of lipotoxicity on the expression of genes regulating fatty acid oxidation (FAO) in insulin resistant skeletal muscles.

Publication Details:

Basu M and Roy SS (2013) Wnt/b-Catenin Pathway Is Regulated by PITX2 Homeodomain Protein and Thus Contributes to the Proliferation of Human Ovarian Adenocarcinoma Cell, SKOV-3. *J. Biol. Chem*, **288**, 4355-4367

Invited Lectures:

Delivered five (5) numbers of invited talks in Kuvempu University, Karnataka, 100th Indian Science Congress, Kolkata, Visva Bharati University, Bolpur & 16th Transcription Meeting, CSIR-IICB, Kolkata

Session Chaired:

Chaired one scientific session at the 81st Annual Meeting of Society of Biological Chemists, in Kolkata, India, on November 10, 2012

Academic Performance:

Acted as Teacher for *course-work* at CSIR-IICB
Acted as Examiner at Kalyani University, West Bengal University of Technology & CSIR-IICB
Acted as Faculty Scientist, for *SAAP Physiology Workshop organized by University of Calcutta*

Abstracts Presented:

No. of Abstracts in National Conference is **14**

Conference/Workshop/Symposia Organized:

Member scientific committee: at the 81st Annual Meeting of Society of Biological Chemists, during November 8-11, 2012 in Kolkata, India
Joint Secretary (Outstation): at the International Symposium on Molecular Signalling, during

February 18-21, 2013 in Visva Bharati University

Students Awarded PhD:

Dr. Debanjali Mitra, for thesis titled "*Molecular and Biochemical studies on the role of different cellular factors associated with reproductive disorders due to hypothyroidism.*", registered at Jadavpur awarded on April 23, 2013

Human Resource:

Technical/Administratice Staff(s): Swapan Kumar Mandal,

Research Fellow(s): Moitri Basu, Nabanita Das, Upasana Roy, Tulika Mitra, Ashok Mandala, Rahul Bhattacharya,

Project Assistant(s): Shreya Roychowdhury,

Summer Trainee(s): Amarnath Pal, Chandni Upadhyay, Esha Cahakraborty, Sonali Putatunda, Sumona Ghosh, Sourabh Sengupta,

Dr. Subhas Ch. Biswas
Cell Biology & Physiology Division

Alzheimer's disease: cell-cycle regulatory molecules as targets for therapy

Alzheimer's disease (AD) is a progressive neurodegenerative disease with no cure till today. Aberrant activation of cell cycle regulatory proteins is implicated in neurodegenerative diseases including AD. We have shown before G1/S transition kinase, Cyclin dependent kinase 4 (Cdk4) is upregulated and activated in AD patient's brain and is required for neuron death. We have also found that dual specificity phosphatase cell division cycle 25A (Cdc25A) which is required for dephosphorylation of inhibitory phosphates on adjacent threonine and tyrosine residues of Cdk4, is induced and activated in neuronal cells in response to insults relevant to AD i.e. nerve growth factor (NGF) deprivation and oligomeric beta amyloid (Aβ) treatment. Inhibition of Cdk4 or Cdc25A by chemical inhibitors protected neurons from both insults. More specifically, silencing Cdc25A by shRNA prevented neuronal cell death under both treatment conditions. We have also tested the efficiency of a small library of synthetic molecule inhibitors targeting Cdk4 or Cdc25A as neuroprotective agents in these models of neuron death. We found that several of these inhibitors significantly protected neuronal cells against death induced NGF deprivation and Aβ treatment. These neuroprotective agents inhibit specifically their target kinase (Cdk4) or phosphatase (Cdc25A) activity, loss of mitochondrial integrity, induction of pro-apoptotic proteins and caspase activation in response to NGF deprivation. The efficacies of

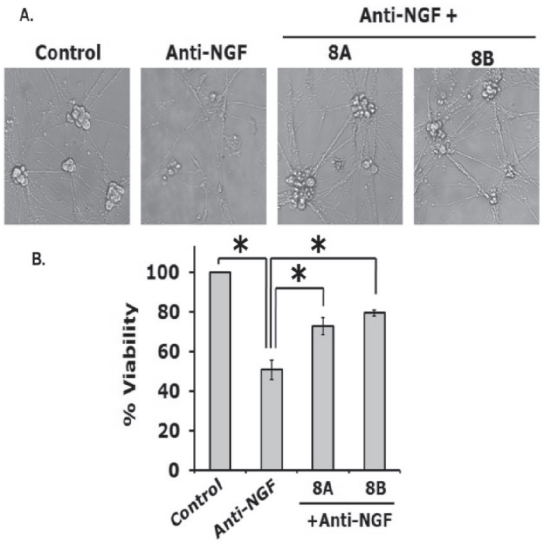


Figure 1: *Synthesized inhibitors of Cdk4 protect primary sympathetic neurons against NGF deprivation. Primary cultures of sympathetic neurons (5DIV) were subjected to NGF deprivation in presence and absence of synthesized small molecule inhibitors of Cdk4 for overnight. (A) Representative phase contrast micrographs show retention of neuronal processes even after NGF deprivation in presence of synthesized Cdk4 inhibitors (8A & 8B). (B) Graphical representation of percentage of viable cells following NGF deprivation in presence of synthesized small molecule Cdk4 inhibitors (8A: 5μM; 8B: 1μM). Data represented as mean ± SD of two independent experiments performed in duplicates. The asterisks denote statistically significant differences between indicated class: *p<0.05.*

commercial and synthesized inhibitors are comparable. Therefore, we propose that Cdc25A or Cdk4 inhibition would be a therapeutic choice for ameliorating neurodegeneration in AD and these synthetic inhibitors could lead to development of effective drugs for AD.

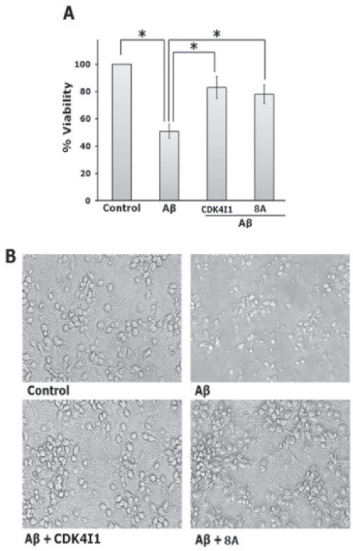


Figure 2: *Cdk4 inhibitors protect primary rat cortical neurons against Aβ induced death. Primary rat cortical neurons (5DIV) were exposed to Aβ (1.5 μM) in presence and absence of Cdk4 inhibitors (Cdk5I1 & 8A) for 48 h. Percentage of viable cells were estimated by intact nuclear counting assay. (A) Graphical representation of percentage of viable cells. Data represented as mean ± SD of two independent experiments. The asterisks denote statistically significant differences between indicated class: *p<0.05. (B) Representative phrase contrast micrographs show retention of neuronal processes in presence of Aβ by Cdk4 inhibitors.*

Publication Details:

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

Invited Lectures:

Delivered two (2) numbers of invited talk in Guru Nanak Dev University, Amritsar and AIIMS, New Delhi

Session Chaired:

Chaired one scientific session at the XXX Annual Conference of Indian Academy of Neurosciences, in India, on October 29, 2012

Chaired one scientific session at the 27th Annual Meeting of Society for Neurochemistry, India (SNCI), in India, on February 21, 2013

Academic Performance

No. of Abstracts in National Conference is **14**

No. of Abstracts in International Conference is **2**

Conference/Workshop/Symposia Organized

Member of Organizing Committee: at the Cell signaling Network & Neurocon 2013, during Sep 11 13, 2012 & Jan 18-20, 2013 respectively in Kolkata

Human Resource:

Research Fellow(s): Mrs. Nandini Chatterjee, Mrs. Rumana Akhter, Mr. Priyankar Sanphui, Ms. Pampa Saha, Ms. Suraiya Saleem,

Research Associate(s): Dr. Swarupa Ghosh,

Summer Trainee(s): Mr. Sandeep Kari, Ms. Peu Santra, Ms. Alibhia Ghosh, Mr. Shirsha Chakraborty,

Dr. Partha Chakrabarti
Chemistry Division

The broad objective of our lab is to understand the pathophysiology of metabolic disorders, particularly type 2 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 plasma Dipeptidyl Peptidase-4, a target for diabetes therapy is linked to the progression of type 2 diabetes. The primary source of plasma DPP4 comes from the peripheral mononuclear cells. Among the three groups (control, prediabetes and diabetes) there was no significant difference of body fat, BMI and other metabolic parameters. This preliminary data suggests that treatment with DPP4 inhibitors could be beneficial in prediabetes stage.

Publication Details:

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

Academic Performance:

Acted as **Teacher** for CSIR-IICB course work

Advisory board member (Academic) at Ramakrishna Mission Bidyamandir, Belur Math

Honours and Awards:

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

Human Resource:

Research Associate(s): Dr Susmita Chandra, Dr Md. Wasim Khan

Research Fellow(s): Mainak Ghosh, Dipsikha Biswas, Moumita Adak, Titli Nargis

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.

Twist in mouse placental development and trophoblast stem cell differentiation: We are exploring the role of Twist in mouse placental development and epithelial mesenchymal transition (EMT) associated with trophoblast stem (TS) cell differentiation.We are also working towards finding out binding partners of Twist in regulating the EMT biomarkers and miRNA mediated regulation of Twist.

MicroRNA regulation of Insulin like growth factor-II during mouse placental development: We found using bioinformatic analysis that Insulin-like growth factor (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 are exploring this hypothesis by determining whether distribution of these miRNAs correlates with that of IGF-II mRNA in the uterus.

The SLIT-ROBO pathway: A regulator of endothelial and trophoblast cell function during placental development in mouse: We have identified a unique pathway, classically known to be involved in axonal guidance in drosophila, to be involved in mouse placental development. Slit is a secreted protein known to function through the Roundabout (Robo) receptor. We are working on trophoblast-endothelial cell interaction mediated by slit-robo pathway during placentation in mice.

***NOSTRIN and NOSIP regulate angiogenesis at the maternal-fetal interface by fine-tuning the endothelial nitric oxide synthase activity*:** We are investigating the role of NOSTRIN and NOSIP in feto-placental angiogenesis. Our data suggest that NOSTRIN and NOSIP are two key regulators of eNOS-mediated angiogenesis in mouse endothelial cells and interact with eNOS at the maternal-fetal interface in a similar fashion that they do in mouse endothelial cells

Invited Lectures:
Delivered one (1) number of invited talk at the international conference on Repromics-Omics in Reproduction held at RGCB, Trivandrum, Kerala

Abstracts Presented:
No. of Abstracts in International Conference is **4**

Human Resource:
Research Fellow(s): Jaganmoy Choudhury, Sarbani Saha, Eswara Murali S and Shreeta Chakraborty
Project Assistant(s): Priyanka Sengupta

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

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

The exercise to formulate Twelfth Five Year Plan Project (TFYP) of CSIR-IICB had started from 2010. During the Eleventh Five Year Plan, CSIR-IICB was involved in **20** projects of which four **(4)** are **Nodal Network Projects** and sixteen (**16**) are **Partner Network Projects**. We have successfully completed the projects and earned valuable experience during the Eleventh Plan through these network projects. After a lot of discussion, deliberation and presentation in different forum of CSIR-HQ, finally PPD-CSIR has cleared **19** projects in Twelfth Five Year Plan, 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 already received by CSIR-IICB.

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

PARTICIPATING LABORATORY

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) Genome	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	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 PROJECT DETAILS

1) TITLE: Understanding and designing the supra molecular ensembles and machines (UNSEEN)
Participating Laboratories: CSIR-IGIB, CSIR-CCMB, CSIR-CDRI, CSIR- IMT

Broad Objective:
Can we solve the structure and intrinsically complex dynamics of functionally important large macromolecular complexes and biological machines, using a 'Hybrid Approach' of different structural biology techniques?
No single technique may unravel the mysteries of these inherently dynamic molecular machines. 'Hybrid Approach' means SAXS/SANS, cryo-EM and other spectroscopic methods as low resolution tools and high resolution structural methods including X-ray crystallography and NMR will be used in combination to understand structural and functional complexity of these systems**.**

Highlights of the Macromolecular Systems to be Studied are as follows:

- Bacterial Secretion Systems
- Supra-molecular Protein Amyloids
- Ribosome Structure and Dynamics
- Transcriptional Co-activators
- RNA Import Complex
- Photosystem I
- Polyketide Synthases of Mtb
- GPCR Structure and Dynamics

Envisaged Outcomes and Outputs

- This is an extremely competitive field of research with only a limited international (and no national) presence. This project is expected to yield significant enhancement of the scientific merit and prestige of the country.
- Structural understanding of large biological complexes with significant implications in human health and diseases.
- Establishment of structural biology hubs with sophisticated instrument facilities in strategic locations.
- Generation of employment and production of highly skilled PhD scientists and technicians (about 15-20 PhD theses and many project fellows).
- Peer-reviewed publications and know-how to build innovative concepts (about 30-40 publications in internationally acclaimed journals).

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

Objectives:

- Value addition (by human clinical trials) to anti-asthma leads (developed in 11th five year plan).
- To explore new targets for COPD.
- To develop animal model for COPD.
- To explore the cellular and molecular mechanisms of COPD and other respiratory disorders.
- To study the impact of Environmental factors and gene interaction in COPD.

Deliverables:

A. Envisaged Outputs:

Scientific Knowledge Creation: About 40-60 publications in high impact factor journals.
Patents … … … : 1-2 Numbers
Commercialization … … :1-2 molecules

B. Envisaged Outcomes:

- **30 numbers of PhDs generation in the area of COPD.**
- **100 numbers of Students trained with COPD research**
- **50 numbers of Scientists with expertise in COPD and related respiratory research.**
- **5 numbers of CSIR Laboratories with expertise in COPD research**

3) TITLE: Neurodegenerative diseases: Causes and Corrections (miND)

Participating Laboratories: CSIR-CCMB, CSIR- IITR, CSIR-CDRI,

CSIR-NCL, CSIR-IICT

Preamble:

- Age related neurodegenerative diseases, especially Alzheimer's disease (AD) and Parkinson's disease (PD) are major health problems to INDIA with rising number of aging population in the country. An estimated 60 m people with 65+ y of age will be with a risk of AD and PD to the tune of 5% and 0.6% respectively as of 2010; and is predicted to double by 2020.
- Unknown etiology, and NO CURE for these diseases.
- Disease progression is poorly understood.
- Treatment are based on classical pathways; Cholinergic and dopaminergic stimulation for AD and PD respectively.
- Therapies are inefficient, with serious side-effects.
- Clinical trials based on canonical pathways β-amyloid and α-synuclein toxicity for AD and PD respectively have been unsuccessful

Objectives:

- To uncover the non-canonical and emerging mechanisms (cell cycle regulation, glycation, epigenetics, microRNA and astrocytic influence) that govern neurodegeneration
- To apply the knowledge for treatments of AD and PD

Envisaged outcomes:

Identification of potential targets for therapeutic intervention in AD & PD by dissecting out :

- Mechanism s of protein aggregation such as amyloid & synuclein
- Cell cycle regulatory molecules in neuronal death & survival
- Glycation end products and their role in aggregation of proteins
- Emerging role of astrosytes in neurodegeneration and neuroprotection
- Understanding epigenetics involved in neurodegeneration
- Micro RNA in neurodegeneration and neuroprotection

Identification of new lead molecules as neuroprotective agents:

- Generation of a portfolio of natural products and their derivatives, and synthetic molecules as anti-AD and anti-PD neuroprotective agents.
  eg. tetraisoquinolines for treatment of PD.

Envisaged outcomes:

- **Scientific research publications** : 150 Numbers
- **PhDs to be generated/awarded** : 65 Numbers
- **HRD (Manpower training, scientific research)** : 100 Numbers
- **Patents** : 10 Numbers
- **Scientific presentations in symposia/conferences:** 165 Numbers

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

Relevance of the project:

- Leishmaniasis threatens about 350 million people in 88 countries around the world, the majority being reported from developing countries including India.
- Available therapies are found to be increasingly less effective, as the organisms rapidly develop resistance to these drugs. Moreover, the pathogen adopts unique biochemical and metabolic pathways to utilize the host cell resources and also to combat the host immune response.
- The current proposal plans to develop a new strategy for identification of key molecular targets that would be useful for discovering 2nd generation inhibitors and drug molecules as new tools to cure leishmaniasis.
- The primary focus of this proposal would be to understand the details of intra- and intermolecular interaction of the molecules of the parasite with that of the host cells.

Objectives:

- What are the unique biochemical and metabolic components of the different phases of life cycle of *Leishmania* that play important role in the infection process?
- What changes are there in the immunological and signaling pathways of the host during infection?
- What genetic and epigenetic changes are there in the parasite and what are the changes in the proteomes of the infected host cells and the pathogen?
- What changes are there in the interactome of the host cells? How to identify *de novo* candidates for drug design using the bioinformatics and mathematical modeling of the infection process?

- Vector to host transfer of parasites: What are the vector specific factors that control the efficacy of infection process?

The work proposed will lead to

- Development of potential vaccines and therapeutics.
- Development of novel inhibitors/ drug molecules including natural products based on leads.
- Development of an extensive framework of host-parasite protein-protein interaction network which will facilitate in identifying new drug targets and developing new drug molecules.

Expected Outputs and Outcomes:

Scientific research publications : 120 Numbers
PhDs to be generated/ awarded : 60 Numbers
HRD (Manpower training, scientific research) : 200 Numbers
Patents to be submitted : 10-12 Numbers

5) TITLE: Bio-energetic Disorder: A multi-model approach to monitoring and management (BEnD)

Participating Laboratories: INTRA- INSTITUTIONAL

Broad Objective:

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

Comprehensive Approach:
Integration of various disciplines to unravel the mechanism of bio-energetic disorder for the design of mitochondrial medicine

Specific Objectives:

- Electron transport chain defect and reactive oxygen species generation

- Mitochondrial Fission-Fusion and cell death
- Metabolic changes and interorganellar network during electron transport chain defect
- Mitochondrial targeted small molecule and regulatory small RNA in bio-energetic disorder

Envisaged Outputs

- Novel "Mitocans" development for mitochondrial therapy: Mitocans are small molecules specifically targeted to mitochondria and prevent mitochondrial pathology and associated diseases
- Generation of knowledge on mitochondrial fission-fusion dynamics: To follow mitochondrial health under normal and disease states in multi-model systems
- Exploration of the mechanism of interorganellar crosstalk under cellular stress: Management of cellular metabolic crisis and inherent cytoprotective mechanisms under bio-energetic disorders and oxidative stress.

General outcome

- Methods for diagnosis and treatment of mitochondrial diseases
- Technology development for drug delivery to the CNS
- Understanding the relation between mitochondrial function and disease
- Knowledge generation, publication and patents
- Training of manpower

Quantitative outcome

Scientific research publications	: **50** Numbers
Patents to be submitted	: **10** Numbers
PhDs to be generated/ awarded	: **20** Numbers
HRD (Manpower training, scientific research	: **100** Numbers
➢ Identification of new drug targets and synthesis of lead molecule	: **3** Numbers

PUBLICATION & INFORMATION AND PLANNING, MONITORING & EVALUATION

PUBLICATION & INFORMATION AND PLANNING, MONITORING & EVALUATION

Dr. Santu Bandopadhyay, Dr .K.P. Mohanakumar, Dr. Asish K. Sen, Dr. G. Suresh Kumar, Dr. Uday S. Chowdhury, Dr. Tanmoy Mukherjee, Dr .Moonmoon Bhaumik, Dr. Samir K. Dutta, Dr. Prasanta Chakraborty, Dr. Siddhartha Majumder, Mr. Arupesh Majumder, Mr. Sekhar Mukherjee, Mr. Swadesh K. Sahoo, Mr. Binayak Pal, Mr. Sankar Bhakta, Md. Ayub Shah ,Miss Lily Das, Mr. Sukhendu Biswas, Mr. Pallab Mukherjee, Mr. Nishikanta Naskar, Mr. Soumalya Sinha, Mr. Samir Thami, Mrs. Debasree Das

The scientific management of the different R&D activities of the institute is the primary focus of this division. The diverse activities of this division have been carried out successfully by seven 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; and [g] Human Resource Group. The details of the scientific management activities of the individual sections are given below separately for the reporting year.

PUBLICATION & INFORMATION AND PLANNING, MONITORING & EVALUATION

Dr. Tanmoy Mukherjee and group

This section is basically catering the 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 is involved in the following wide spectrum of programmes during the report year.

Preparation of IICB Annual Report (2011-12).

Preparation of documents released during events.

Preparation of Annual Plan (2013-14) and Budget.

Dissemination of information to scientific milieu on relevant subjects.

Documents on IICB inputs for “CSIR Annual Report 2011-12” and “CSIR Research Output 2012”.

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

Total management of all technical queries.

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.

Write-up on CSIR-IICB for a Special Feature titled "CSIR @ 70" in November,2012 issue of Engineering Watch Magazine

Monthly Report of CSIR-IICB for PPD, CSIR.

Matters CSIR News & CSIR-IICB News Letter.

Preparation of Performance Indicator data for CSIR-IICB.

Assistance for press & publicity of 2nd Convocation of mentor Institute, NIPER-KOLKATA.

Write-up on CSIR-IICB for 'Medicall Special an exclusive edition' which feature India's premier medical institutions.

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. A list of '**Scientist Visitors**' 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 Exhibition

Like preceding years, P&I Section has participated in exhibitions during 2012-13 in and around Kolkata organized by various organizations like 16th National Science Exhibition, organized by Central Calcutta Science & Culture Organization at Kolkata, 100th Indian Science Congress organized by Calcutta University at Kolkata, etc. CSIR-IICB has a mandate to carry out basic and applied research in health problems of the country. The main objective of this section is to present recent scientific developments of the institute to the common people. The successful presentation of scientific works and developments of CSIR-IICB brought in a number of awards through these exhibitions.

Management of Laboratory Visit for Students

On the occasion of CSIR Foundation Day celebration-2012, 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 five 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 seven (07) numbers of visits were organized throughout the year (2012-13).

Sectional Members

Dr. Uday S. Chowdhury, Mr. Sekhar Mukherjee, Mr. Arupesh Majumdar, Mr. Pallab Mukherjee, ***Mr. Sankar Bhakta***

Intellectual Property Management Cell

Dr. Tanmoy Mukherjee and group

CSIR-IICB is continuously developing it's knowledgebase through high science and the inventions with potential of commercialization are protected as patents and copyrights by its Intellectual Property Management (IPM) cell. The IPM cell in CSIR-IICB, in co-ordination with Intellectual Property Unit (IPU) of CSIR, is engaged in protecting the technologies developed with an objective to put forward these technologies towards the benefit of common

people in our country and abroad. With the help of a new Comprehensive Patent Database prepared by this cell, now information about a patent filed by CSIR-IICB, since 1990 is just a click away.

This cell has continuously maintained liaison with Scientists of CSIR-IICB and IPU, CSIR to protect Intellectual Properties of CSIR-IICB/CSIR. The IPM Cell, CSIR-IICB provided all information, clarifications, explanations and reports to IPU, CSIR regarding new patent applications, granted patents and renewal or lapsing of existing patents in consultation with concerned inventors within corresponding time-limit. During the reporting period, a large number of correspondences were made with IPU, CSIR, a significant number of responses were conveyed to IPU, CSIR for patent applications in India and abroad and a considerable number of communications were made with CSIR-IICB scientists regarding patent queries to provide necessary information to IPU, CSIR to obtain productive results. The IPM Cell always extended co-operation to the inventors, CSIR-IICB in writing and filing patent applications. This cell has prepared, maintained and disseminated all information regarding patent application, status of the application, renewal etc. as and when it was required. IPM cell, CSIR-IICB 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 regarding Audit and Parliamentary Question; prepared necessary documents on patents licensed out by CSIR-IICB; prepared year wise documents on total Patents of CSIR-IICB filed and granted; prepared Commercial Working Report of CSIR-IICB Patents for IPU, CSIR; approved number of Declaration forms for non patentability of publication and sent Renewal / Lapse recommendations of CSIR-IICB patents to IPU, CSIR

Apart from these, 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.

During reporting period, the performance at a glance of IPM Cell is as follows:

Patents Filed:

International Patents Filed … **4**

Patents Granted:

International Patents Granted … **3**

Patents Filed Abroad

SNo	Title	Country	Inventors	Filing Date
1	INHIBITORS OF IL-4 AND IL-5 FOR THE TREATMENT OF BRONCHIAL ASTHMA	WORLD	SANTU BANDYOPADHYAY, BALARAM GHOSH, PARASURAMAN JAISANKAR, BIKAS CHANDRA PAL, SIDDHARTHA ROY, BHOLANATH PAUL, ARJUN RAM, ULAGANATHAN MABALIRAJAN, NAHID ALI, ARUN BANDYOPADHYAY, ADITYA KONAR, JAYASHREE BAGCHI CHAKRABOTRY, INDRANI CHAUDHURY MUKHERJEE, JAYDEEP CHAUDHURI, SANJIT KUMAR MAHATO, ANIRBAN MANNA, ROMA SINHA, PRADYOT BHATTACHARYA, JAYARAMAN VINAYAGAM, DEBA PRASAD JANA, SUSHOVAN CHOWDHURY	11/04/2012
2	TRIAZINE-ARYL-BIS-INDOLES AND PROCESS FOR PREPARATION THEREOF	CHINA	VASANTA MADHAVA SHARMA GANGAVARAM, JHILLU SINGH YADAV, RADHA KRISHNA PALAKODETY, ARUN BANDYOPADHYAY, SIDDHARTHA ROY, SANTU BANDYOPADHYAY, RAKESH KAMAL JOHRI, SUBHASH CHANDER SHARMA, BALARAM GHOSH, MABALIRAJAN ULAGANATHAN, SAKSHI BALWANI, BHOLANATH PAUL, ASHOK KUMAR SAXENA	23/05/2012
3	TRYPTAMINE DERIVATIVES, THEIR PREPARATION AND THEIR USE IN GASTROPATHY	USA	BANDYOPADHYAY UDAY, PAL CHINMAY, BINDU SAMIK, ADHIKARI SUSANTA SEKHAR	12/03/2013
4	TRYPTAMINE DERIVATIVES, THEIR PREPARATION AND THEIR USE IN GASTROPATHY	JAPAN	BANDYOPADHYAY UDAY, PAL CHINMAY, BINDU SAMIK, ADHIKARI SUSANTA SEKHAR	13/03/2013

Patents Granted Abroad

SNo	Title	Country	Inventors	Grant Date	Patent No.
1	ANTIMONOCYTIC ACTIVITY OF EXTRACTS OF PIPER BETEL BETEL LEAVES	JAPAN	SANTU BANDYOPATHYAY, BIKASH PAL, SAMIR BHATTACHARYA, MITALI RAY, KESHAB CHANDRA ROY	13/07/2012	5037778
2	A PHARMACEUTICAL COMPOSITION USEFUL FOR THE TREATMENT OF PROSTATE CANCER	CHINA	SINHA SWATI, PAL BIKAS CHANDRA, BHATTACHARYA SAMIR	02/01/2013	ZL200680032192.8
3	PHARMACEUTICAL COMPOSITION USEFUL FOR THE TREATMENT OF PEPTIC ULCER DISEASES	USA	SUKDEB BANERJEE, PRATAP K DAS, SUCHANDRA GOSWAMI, C. ANNALAKSHMI, NILENDU PANDA, NIRANJAN PRASAD SAHU, BASUDEB ACHARI	26/02/2013	8383690

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, etc., details of extramural project activities (both completed, sanctioned and currently progressing are provided in a separate page as '**External Funding**', 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.).

Altogether CSIR-IICB has 23 projects that have been submitted; six projects each have been newly sanctioned, and completed during the financial year 2012 - 13.

Role of PME in ERP

Enterprise resource planning is taken up by PME specifically on the following areas:

i. CSIR-IICB Employee role mapping (Primary & Secondary)

ii. Creating/Adding a new Projects (Except Network Project)

iii. Updating and modifying the projects status

a. Sanction Module :- Defining Sanction Limit under different Budget Head to the Principal Investigator of a particular projects

iv. R & D Module :-

a. Adding funding organization details

b. Configuring work flow

c. Adding R&D area and sub-area

Sectional Members

Dr. Prasanta Chakraborty, Mr. Sukhendu Biswas, Mr. Soumalya Sinha and Mr. Samir Thami

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: AcademicAdministration related activities concerning RFs & RAs, PhD program, student affairs, Summer/winter Training Programme, different training & outreach programs.

The functions include: oversight, guidance and co-ordination of different HR development program & talent-management activities.

Activities, Guidance and Initiatives:

Student Affairs

Admission and Orientation of 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

Securitization of research student's applications

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

PhD students, post-docs & project assistants:

Number of existing Research Fellows & Associates: 323
(CSIR/UGC/DST/DBT/ICMR/TLP)
Number of Project Assistants: 55

Summer Training / Project Work / Dissertation Work:

HRG coordinates the Summer Training Programme for the 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 available in CSIR-IICB website at HRG site. Under this programme the Institute conducts training of short duration in various disciplines and is absolutely free of cost. **Number of Summer Trainee/Project Trainee in 2012-13 was 133.**

Learning and instructional support: PhD Course Work:

HRG function as a coordinating centre for the **CSIR-IICB PhD course work** for the PhD students. This programme is carried out with the active participation and advice of Dr. K.Chaudhuri, Chief Scientist & Head, Academic affairs Division. The academic affairs committee acts as an Advisory Committee in connection with the PhD course work. The management of the PhD CW is carried out by the HRG personal and other associated personals. **Total number of Course work students for 2012-13 was 70.**

Incentives/ award: Depending on the academic performance, several incentives are offered to meritorious students. These include cash awards to the PhD course work students based on the performance in the course work examination.

Training & Workshop (Inter & Intra):

Suitable Scientists/Officers names are recommended for consideration of their nomination in different training programme /workshop organized by CSIR-HRDC and 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:

An Orientation Program for newly recruited CSIR-IICB PhD Research Fellows was organized on 4th September, 2012 at CSIR-IICB. About 75 students participated in this program. Welcome address was delivered by Prof. Siddhartha Roy, Director, CSIR-IICB. Head Academic Affairs Division, Head HRG, Chairman & members of Academic affairs and the Lab-Coordinator, AcSIR were present in this program.

One day outbound training program *"Unleash Your Power Within"* was organised by CSIR-HRG at IBIZA resort, Amtala, Diamond Harbour Road on 7th June, 2012 for the staff members associated with Purchase, Finance & Accounts and Administrative department. About thirty participants attended this program conducted by 'Centre of personal Transformation', Kolkata. Director, CSIR-IICB was kind enough to be present there to inspire the participants and addressed them. Divisional Heads of Administration, Stores & Purchase, Finance & Accounts were also present.

A "Scientific Communication Skill development Workshop" delivered by British Council for the CSIR-IICB PhD Course Work students from 25th June to 6th July, 2012 organised by HRG at CSIR-IICB. About 90 students (in four batches) participated in this programme. **T**he course content for this workshop comprised judicious blend of lecture, discussion, and group-exercises. Presentation of seminar, paper writing, and proposal writing along with other standard format needed for communication skill development were included in the courses.

Director, CSIR IICB addressing the **CSIR-IICB PhD Research Fellows** in **Orientation Program and** a view of participants along with Director & some officials in the T**raining program:** ***"Unleash Your Power Within".***

[b] Training Programme: Nominated/recommended for participation:

Sri K. Bhattacharya, A.O. and Sri A.K. Jha, S.O. (F&A) was nominated for **Management Development Programme for Common cadre officers** held from 06 to 10 February, 2012, at CSIR-HRDC, Ghaziabad.

Mrs. S. Sengupta, S.O. (G) was nominated for participation in "Work life balance for women scientists and officers" programme held at CSIR-HRDC, Ghaziabad from 30 April to 02 May, 2012.

Sri Akash Gupta, was nominated for participation in programme on "Project Management : Tools & Techniques" held from 19 to 21 September, 2012, at CSIR-HRDC, Ghaziabad.

Sri Sabyasachi Karmakar, Security Officer, has participated in 'Workshop on Fire Safety' held at IIT, Gandhinagar, Ahmedabad from 02 to 03 March, 2012.

Sri K. Bhattacharya, A.O. and Sri A.K. Jha, S.O. (F&A) was nominated in the programme on 'Taxation laws Direct and Indirect Taxes' (Second series) held from 25 to 26 February, 2013, at CSIR-HRDC, Ghaziabad.

Sectional Members

Ms. Lily Das; Ms. Debasree Das; Md. Ayub Shah

Art & Photography Section

Dr. Tanmoy Mukherjee and group

Art Section under the supervision of ***Dr. Tanmoy Mukherjee*** 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.

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

ISTAD Section

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.

Business Development Group

Dr. Asish K. Sen and Group

Major activity of this group involves

Liaison with private industries/R&D institutes/academic institutions/Govt. organizations and other potential clients.
Negotiating business plans with industries and corporate sectors and implementing them and also drawing agreements and memorandum of understandings
Dealing with matters related to service tax (registration and filing returns).
Arranging and conducting meetings between institute and industry/corporate clients, induction of new schemes, arrangement of visitors interaction with scientists etc.
Dealing with Parliamentary and other related matters, responses to parliamentary queries and questions etc.
Distribution of premia & royalty earned.
Preparation of lists of knowledge base/products developed, dissemination of information on technologies developed etc.
Negotiation of collaborative/interdisciplinary research with academic institution and signing of memorandum of understandings.

Events of CSIR-IICB

Date	Salient details
2nd April, 2012	CSIR-IICB: Organized its 56th Foundation Day celebration. Prof. R. N. Mukherjee, Director, IISER, Kolkata was present as Guest-in-Chief and Prof. Obaid Siddiqi, National Research Professor, National Centre for Biological Sciences, Bengaluru delivered the 24th JC Ray Memorial Lecture.
30th April 2012	CSIR-IICB: Organized Cell Biology and Physiology Research Festival (CBPRF) by Cell Biology and Physiology Division. This festival was introduced last year to foster close interactions amongst the scientists and research fellows
18th May, 2012	CSIR-IICB: Organized Second Convocation of NIPER-Kolkata as mentor Institute. The convocation was presided over by Sri. Dilsher Singh Kalha, IAS, Secretary, Department of Pharmaceuticals, Ministry of Chemicals and Fertilizers, Govt. of India & Chairman, Steering Committee of NIPER-Kolkata and Prof. Goverdhan Mehta, National Research Professor & Lilly-Jubilant Chair, School of Chemistry; Hyderabad was the Guest-in-Chief. Dr. Siddhartha Roy, the Director of CSIR-IICB, the mentor institute & Chairman, Advisory Committee, NIPER-Kolkata administered the exhortation to the recipients of the degrees.
7th June, 2012	CSIR-IICB: One day outbound training program “Unleash Your Power Within” was organized for the staff members associated with Purchase, Finance & Accounts and Administrative department. About thirty participants attended this program conducted by ‘Centre of personal Transformation’, Kolkata.

Events of CSIR-IICB

25th June - 6th July, 2012	CSIR-IICB: A Scientific Communication Skill development Workshop was delivered by British Council for the PhD Course Work students. About 90 students participated in this programme.
4th September, 2012	CSIR-IICB: An Orientation Program for newly recruited PhD Research Fellows was organized. About 75 students participated in this program.
11th – 13th September, 2012	CSIR-IICB: Organized First International Meet in Cell Signaling Network (CeSiN-2012). Prof. Indranil Manna, Director, CSIR-CGCRI, graced the occasion as Guest-in-Chief and Swami Tyagarupananda, Principal, Ramakrishna Mission Vidyamandira, Belur was present as the Special Guest.
10th -14th September, 2012	CSIR-IICB: Observed Hindi Week during by organizing different competitions like debate in Hindi, noting & drafting competitions and a workshop was conducted on Unicode. The Institute also celebrated National Hindi Day on 14th September, 2012. The chief guest of the day was Prof Tanuja Majumdar, Professor, Presidency University, Kolkata
September 22-23, 2012	CSIR-IICB: Organized Neuro Update-2012, a national symposium of neurobiologists and neurologists, in collaboration with Calcutta National Medical College, Kolkata.
September 25, 2012	CSIR-IICB: Observed 70th Foundation Day of CSIR at its premises. Dr. Samit Adhya, Acting Director, CSIR-IICB presided over the function in which Dr. Saroj Ghose, former Director General, National Council of Science Museums (NCSM) & former President of the International Council of Museums was present as Guest-in chief. Prof. Alok Bhattacharya, School of Life Sciences, Jawaharlal Nehru University & Vice President, Indian National Science Academy (INSA) delivered the Foundation Day invitation lecture.

Events of CSIR-IICB

23rd - 25th November,2012	CSIR-IICB: Organized Hundred Years of Antimonials : An International Conference. The inaugural speech was delivered by Guest-in-chief Prof. Samir Kumar Brahmachari, Director-General, CSIR & Secretary, DSIR, Govt of India. Prof Brahmachari also announced the Sir U. N. Brahmachari Award on this occasion.
January 18-20, 2013	CSIR-IICB: Organized 'NEUROCON 2013' – International Conference on Neurodegenerative and Neuro-developmental Disorders: Translational Aspects; jointly with Department of Biochemistry, Institute of Post Graduate Medical Education and Research, Kolkata
27th – 29th January, 2013	CSIR-IICB: Organized International Symposium on Challenges in Chemical Biology, (ISCCB 2013). Prof. P. Balaram, Director, IISc., Bangalore delivered the inaugural lecture.

SCIENTIST VISITORS

No.	Date	Speaker	Title of Seminar
1.	12.04.2012	**Dr. Debabrata Mandal** M. I. T. Cambridge, Mass.	*Transfer RNA modifications and their role in translational fidelity*
2.	04.05.2012	**Dr. Subrata Ghosh** NIMS, Tsukuba, Japan.	*3D nano-brain, a Dendritic supra molecular architecture, mimicking human brain*
3.	07.06.2012	**Dr. Prasanjit Mazumdar** Cleve Land State University, USA	*An extra-ribosomal function of ribosomal protein L13a, in macrophage resolves inflamation by translation silencing*
4.	11.06.2012	**Dr. Rajkum Halder** The Scripps Research Institute, USA.	*A short walk from catalysts development to drug discovery*
5.	25.07.2012	**Dr. Subhash Ghosh** A*STAR, Singapore.	*Environmentally benign amide synthesis by oxidative amidation of alcohols or aldehydes with amines*
6.	26.07.2012	**Prof. Tanya Das** Bose Institute, Kolkata	*An approach towards modulation therapy of Cancer : Single bullet, multiple targets*
7.	09.08.2012	**Dr. Sudhiranjan Gupta** Texas A & M-Health Science Centre	*NF-kB Mediated miRNA Regulation in Cardiovascular and Metabolic Remodeling*
8.	22.08.2012	**Dr. Kishor Mohanan** Institut des Sciences Moleculaires de Marseille, France	*From radical chemistry to stereoselective synthesis: a swift entry to drug – like heterocycles*
9.	29.08.2012	**Dr Rituparna Sinha Roy** IISER, Kolkata	*Engineering biomolecules for biology and medicine*
10.	10.09.2012	**Dr. Rajesh K Sharma** University of Louisville, KY, USA	*Cancer Biomarkers and Immunotherapics : A Novel Approach for Cancer Treatment and Management*
11.	30.10.2012	**Dr. Anindya Ghosh Roy** University of California, San Diego	*Cell Biology of Axon Regeneration in C. elegans*
12.	31.10.2012	**Dr. Gouriprasanna Roy** The Scripps Research Institute, USA	*ApoB-100-containing lipoproteinsare major carriers of 3-iodothyronamine in circulation*

SCIENTIST VISITORS

No.	Date	Speaker	Title of Seminar
13.	14.11.2012	**Dr. Jayanta Chatterjee** EMBO Postdoctoral Fellow, Germany	*Peptides : from chemical genetics to orally available drugs*
14.	17.12.2012	**Dr. Dipayan Rudra** Sloan-Kettering University, N.Y, USA	*A Complex Regulatory Network : Transcription Factor Foxp3 and its Partners*
15.	27.12.2012	**Dr. Samit Guha** University of Gottingen, Germany	*Design of Artificial Molecular and Ion Recognition Systems*
16.	04.01.2013	**Dr. Suman Nag** Stanford University, USA	*Molecular Level Understanding of Human Cardiomyopathic Mutations*
17.	11.01.2013	**Dr.Kenneth S Shindler, MD** University of Pennsylvania, USA	*Preventing Neuronal Loss Using Eye as a Model*
18.	16.01.2013	**Prof. Amitabha Chattopadhyay** CCMB, Hydrabad	*Role of AcSIR in contemporary India : Some thoughts and perspectives*
19.	04.02.2013	**Dr. Supriya Sen** University of California, San Diego	*Role of RNA binding protein, SRSF3, in metabolism and hepatocellular carcinoma.*
20.	06.02.2013	**Dr. Amitabha Majumdar** Stowers Institute of Medical Inst, USA	*The role of a self-sustaining amyloidogenic protein in persistence of memory*
21.	14.02.2013	**Dr. Nivedita Mitra** Department of Chemistry, Yale university, New Haven, CT.	*Siglecs – A class of membrane proteins in human evolution and disease*
22.	25.02.2013	**Dr. Deva Raj Subramanian** EMBL, Heidelberg, Germany	*Chemical Biology : applying Chemistry to Biological Questions.*
23.	22.03.2013	**Dr. Anirban Majumder** Regenerative Bioscience Center, University of Georgia Athens, GA 30602	Towards tissue representative cellular assays - Derivation of astrocytes from Human embryonic stem cells

SCIENTIST VISITORS

Colloquium Lecture

No.	Date	Speaker	Title of Seminar
1.	10.05.2012	**Dr. Chinmoy Chowdhury** CSIR- IICB, Kolkata	*Capturing the Essence of Molecules: From Designed compounds to Bioactive Natural Products*
2.	22.05.2012	**Prof. Young-Tae Chang** National University of Singapore	*New approach for Molecular Imaging by Diversity Oriented Fluorescence Library Approach (DOFLA)*
3.	14.06.2012	**Dr. Ashok K. Giri** CSIR-IICB, Kolkata	*Arsenic in Ground Water and its impact on health: How Safe Are We?*
4.	19.07.2012	**Dr. Kunal Ray** CSIR-IICB, Kolkata	*A Journey Through The Genetic Landscape of India: Perspective on Diseases*
5.	26.07.2012	**Prof. Vaskar Saha** University of Manchester, USA.	*The Role of the Microenvironment in the Treatment Response in Childhood Leukaemia.*
6.	14.08.2012	**Dr. Mrinal Kanti Ghosh** CSIR-IICB	*Regulation of gene expression in cancer*
7.	24.08.2012	**Prof. Asis Datta** NIPGR, New Delhi	*Dream to bring science to society*
8.	05.09.2012	**Dr. Gautam Sanyal** AstraZeneca R&D Boston, USA.	*Biophysical approaches to targeting DNA replication enzymes for antibacterial drug discovery*
8.	27.09.2012	**Dr. Saikat Chakraborti** CSIR-IICB	*Biomolecular Interaction: Text Mining to Molecular Dynamics*
9.	18.12.2012	**Dr. Syamal Dana** CSIR – IICB, Kolkata	*Chao sand Synchrony : Rhytms of Nature*

SCIENTIST VISITORS

Scientific Presentation

No.	Date	Speaker	Title of Seminar
1.	20.04.2012	**Dr. Poolo Soldati** Silicon Biosystems, Italy	*Sorting and Recovery of Rare Cells by DEP Array : A unique Platform to enable isolation of Single 100% pure Circulating Tumor Cells and Other Biomedical Research relevant Applications*
2.	04.10.2012	**Dr. Richard Kelly & Dr. Emma Wilson** Royal Society of Chemistry, U.K.	*RSC Publishing : How to publish in high impact journals*
3.	10.10.2012	**Mr. Yoichi Iki** Nikon , Tokyo, Japan	*Principle of Super-Resolution Microscope and Nikon Advanced Super Resolution Microscope Technology*
4.	28.02.2013	**Mr. Widmer Urs** Bruker Inc.	*Latest range of NMR Spectrometers*

EXTERNAL FUNDING

PROJECTS ONGOING IN 2012 - 2013

Sl. No	Principal Investigator	Project Title	Funding Agency	Total Fund (Rs. In lakhs)	Duration
1	Bhattacharya Dr. Debasish	Biochemical characterization of the drug 'Placentrex'	Albert David Ltd.	29.25	1999 - June, 14
2	Giri Dr. Ashok K	PRAMA: Probabilistic Risk Assessment Modelling to inform groundwater Arsenic Mitigation	UKIERI	15.38	10.06.08 - 23.10.13
3	Ali Dr. Nahid	A comparative evaluation of the potency and durability of *Leishmania donovani* gp63 DNA – and protein-based vaccines against experimental visceral leishmaniasis	DST	23.23	27.10.08 - 14.07.12
4	Misra Dr. Mridula	Tyr3 -octreotide derivatives: Synthesis, radiolabelling and application as tumor targeted radiopharmaceuticals	DAE	18.76	18.03.09 - 31.03.13
5	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	36.87	25.06.09 - 24.06.13
6	Roy Dr. Syamal	New tools for monitoring drug resistance and treatment response in visceral Leishmaniasis in the Indian subcontinent	DST-European Union	184.53	03.05.09 - 30.04.13
7	Roy Dr. Syamal	Development of a DNA vaccine for visceral leishmaniasis	DST-European Union	75.28	Sept., 09 - Aug., 12
8	Saha Dr. Krishna Das	Effect of the membrane proteins of attenuated *Leishmania donovani* on the growth of cancer cell	ICMR	12.29	01.07.09 - 30.06.12
9	Debnath Dr. Mita Chatterjee	Physicochemcial and biological evaluation of transition metal chelates of some sulfur containing amino acids	ICMR	10.54	21.10.09 - 20.10.12
10	Dana Shyamal K	Chaos synchronization: Exploring technology prospects	DAE	17.98	22.10.09 - 20.10.12
11	Debnath Mita Chatterjee	Evaluation of 99mTc-tricarbonyl chelates fluoroquinolones, nitrofuryl carbazones and nitrofuryl thiosemicarbazone for detecting sites of infection	DAE	16.05	07.12.09 - 31.03.13

EXTERNAL FUNDING

Sl. No	Principal Investigator	Project Title	Funding Agency	Total Fund (Rs. In lakhs)	Duration
12	Chowdhury Dr. Chinmay	Chemical & Biological evaluation of selected Indian medicinal plants for anti-cancer activities	DST	16.22	08.02.10 - 07.02.13
13	Konar Dr. Aditya	Nanotechnology based drug delivery system for prevention of cataract: Proof of concept in a Rabbit Model	DBT	11.97	27.09.10 - 26.09.13
14	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	26.79	01.11.10 - 31.10.13
15	Bhattacharyya Suvendra	Mechanism of mRNA compartmentalization in the cyloplasm of mammalian cells	Wellcome Trust	230.89	01.10.09 - 30.09.14
16	Das Dr. Padma	Studies of anticarcinogenic functiions of compounds isolated from the edible mushroom	DBT	19.42	04.03.11 - 03.03.14
17	Biswas Subhas Chandra	Identifying molecular targets for therapeutic intervention in Alzheimer's disease	DST	33.90	06.07.11 - 05.07.14
18	Mondal Dr. Nirup Bikash	Chemical tranformation of Andrographolide for enhancement of Anticancer Efficacy	DST, WB	10.99	11.07.11 - 31.10.13
19	Biswas Dr. Subhas Chandra	Understanding the molecular basis of neurodegeneration in Alzheimers disease identification and characterization of neurotoxic molecules	DBT	52.60	20.10.11 - 19.10.14
20	Mohanakumar K P	Mitochondrial invlovement in the pathophysiology of neurodevelopmental disorders, ADHD and ASD	DBT	33.97	16.11.11 - 15.11.13
21	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	10.79	20.09.11 - 19.03.14
22	Roychowdhury Susanta	Identification of candidate tumor suppressor genesloci in chromsomes 3,4 and 11 associated with the development of uterine cervical carcinoma	DST	10.20	07.09.11 - 06.09.14
23	Bhattacharya Debasish	Figer-printing and biochemical characterization of the drug, Sterodin	Union Drug Company	12.10	28.03.12 - 27.03.14

EXTERNAL FUNDING

Sl. No	Principal Investigator	Project Title	Funding Agency	Total Fund (Rs. In lakhs)	Duration
24	Khowala Suman	Lignocellulolytic enzymes production by the filamentous fungus Termitomyces clypeatus using low cost agro wastes	DBT	26.09	07.03.12 - 06.03.15
25	Sen (Jr.) Dr. Asish K	Synthesis and characterization of receptor specific mannose/manno-oligosaccharides linked miltefosine derivatives; biological evaluation of their antileishmanial activity	DBT	40.33	21.03.12 - 20.03.15
26	Jaisankar Dr. P	Translation of basic science discoveries on DNA topoisomerases I & II in the clinical arena with respect to leishmaniasis	DBT	48.10	14.03.12 - 13.03.15
27	Mohanakumar Dr. 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	64.01	23.03.12 - 22.03.15
28	Mohanakumar Dr. K P	Effect of hypercholesterolemia on brain function : Effects of indigenous plants components of North-East India	DBT	16.50	23.04.12 - 22.04.15
29	Mandal Dr. Chitra	Evaluation of a blood-based antigen detection assay by quantitating unique sialoglycoprotein specifically induced on erythrocytes for daily diagnosis and monitoring patients with Indian visceral Leishmaniasis in two referral centers	ICMR	7.00	22.03.12 - 21.03.15
30	Bhattacharyya Dr. Debasish	Growth inhibition and destabilation of B- amyloid aggregate by protease derived peptides	DST	40.76	26.03.12 - 25.03.15
31	Giri Dr. Ashok K	Comparative genomic hybridization and MitoChip array analysis of individuals with and without arsenic induced skin lesions	ICMR	12.65	16.04.12 - 30.11.13
32	Ghosh Dr. Mrinal K	Crosstalk between Stat3 and Beta-catenin: Understanding the mechanisms to counteract prostate cancer	SERB, DST	48.10	19.06.12 - 18.06.15
33	Majumder Dr. Hemanta K	A joint INDO-BRAZIL project to decipher biological processes of organisms causing diseases of clinical importance in both the countries	DST	38.43	14.08.12 - 13.08.15

EXTERNAL FUNDING

Sl. No	Principal Investigator	Project Title	Funding Agency	Total Fund (Rs. In lakhs)	Duration
34	Maiti Dr. Nukul Chandra	α-Synuclein and Tau interaction : Implication on neurodegenerative diseases	DBT	88.40	11.12.12 - 25.03.16
35	Sen Dr. Malini	Role of Wnt5a signaling in the initiation and progression of sepsis	DBT	85.25	26.03.13 - 25.03.16

PROJECTS COMPLETED IN 2012 - 2013

Sl. No.	Principal Investigator	Project Title	Funding Agency	Total Fund (Rs. in lakhs)	Duration
1	Ali Dr. Nahid	A comparative evaluation of the potency and durability of leishmanial donovani gp63 DNA – and protein-based vaccines against experimental visceral leishmaniasis	DST	23.23	27.10.08 - 14.07.12
2	Misra Dr. Mridula	Tyr3 -octreotide derivatives: Synthesis, radiolabelling and application as tumor targeted radiopharmaceuticals	DAE	18.76	18.03.09 - 31.03.13
3	Roy Dr. Syamal	Development of a DNA vaccine for visceral leishmaniasis	DST-European Union	75.28	Sept. 09 - Aug. 12
4	Saha Dr. Krishna Das	Effect of the membrane proteins of attenuated Leishmania donovani on the growth of cancer cell	ICMR	12.29	01.07.09 - 30.06.12
5	Debnath Dr. Mita Chatterjee	Evaluation of 99mTc-tricarbonyl chelates fluoroquinolones, nitrofuryl carbazones and nitrofuryl thiosemicarbazone for detecting sites of infection	DAE	16.05	07.12.09 - 31.03.13
6	Chowdhury Dr. Chinmay	Chemical & Biological evaluation of selected Indian medicinal plants for anti-cancer activities	DST	16.22	08.02.10 - 07.02.13

EXTERNAL FUNDING

PROJECT SANCTIONED IN 2012 2013

Sl. No.	Principal Investigator	Project Title	Funding Agencey	Total Fund (Rs. in lakhs)	Duration
1	Mohanakumar Dr. K P	Effect of hypercholesterolemia on brain function : Effects of indigenous plants components of North-East India	DBT	16.50	23.04.12 - 22.04.15
2	Bandyopadhyay Dr. Arun	Comparative genomic hybridization and MitoChip array analysis of individuals with and without arsenic induced skin lesions	ICMR	12.65	16.04.12 – 15.04.13
3	Ghosh Dr. Mrinal K	Crosstalk between Stat3 and Beta-catenin: Understanding the mechanisms to counteract prostate cancer	DST	48.10	19.06.12 – 18.06.15
4	Das Dr. Pijush K	A Joint INDO-BRAZIL Project to decipher biological processes of organisms causing diseases of clinical importance in both the countries	DST	38.43	14.08.12 - 13.08.15
5	Maiti Dr. Nukul Chandra	α-Synuclein and Tau interaction : Implication on neurodegenerative diseases	DBT	88.40	11.12.12 – 10.12.15
6	Sen Dr. Malini	Role of Wnt5a signaling in the initiation and progression of sepsis	DBT	85.25	26.03.13 – 25.03.16

Academic Affairs Division

Dr. Keya Chaudhuri (Head), Dr. Siddhartha Majumdar, Ms Debasree Das, Ms Mahua Bhattacharya, Ms. Lily Das, 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.

As part of the courses, effective presentation & writing skill development, Bioethics-Laboratory safety courses (in workshop mode) have also been introduced.

The division along with HRG were involved in the publication of Course-catalouge, Academic calendar, General guidelines for Faculty members and O-Book for CSIR-IICB PhD programme 2012-13 and organization of Orientation programme for the students enrolling for PhD course work.

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.

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 IICB. The annual procurement budget of 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 IICB that are either purchased by 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

This year in accordance with the official language act, the compliance has been successfully made in the Institute with special reference to implementation of various

practical usage of official language in the daily activities like day to day translation, Hindi word writing and displaying etc. including but not limited to preparation of official memos, general orders, issuance of notices, tenders, etc in bilingual form which is in accordance to rule 3(3) of the official language act. The Hindi week was celebrated in CSIR-IICB during September 10 to 14, 2012. On the 10th of September an essay, noting & drafting competition was organized for the employees & research scholars. There were a noted number of interested participants in this competition.The second day i.e. 11th of September saw the Hindi debate competition. It was conducted by Sri Naveen Prajapti,

Senior Hindi officer, DVC, Kolkata and Sri Vijay Shankar Misra, Hindi teacher of this institute. The topic of the house was 'Pashchatya Sanskriti ka anukaran yuva peedi ke charitra nirman me sahayak hai'. The competitors took great interest in this debate and the enthusiastic participants of the institute gave their best efforts in presenting their arguments in favour of and against the motion.

On 12th September a Hindi workshop was organized for the scientific employees of the institute. The workshop was conducted by senior Hindi Officer Mr P. Paliwal of CSIR-CGCRI, Kolkata. He delivered a lecture on Unicode and helped all the participants to work in Hindi in this mode.

On 13th of September there was Hindi recitation and extempore competition. Hindi poems by noted poets were memorized and recited by the competitors. The institute observed a substantial number of participants in this competition too. The extempore competition in Hindi was also very interesting & exciting. The members of institute participated in this programme in large numbers. The judges for this competition were Sri. B. Gopal Reddy, Deputy General Manager (Hindi), State Bank of India, Kolkata and Sri P. Paliwal, Senior Hindi officer, CSIR-CGCRI, Kokata.Hindi Day was celebrated on 14th September. Dr. T.K. Dhar, Senior Scientist of the institute delivered the welcome address and emphasized on the importance of the official language implementation in the institute. The chief guest on this day was Prof Tanuja Majumdar, Professor of the famous Presidency University of Kolkata. She urged the gathering to work in Hindi and create a conducive environment in this language as Hindi is the official language of the Government and it is the language which binds us all over the country in one thread. Dr S.B.Mandal a senior scientist of this institute

addressed the audience by a short talk on the achievements of Hindi in the institute like the Hindi 'O book', Hindi website and Hindi patrika 'Sanjeevani' and other day to day activities in Hindi. The administrative officer offered vote of thanks and the prizes of the weeklong competitions were given on this day. The programme was ended with screening of an award winning Hindi film in the auditorium 'Main Kalam Hun' which was appreciated by all.

Central Instrumentation

Dr.S.K.Dana(Head), Sri T.K. Mukherjee, Sri A.K. Pramanik, Sri T.P. Nandi, Sri R. Vignesh

Vision

The division supports in-house operation and maintenance of various sophisticated scientific instruments, video-conferencing system and audio-visual systems. Central instrumentation facilities consist of Electron Microscopes (Transmission and Scanning), NMR 300 MHz (Bruker) and NMR 600MHz, Mass Spectrometer. The division has facilitied for UV/IR Spectrophotometers, Ultra Centrifuges and Super Speed Refrigerated Centrifuges. The division attempts to develop simple instruments for biological research like a cell fusion apparatus. In addition, the division carries out basic research in the field of nonlinear dynamics and explores application of synchronization in chaotic electronic circuits, synthetic genetic networks. The division also takes care of the central instrumentation facility to external users mainly from different universities and research institutes in India.

Research and Development

Research activities involve studies of chaos synchronization in nonlinear systems. The studies mainly focused on experimental verification of synchronization in chaotic electronic circuits. Recently, an extension to studies of synthetic genetic networks is made. It concerns theoretical studies on models of synthetic genetic networks, a search for new devices using synthetic genetic networks. An electronic analog of repressilator is proposed which help investigate collective behaviors of several repressilators under quorum sensing type interactions.

Publication Details:

P. Pal, K.Kumar, P.Maity, **S.K.Dana**, (2013) Pattern dynamics near inverse homoclinic bifurcation in Rayleigh-Bénard fulid, *Phys.Rev*.E **87**, 23001

S.K.Bhowmick, Chittaranjan Hens, Dibakar Ghosh, **S.K.Dana,** (2012) Mixed synchronization in chaotic oscillators using scalar coupling, *Phys.Letts*. A **376**, 2490

S.K.Bhowmick, P.Pal, P.K.Roy, **S.K.Dana**, (2012) Lag synchronization and scaling of chaotic attractors in coupled system, *Chaos* **22**, 023151

D.Ghosh, I.Grosu, **S.K.Dana**, (2012) Design of coupling for synchronization in time-delayed systems, *Chaos* **22,** 033111

E.Padmanaban, R.Banerjee, **S.K.Dana**, (2012) Targeting and control of synchronization in chaotic oscillators, *Int.J.Bifur. Chaos* **22** (7) 1250177

A.Sharma, M.Shrimali, **S.K.Dana**, (2012) Phase-flip transition in nonlinear oscillators coupled by dynamic environment, *Chaos* **22**, 023147

S.K.Bhowmick, R.E.Amritkar, **S.K.Dana,** (2012) Experimental evidence of synchronization of time-varying dynamical Network, *Chaos* **22**, 023105

Invited Lectures:

Invited Faculty, DST-SERC School on Nonlinear Dynamics, S.N.Bose Centre for Basic sciences, Kolkata, December, 2012

Invited Speaker, National Conf. Nonlinear System Dynamics, IISER-Pune, July, 2012

Invited Speaker, Workshop on Biological system Modeling, Mizoram University, August, 2012

Deputation Abroad:

Invited speaker, Asia pacific Dynamic Days, Taipei, Taiwan September, 2012

Visiting Scholar (April, 2012 for one month), University of Agriculture, Abeokuta, Nigeria

Honors and Award

Syamal Dana is awarded **Visiting Scholar,** Abdus Salam International Center of Theoretical Physics, Trieste, Italy

Research Fellow(s): Sourav K. Bahowmick, Chittaranjan Hens

ANIMAL HOUSE

Dr. A. Konar (Head), Mr. S. S. Verma, ,Mr. A. Das, Mr. R.K.. Sarkar , Mr. A. Sardar, Mr. J. Middya, Mr. P. Middya, Mr. T. Sarkar, Mr. L. Sardar, Mr. S.K. Midya and Mr. G.Ch. Sardar

CSIR-IICB with its Cpcsea registered animal facility (Registration No 147/1999/CPCSEA) is identified as a key-organization for biomedical research. There are a number of projects where laboratory animals are used as a basic tools. All (animals) but a few special strain of mouse, are being supplied from the in-house breeding colony. Moreover, some other research institutes who have their CPCSEA registration, also collect animals from the facility for their IAEC approved research projects.

The animals are produced and kept in a scientifically maintained environment (Room Temp. 24 , 2 ^{0}C ; relative humidity 55 60%; light and dark schedule 12:12hrs; illumination 400 lux at 1 mt above the floor). The house keeping of the facility acclaimed high appreciation not only from the associated scientists but also the representatives of CPCSEA, representative of different NGOs and private entrepreneurs, distinguished scientists, etc. who visited the facility during this period.

Animals (specially mouse) were purchased from other registered breeders only when the required strain was not available in the colony or when animals of same specification was required in a bulk. However, proper utilization of animals was strictly monitored and animals were produced in such a number, that the number of unutilized animals be minimum but the scientists get their animals as and when they require.

Computer Division

Dr. Asoke Kr. Dasgupta, Mr. Pradeep Sypureddi, Mr. Sujit K. Majumdar, Mr. Prahlad Das

Introduction

Computer Division is backbone of the 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 & Network infrastructure time to time along with setup, maintenance and support.

It 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 programmers. The IT group has been in the forefront of deploying information technologies to help our scientists to be in their chosen area of research and also taken the active part to implement CSIR ERP project in IICB.

The Division has extended its service to 1000 users with 100 Mbps ILL connection from NKN. The present IICB Network facility management system has been upgraded with latest technologies like Radius Server, Webmail, Band width management and RFID. besides these, 600 desktop PC`s, laptops and printers have been procured and distributed to the Staff members including Scientists, Technical and Administrative Staffs.

The Division also extended its services to CSIR-IICB new campus at Salt Lake, Kolkata and handled the project successfully to Establish

Activities

Technical Activities

- Wired and Wireless Networking Solutions & Services
- Internet Connectivity to all Scientists, Staff and Students of IICB
- Cyber Security Solutions
- Infrastructure Procurement, Installation and Maintenance
- ERP Storage Solutions and Backups
- Web Services include Website / Bulletin board / E-Resource Access
- Design and Maintenance of Intranet and IICB Websites

(www.iicb.res.in and www.csiriicb.in)

- 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 IICB Staff members including Scientists, Technical and Administrative Staffs and Students
- Maintenance of IICB Alumni Website
- Technical support in VC and ERP Implementation

ERP SAN

Campus Intranet

Academic Activities

- Dr Asoke Kr Das Gupta has been nominated as a Member of the NIPER , Kolkata advisory committee
- Dr Asoke Kr Das Gupta has been nominated as a faculty member of NIPER , Kolkata & IICB PhD academic course work

Facilities

- High performance servers managing IICB services with Web, DHCP, DNS and Proxy
- Email services
- Electronic Display System
- 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

- Establishment and Implementation of LAN and WiFi system at new campus of IICB Salt Lake, Kolkata
- Member and Active role to implement ERP in IICB including ERP Facilitation center
- Maintenance and Internal hosting services of IICB Alumni Website
- The WiFi System has been introduced at IICB Campus as well as at NIPER Office and NIPER Hostel with latest WIFI MIMO Technology
- Electronic Display System introduced for various types of Official works
- New Website with www.csiriicb.in has been introduced for alternative

Library & Documentation Division

Mr. N. C. Ghosh(Head), Mrs. P. Chatterjee, Mr. S.K. Naskar, Mrs. S. Ganguly, Mr. M. Halder, Mr. S. Nath & Mr. Asoke Ram,

The Division has been providing continuous supports to its users through its collection, systems, facilities and services during the period under review**.**

Collections	**Upto 31.03.2013**
Books (including Hindi)	14096
Journals (print + online) including Indian titles	223
Bound volumes	33811
ADONIS (CD-Rom Database)	743 journals covered full text (1991-2002)
Science-Direct (Back files) (http://www.iicb.res.in/bkfiles_library.html)	202 journals full text up to 1994
Annual Reports	3917
Thesis (CDs)/online	177
Newspapers (English, Bengali & Hindi)	9

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 presented here in quantities.

Services	**Upto 31.03.2013**
Reading Room & E-journals section accessed	4315 users
Photocopy services rendered	4684 pages
Circulation services (Issue/Return)	822 documents
Articles print outs from ADONIS (CD-Rom Database)	27 Articles
Resource Sharing (Electronic Document Delivery Service)	320 Articles
Walk in users	50

Library functions and services are maintained in a computerized environment through library management software **"LIBSYS"** and Online Public Access Catalogue (OPAC) is available at http://14.139.223.107:8080/webopac/html/SearchForm which has utilized as a very useful tool for surfing library collections.

Open Access Repository (IR) maintaining in E-prints for archiving peer reviewed journals articles, Conference papers, Theses and other research documents produced by IICB researchers. This can be

viewed in at: http://www.eprints.iicb.res.in. So far 1397 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 694 till 31/03/2013. It has renewed its subscription to **'SciFinder'** for the period under review and login id & password has been provided to all the NIPER students for accessing 'SciFinder' online round the clock.

ANNUAL
REPORT
2012-13

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), which act as an Mentor Institute. 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.

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 o 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.

Admission of students in 2012-2013

Counselling for admission of students took place in NIPER-Mohali in the month of July, 2013.The orientation programme for the students took place on 1st August, 2012 and the first year first semester classes commenced from 2nd August, 2012.

Academic Programme

Discipline	No. of students
Medicinal Chemistry	15
Natural Products	13
Pharmacoinformatics	09

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, graduated in June, 2012 and the fifth batch of 47 students are in their third semester and they will be completing the course in June, 2013.

The sixth batch of 37 students is in their 2nd semester and they will be graduating in June, 2014.

A total of 500 books have been purchased by NIPER-Kolkata. The Institute subscribes for SciFinder.

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 placement activities for the fifth 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.

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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, CSIR-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
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

PUBLICATION HIGHLIGHTS- 2012

journal impact factor ⩾ 4.0

Research Publication

1.	Chowdhury, S; Mukherjee, T; Mukhopadhyay, R; Mukherjee, B; Sengupta, S; Chattopadhyay, S; Jaisankar, P; Roy, S; Majumder, HK. 2012. The lignan niranthin poisons Leishmania donovani topoisomerase IB and favours a Th1 immune response in mice. EMBO MOLECULAR MEDICINE, 4 (10) : 1126-1143.	**10.333**
2.	Maiti, G; Naskar, D; Sen, M. (2012). The Wingless homolog Wnt5a stimulates phagocytosis but not bacterial killing. PROC.NATL. ACA. SCI., USA, 109(41) : 16600-16605.	**9.681**
3.	Karmakar, S; Bhaumik, SK; Paul, J; De, T. 2012. TLR4 and NKT Cell Synergy in Immunotherapy against Visceral Leishmaniasis. PLOS PATHOGENS, 8(4) Article Number: e1002646.	**9.127**
4.	Sharma, AV; Ganguly, K; Paul, S; Maulik, N; Swarnakar, S; (2012) Curcumin Heals Indomethacin-Induced Gastric Ulceration by Stimulation of Angiogenesis and Restitution of Collagen Fibers via VEGF and MMP-2 Mediated Signaling. ANTIOXIDANTS & REDOX SIGNALING, 16(4) : 351-362.	**8.456**
5.	Pal, C; Bandyopadhyay, U. (2012) Redox-Active Antiparasitic Drugs. ANTIOXIDANTS & REDOX SIGNALING, 17(4) : 555-582	**8.456**
6.	Goyal, M; Alam, A; Iqbal, MS; Dey, S; Bindu, S; Pal, C; Banerjee, A; Chakrabarti, S; Bandyopadhyay, U. 2012. Identification and molecular characterization of an Alba-family protein from human malaria parasite Plasmodium falciparum. NUCLEIC ACIDS RESEARCH, 40(3) : 1174-1190.	**8.026**
7.	Chakraborty, A; Mandloi, S; Lanczycki; CJ, Panchenko, AR; Chakrabarti, S. 2012. SPEER-SERVER: a web server for prediction of protein specificity determining sites (2012) NUCLEIC ACIDS RESEARCH: 40 (W1): W242- W248.	**8.026**
8.	Chakraborty, A; Ghosh, S; Chowdhary, G; Maulik, U; Chakrabarti, S. 2012 DBETH: A Database of Bacterial Exotoxins for Human.NUCLEIC ACIDS RESEARCH, 40(D1) : D615-D620.	**8.026**

9.	Chakraborty, S; Stalin, S; Das, N; Choudhury, ST; Ghosh, S; Swarnakar, S. 2012. The use of nano-quercetin to arrest mitochondrial damage and MMP-9 upregulation during prevention of gastric inflammation induced by ethanol in rat. 2012. BIOMATERIALS. 33(10) : 2991-3001.	**7.404**
10.	Banerjee, T; Mukherjee, S; Biswas, M; Dutta, S; Chatterjee, S; Ghosh, S; Pattari, S; Nanda, NC; Bandyopadhyay, A. 2012. Circulating carboxy-terminal propeptide of type I procollagen is increased in rheumatic heart disease. INTERNATIONAL JOURNAL OF CARDIOLOGY, 156 (1) : 117-119.	**7.078**
11.	Mazumder, A; Maiti, A; Roy, K; Roy, S. 2012. A Synthetic Peptide Mimic of lambda-Cro shows Sequence-Specific Binding in Vitro and in Vivo. ACS CHEMICAL BIOLOGY, 7(6) : 1084-1094.	**6.446**
12.	Chakraborty, A; Mukhopadhyay, A; Bhattacharyya, D; Choudhuri, K; Mukhopadhyay, S; Gangopadhyay, S; Basak, J.(2012) FREQUENCY OF 5382INSC AND 185DELAG MUTATION OF BRCA1 GENE: AN EXPERIENCE FROM EASTERN INDIA. ANNALS OF ONCOLOGY, 23 : 38-39	**6.425**
13.	Vanaerschot, M; Decuypere, S; Downing, T; Imamura, H; Stark, O; De Doncker, S; Roy, S; Ostyn, B; Maes, L; Khanal, B; Boelaert, M; Schonian, G; Berriman, M; Chappuis, F; Dujardin, JC; Sundar, S; Rijal, S. 2012. Genetic Markers for SSG Resistance in Leishmania donovani and SSG Treatment Failure in Visceral Leishmaniasis Patients of the Indian Subcontinent. JOURNAL OF INFECTIOUS DISEASES,206(5): 752-755.	**6.420**
14.	Das, G; Misra, AK; Das, SK; Ray, K; Ray, J. 2012. Role of tau kinases (CDK5R1 and GSK3B) in Parkinson's disease: A study from India. NEUROBIOLOGY OF AGING, 33(7) : Article Number : 485.e9.	**6.189**
15.*	Ghorai, A; Padmanaban, E; Mukhopadhyay, C; Achari, B; Chattopadhyay, P. 2012. Design and synthesis of regioisomeric triazole based peptidomimetic macrocycles and their dipole moment controlled self-assembly. CHEMICAL COMMUNICATIONS, 48(98): 11975-11977.	**6.169**
16.	Sinha, A; Krishnan, V; Sethi, T ; Roy, S; Ghosh, B; Lodha, R; Kabra, S; Agrawal, A. 2012. Metabolomic signatures in nuclear magnetic resonance spectra of exhaled breath condensate identify asthma.	**5.895**

	EUROPEAN RESPIRATORY JOURNAL, 39(2) : 500-502.	
17.*	Mukherjee, S; Tripathi, PN; Mandal, SB. 2012. Allyloxy and Propargyloxy Group Migration: Role of Remote Group Participation in the Synthesis of 5-C-Nucleosides and Other Sugar Derivatives. ORGANIC LETTERS, 14(16) : 4186-4189.	**5.862**
18.	Mukherjee, D; Ghosh, AK; Bandyopadhyay, A; Basu, A; Datta, S; Pattari, SK; Reiter, RJ; Bandyopadhyay, D. 2012. Melatonin protects against isoproterenol-induced alterations in cardiac mitochondrial energy-metabolizing enzymes, apoptotic proteins, and assists in complete recovery from myocardial injury in rats. JOURNAL OF PINEAL RESEARCH, 53(2) : 166-179.	**5.794**
19.	Srivastav, S; Kar, S; Chande, AG; Mukhopadhyaya, R; Das, PK. 2012. Leishmania donovani Exploits Host Deubiquitinating Enzyme A20, a Negative Regulator of TLR Signaling, To Subvert Host Immune Response. JOURNAL OF IMMUNOLOGY, 189(2) : 924-934.	**5.788**
20.	Jash, S; Adhya, S. 2012. Induction of muscle regeneration by RNA-mediated mitochondrial restoration. FASEB JOURNAL, 26(10) : 4187-4197.	**5.712**
21.	Ghosh, J; Das, S; Guha, R; Ghosh, D; Naskar, K; Das, A; Roy, S. 2012. Hyperlipidemia offers protection against Leishmania donovani infection: role of membrane cholesterol. JOURNAL OF LIPID RESEARCH, 53(12) : 2560-2572.	**5.559**
22.	Das, P; Kumar, D; Roy, R; Chowdhury, C; Chatterjee, M. 2012. Andrographolide Analogue Induces Apoptosis and Autophagy Mediated Cell Death in U937 Cells.EUROPEAN JOURNAL OF CANCER. 48, S156-S156	**5.536**
23.	Kumar, D; Mandal, M; Roy, R; Jaisankar, P; Das; P. 2012. Biological Mechanism of Action of Novel-3-(2,5-diphenylfuran-3-yl)-4-methoxy-1H-indole in Human Leukemic Cell Lines. EUROPEAN JOURNAL OF CANCER 48, S219-S219.	**5.536**
24.	Roy, R; Kumar, D; Chowdhury, C; Das, P. 2012. Autophagic and Apoptotic Mechanisms of Death Induced by Sesbania Grandiflora Flower in Human Leukemic Cells.EUROPEAN JOURNAL OF CANCER. 48, S27-S27.	**5.536**

Research Publication

25.	Goyal, M; Singh, P; Alam, A; Das, SK; Iqbal, MS; Dey, S; Bindu, S; Pal, C; Das, SK; Panda, G; Bandyopadhyay, U. 2012. Aryl aryl methyl thio arenes prevent multidrug-resistant malaria in mouse by promoting oxidative stress in parasites. FREE RADICAL BIOLOGY AND MEDICINE, 53(1) : 129-142.	**5.423**
26.	Bose, M; Saha, R; Sen Santara, S; Mukherjee, S; Roy, J; Adak, S. 2012. Protection against peroxynitrite by pseudoperoxidase from Leishmania major FREE RADICAL BIOLOGY AND MEDICINE, 53(10) : 1819-1828.	**5.423**
27.	Paul, J; Karmakar, S; De, T. 2012. TLR-mediated distinct IFN-gamma/IL-10 pattern induces protective immunity against murine visceral leishmaniasis. EUROPEAN JOURNAL OF IMMUNOLOGY, 42 (8) : 2087-2099.	**5.103**
28.	Bhaumik, SK; Paul, J; Naskar, K; Karmakar, S; De, T. 2012. Asiaticoside induces tumour-necrosis-factor--mediated nitric oxide production to cure experimental visceral leishmaniasis caused by antimony-susceptible and -resistant Leishmania donovani strains. JOURNAL OF ANTIMICROBIAL CHEMOTHERAPY, 67(4) : 910-920.	**5.068**
29.	Bhattacharya, A; Biswas, A; Das, PK. 2012. Identification of a protein kinase A regulatory subunit from Leishmania having importance in metacyclogenesis through induction of autophagy. MOLECULAR MICROBIOLOGY, 83(3) : 548-564.	**5.010**
30.	Mandal, S; Mukherjee, S; Chowdhury, KD; Sarkar, A; Basu, K; Paul, S; Karmakar, D; Chatterjee, M; Biswas, T; Sadhukhan, GC; Sen, G. 2012. S-allyl cysteine in combination with clotrimazole downregulates Fas induced apoptotic events in erythrocytes of mice exposed to lead BIOCHIMICA ET BIOPHYSICA ACTA-GENERAL SUBJECTS, 1820(1) : 9-23.	**5.000**
31.	Mandal, S; Mukherjee, S; Chowdhury, KD; Sarkar, A; Basu, K; Paul, S; Karmakar, D; Chatterjee, M; Biswas, T; Sadhukhan, GC; Sen, G. 2012. S-allyl cysteine in combination with clotrimazole downregulates Fas induced apoptotic events in erythrocytes of mice exposed to lead (vol 1820, pg 9, 2012). 2012. BIOCHIMICA ET BIOPHYSICA ACTA-GENERAL SUBJECTS, 1820(7), 878-878.	**5.000**

32.	Khatua, B; Bhattacharya, K; Mandal, C. 2012. Sialoglycoproteins adsorbed by Pseudomonas aeruginosa facilitate their survival by impeding neutrophil extracellular trap through siglec-9. JOURNAL OF LEUKOCYTE BIOLOGY, 91(4) : 641-655.	**4.992**
33.	Chakravarty, R; Banerjee, PC. 2012. Mechanism of cadmium binding on the cell wall of an acidophilic bacterium. BIORESOURCE TECHNOLOGY, 108 : 176-183.	**4.980**
34.	Goyal, M; Alam, A; Bandyopadhyay, U. 2012. Redox Regulation in Malaria: Current Concepts and Pharmacotherapeutic Implications CURRENT MEDICINAL CHEMISTRY, 19(10) : 1475-1503.	**4.859**
35.	Purkait, B; Kumar, A; Nandi, N; Sardar, AH; Das, S; Kumar, S; Pandey, K; Ravidas, V; Kumar, M; De, T; Singh, D; Das, P. 2012. Mechanism of Amphotericin B Resistance in Clinical Isolates of Leishmania donovani. ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, 56(2) : 1031-1041.	**4.841**
36.	Palit, P; Hazra, A; Maity, A; Vijayan, RSK; Manoharan, P; Banerjee, S; Mondal, NB; Ghoshal, N; Ali, N. 2012. Discovery of Safe and Orally Effective 4-Aminoquinaldine Analogues as Apoptotic Inducers with Activity against Experimental Visceral Leishmaniasis. ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, 56(1) : 432-445.	**4.841**
37.	Goswami, S; Bhakuni, RS; Chinniah, A; Pal, A; Kar, SK; Das, PK. 2012. Anti-Helicobacter pylori Potential of Artemisinin and Its Derivatives. ANTIMICROBIAL AGENTS AND CHEMOTHERAPY, 56(9) : 4594-4607.	**4.841**
38.	Kar, S; Palit, S; Ball, WB; Das, PK. 2012. Carnosic acid modulates Akt/IKK/NF-kappa B signaling by PP2A and induces intrinsic and extrinsic pathway mediated apoptosis in human prostate carcinoma PC-3 cells. APOPTOSIS, 17(7) : 735-747.	**4.788**
39.	Biswas, N; Mahato, SK; Chowdhury, AA; Chaudhuri, J; Manna, A; Vinayagam, J; Chatterjee, S; Jaisankar, P; Chaudhuri, U; Bandyopadhyay, S. 2012. ICB3E induces iNOS expression by ROS-dependent JNK and ERK activation for apoptosis of leukemic cells. APOPTOSIS, 17(6) : 612-626.	**4.788**

Research Publication

40.	Ravindran, R; Maji, M; Ali, N. 2012. Vaccination with Liposomal Leishmanial Antigens Adjuvanted with Monophosphoryl Lipid-Trehalose Dicorynomycolate (MPL-TDM) Confers Long-Term Protection against Visceral Leishmaniasis through a Human Administrable Route. MOLECULAR PHARMACEUTICS, 9(1) : 59-70.	**4.782**
41.	Pal, C; Bindu, S; Dey, S; Alam, A; Goyal, M; Iqbal, MS; Sarkar, S; Kumar, R; Halder, KK; Debnath, MC; Adhikari, S; Bandyopadhyay, U. 2012. Tryptamine-Gallic Acid Hybrid Prevents Non-steroidal Anti-inflammatory Drug-induced Gastropathy CORRECTION OF MITOCHONDRIAL DYSFUNCTION AND INHIBITION OF APOPTOSIS IN GASTRIC MUCOSAL CELLS. JOURNAL OF BIOLOGICAL CHEMISTRY, 287 (5) : 3495-3509.	**4.773**
42.	Haldar, S; Chattopadhyay, K. 2012. Interconnection of Salt-induced Hydrophobic Compaction and Secondary Structure Formation Depends on Solution Conditions REVISITING EARLY EVENTS OF PROTEIN FOLDING AT SINGLE MOLECULE RESOLUTION. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(14) : 11546-11555.	**4.773**
43.	Ghosh, S; Basu, M; Roy, SS. 2012. ETS-1 Protein Regulates Vascular Endothelial Growth Factor-induced Matrix Metalloproteinase-9 and Matrix Metalloproteinase-13 Expression in Human Ovarian Carcinoma Cell Line SKOV-3. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(18) : 15001-15015.	**4.773**
44.	Ahmed, SF; Deb, S; Paul, I; Chatterjee, A; Mandal, T; Chatterjee, U; Ghosh, MK. 2012. The Chaperone-assisted E3 Ligase C Terminus of Hsc70-interacting Protein (CHIP) Targets PTEN for Proteasomal Degradation (2012) JOURNAL OF BIOLOGICAL CHEMISTRY: 287 (19); 15996- 16006.	**4.773**
45.	Alam, A; Haldar, S; Thulasiram, HV; Kumar, R; Goyal, M; Iqbal, MS; Pal, C; Dey, S; Bindu, S; Sarkar, S; Pal, U; Maiti, NC; Bandyopadhyay, U. 2012. Novel Anti-inflammatory Activity of Epoxyazadiradione against Macrophage Migration Inhibitory Factor INHIBITION OF TAUTOMERASE AND PROINFLAMMATORY ACTIVITIES OF MACROPHAGE MIGRATION INHIBITORY FACTOR. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(29) : 24844-24861.	**4.773**

46.	Guturi, KKN; Mandal, T; Chatterjee, A; Sarkar, M; Bhattacharya, S; Chatterjee, U; Ghosh, MK. 2012. Mechanism of beta-Catenin-mediated Transcriptional Regulation of Epidermal Growth Factor Receptor Expression in Glycogen Synthase Kinase 3 beta-inactivated Prostate Cancer Cells. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(22) :18287-18296.	**4.773**
47.	Dey, S; Bindu, S; Goyal, M; Pal, C; Alam, A; Iqbal, MS; Kumar, R; Sarkar, S; Bandyopadhyay, U. 2012. Impact of Intravascular Hemolysis in Malaria on Liver Dysfunction. INVOLVEMENT OF HEPATIC FREE HEME OVERLOAD, NF-kappa B ACTIVATION, AND NEUTROPHIL INFILTRATION. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(32) : 26630-26646.	**4.773**
48.	Mukherjee, S; Sen Santara, S; Das, S; Bose, M; Roy, J; Adak, S. 2012. NAD(P)H Cytochrome b(5) Oxidoreductase Deficiency in Leishmania major Results in Impaired Linoleate Synthesis Followed by Increased Oxidative Stress and Cell Death. JOURNAL OF BIOLOGICAL CHEMISTRY, 287(42) : 34992-35003.	**4.773**
49.	Mukherjee, S; Mukherjee, B; Mukhopadhyay, R; Naskar, K; Sundar, S; Dujardin, JC; Das, AK; Roy, S. 2012. Imipramine Is an Orally Active Drug against Both Antimony Sensitive and Resistant Leishmania donovani Clinical Isolates in Experimental Infection. PLOS NEGLECTED TROPICAL DISEASES, 6 (12).	**4.716**
50.	Jana, S; Paul, S; Swarnakar, S. Curcumin as anti-endometriotic agent: Implication of MMP-3 and intrinsic apoptotic pathway. 2012. BIOCHEMICAL PHARMACOLOGY, 83(6) : 797-804.	**4.705**
51.	Vijayan, RSK; Trivedi, N; Roy, SN; ; Bera, I; Manoharan, P; Payghan, PV; Bhattacharyya, D; Ghoshal, N. 2012. Modeling the Closed and Open State Conformations of the GABA(A) Ion Channel - Plausible Structural Insights for Channel Gating. JOURNAL OF CHEMICAL INFORMATION AND MODELING, 52(11) : 2958-2969.	**4.675**
52.	Bhowmick, S; Chatterjee, D; Chaudhuri, K. 2012. Human epithelial cells stimulated with Vibrio cholerae produce thymic stromal lymphopoietin and promote dendritic cell-mediated inflammatory Th2 response. INTERNATIONAL JOURNAL OF BIOCHEMISTRY & CELL BIOLOGY. 44 (11) : 1779-1790.	**4.634**

53.*	Biswas, MK; Patra, SC; Maity, AN; Ke, SC; Das Adhikary, N; Ghosh, P. 2012. Electronic Structures of Ruthenium and Osmium Complexes of 9,10-Phenanthrenequinone. INORGANIC CHEMISTRY, 51(12) : 6687-6699.	**4.601**
54.	Mukhopadhyay, A; Joshi, N; Chattopadhyay, K; De, G. 2012. A Facile Synthesis of PEG-Coated Magnetite (Fe3O4) Nanoparticles and Their Prevention of the Reduction of Cytochrome C. ACS APPLIED MATERIALS & INTERFACES, 4(1) : 142-149.	**4.525**
55.*	Chowdhury, C; Das, B; Mukherjee, S; Achari, B. 2012. Palladium-Catalyzed Approach for the General Synthesis of (E)-2-Arylmethylidene-N-tosylindolines and (E)-2-Arylmethylidene-N-tosyl/nosyltetrahydroquinolines: Access to 2-Substituted Indoles and Quinolines. JOURNAL OF ORGANIC CHEMISTR, 77(11) : 5108-5119.	**4.450**
56.*	Das Adhikary, N; Chattopadhyay, P. 2012. Design and Synthesis of 1,2,3-Triazole-Fused Chiral Medium-Ring Benzo-Heterocycles, Scaffolds Mimicking Benzolactams. JOURNAL OF ORGANIC CHEMISTRY, 77(12) : 5399-5405.	**4.450**
57.	Chatterjee, N; Das, S; Bose, D; Banerjee, S; Das, S (Das, Sujata); Chattopadhyay, D; Das Saha, K. 2012. 2-phenylquinazoline analog with protection against inflammatory injury. TOXICOLOGY AND APPLIED PHARMACOLOGY, 264(2) : 182-191.	**4.447**
58.	Ghosh, A; Ghosh, S; Maiti, GP; Mukherjee, S; Mukherjee, N; Chakraborty, J; Roy, A; Roychoudhury, S; Panda, CK. 2012. Association of FANCC and PTCH1 with the Development of Early Dysplastic Lesions of the Head and Neck. ANNALS OF SURGICAL ONCOLOGY, Volume 19, Pages: S528-S538.	**4.166**
59.	Banerjee, S; Chakraborty, P; Saha, P; Bandyopadhyay, SA; Banerjee, S; Kabir, SN. 2012. Ovotoxic Effects of Galactose Involve Attenuation of Follicle-Stimulating Hormone Bioactivity and Up-Regulation of Granulosa Cell p53 Expression. PLOS ONE, 7(2), Article Number: e30709.	**4.092**
60.	Shasmal, M; Sengupta, J. 2012. Structural Diversity in Bacterial Ribosomes: Mycobacterial 70S Ribosome Structure Reveals Novel Features. PLOS ONE,7(2) Article Number: e31742.	**4.092**

61.	Haldar, S; Paul, S; Joshi, N; Dasgupta, A; Chattopadhyay, K. 2012. The Presence of the Iron-Sulfur Motif Is Important for the Conformational Stability of the Antiviral Protein, Viperin PLOS ONE, 7(2) Article Number: e31797.	**4.092**
62.	Mondal, S; Bhattacharya, K; Mallick, A; Sangwan, R; Mandal, C. 2012. Bak Compensated for Bax in p53-null Cells to Release Cytochrome c for the Initiation of Mitochondrial Signaling during Withanolide D-Induced Apoptosis. PLOS ONE, 7(3) Article Number: e34277.	**4.092**
63.	Mitra, S; Mazumder-Indra, D; Mondal, RK (Mondal, Ranajit K.); Basu, PS; Roy, A; Roychoudhury, S; Panda, CK. 2012. Inactivation of SLIT2-ROBO1/2 Pathway in Premalignant Lesions of Uterine Cervix: Clinical and Prognostic Significances. PLOS ONE, 7(6) Article Number: e38342.	**4.092**
64.	Bhowmik, D; Das, S; Hossain, M; Haq, L; Kumar, GS. 2012. Biophysical Characterization of the Strong Stabilization of the RNA Triplex poly(U).poly(A)(*)poly(U) by 9-O-(omega-amino) Alkyl Ether Berberine Analogs. PLOS ONE, 7(5) Article Number: e37939.	**4.092**
65.	Manna, A; Saha, P; Sarkar, A; Mukhopadhyay, D; Bauri, AK; Kumar, D; Das, P; Chattopadhyay, S; Chatterjee, M. 2012. Malabaricone-A Induces A Redox Imbalance That Mediates Apoptosis in U937 Cell Line. PLOS ONE, 7(5), Article Number: e36938.	**4.092**
66.*	Pal, S; Saha, C; Hossain, M; Dey, SK; Kumar, GS. 2012. Influence of Galloyl Moiety in Interaction of Epicatechin with Bovine Serum Albumin: A Spectroscopic and Thermodynamic Characterization. PLOS ONE, 7(8) Article Number: e43321.	**4.092**
67.	Samanta, S; Ghoshal, A; Bhattacharya, K; Saha, B; Walden, P; Mandal, C. 2012. Sialoglycosylation of RBC in Visceral Leishmaniasis Leads to Enhanced Oxidative Stress, Calpain-Induced Fragmentation of Spectrin and Hemolysis. PLOS ONE, 7(7) Article Number: e42361.	**4.092**
68.	Mookherjee, S; Acharya, M; Banerjee, D; Bhattacharjee, A; Ray, K. 2012. Molecular Basis for Involvement of CYP1B1 in MYOC Upregulation and Its Potential Implication in Glaucoma Pathogenesis. PLOS ONE, 7 (9) Article Number: e45077.	**4.092**

69.	Basu, M; Das, T; Ghosh, A; Majumder, S; Maji, AK; Kanjilal, SD; Mukhopadhyay, I; Roychowdhury, S; Banerjee, S; Sengupta, S. 2012. Gene-Gene Interaction and Functional Impact of Polymorphisms on Innate Immune Genes in Controlling Plasmodium falciparum Blood Infection Level. PLOS ONE, 7(10) Article Number: e46441.	**4.092**
70.	Balwani, S; Chaudhuri, R; Nandi, D; Jaisankar, P; Agrawal, A; Ghosh, B. 2012. Regulation of NF-kappa B Activation through a Novel PI-3K-Independent and PKA/Akt-Dependent Pathway in Human Umbilical Vein Endothelial Cells. PLOS ONE, 7(10) Article Number: e46528.	**4.092**
71.	Chowdhury, AR; Dutta, C. 2012. A pursuit of lineage-specific and niche-specific proteome features in the world of archaea. BMC GENOMICS, 13 Article Number: 236.	**4.073**

Indicates Chemistry Divisional high impact publications

Doctorates from CSIR-IICB in 2012

No.	Recipient's Name	Title of Thesis	University	Date of Award	Supervisor's Name	Division
1.	**Dr. Sanjukta Mukherjee**	Development of Palladium Catalysed Methods for the Synthesis of Novel Heterocycles	J.U.	October, 2012	**Dr. Chinmay Chowdhury**	Chemistry
2.	**Dr. Anup Kumar Sasmal**	Development of Elegant Methods for the Synthesis of Novel Heterocycles	J.U.	October, 2012	**Dr. Chinmay Chowdhury**	Chemistry
3.	**Dr. Pritam Saha**	Transition metal assisted synthesis of novel polycyclic heteroaromatics based on quinolines	K.U.	May, 2012	**Dr. N.B.Mondal and Dr.Shakti P Das**	Chemistry
4.	**Dr. Shubhendu Naskar**	Synthesis of polynuclear azahetrocycles based on Indoles and Fused quinolines	J.U.	December, 2012	**Dr. N.B.Mondal and Dr.Sukdeb Banerjee**	Chemistry
5.	**Krishnendu B. Sahu**	Synthesis of bioactive Polycyclic heteroaromatics via Phase transfer and transition metal catalysed C-C bond forming reaction.	J.U	December, 2012	**Dr. N.B.Mondal and Dr.Sukdeb Banerjee**	Chemistry
6.	**Dr. Shyamal Mondal**	Synthesis of some novel polynuclear hetroaromatics based on quinoline and Isoquinolines	J.U	December, 2012	**Dr. N.B.Mondal and Dr.Sukdeb Banerjee**	Chemistry
7.	**Dr. Rupankar Paira**	Synthesis of Polynuclear Hetero-aromatics mainly based on Pyridine and Quinoline	J.U	December, 2012	**Dr. N.B.Mondal and Dr.Sukdeb Banerjee**	Chemistry

8.	**Dr. Nirmal Das Adhikary**	Synthesis of medium ring azaheterocycles and analogues from carbohydrate derivatives	J.U	August, 2012	**Dr Partha Chattopadhyay**	Chemistry`
9.	**Dr. Ishita Sanyal**	Approaches to stereo selective synthesis of pantolactone, pantothenic acid and their closely related heterocyclic analogues starting from carbohydrate	J.U	December, 2012	**Dr. Asish Kr. Banerjee**	Chemistry
10.	**Dr. Ishita Saha**	Studies on the structural and energetic aspects of the interaction of phenazinium dyes with deoxyribonucleic acids	J.U	October, 2012	**Dr. G.Suresh Kumar**	Chemistry
11.	**Dr. Prithwish K Jana**	Synthesis of ether backbone RNA analogue and the development of a method for carbohydrate homologation	J.U	May, 2012	**Dr. S. B. Mandal**	Chemistry
12.	**Dr. Subhrangshu Mukherjee**	Synthetic studies on the novel chiral heterocycles and nucleosides for carbohydrate derivatives	J.U	November, 2012	**Dr. S. B. Mandal**	Chemistry
13.	**Dr. Jayaraman Vinayagam****	Synthesis and Biological Evaluation of Some Important Heterocycles as Possible Drug Candidates	JU	March, 2012	**Dr. P. Jaisankar**	Chemistry
14.	**Dr. Sanjit Kumar Mahato**	Development of Novel Catalysts for Synthesis of Heterocycles	JU	August, 2012	**Dr. P. Jaisankar**	Chemistry

15.	**Dr. (Mrs.) Ramesh Kumari Dasgupta****	Identification And Characterization Of Anticancer, Antimicrobial, Anti-Inflammatory Compounds From Indian Traditional Medicinal Plants	JU	March, 2012	**Dr. P. Jaisankar**	Chemistry
16.	**Dr. Tanaya Das**	Experimental Evaluation of Naja naja Venom Fraction(s) as an Anticancer Agent.	J.U.	December, 2012	**Dr. S.R. Dungdung**	Cell Biology and Physiology
17.	**Dr. Piyali Saha**	Laboratory appraisal of saponins and phenol derivatives with respect to contragestative and anti-cancer potentials	J.U.	December, 2012	**Dr. S.N. Kabir**	Cell Biology and Physiology
18.	**Ms Debanjali Mitra**	Molecular and Biochemical Studies on the Role of Different Cellular Factors Associated with Reproductive Disorders due to Hypothyroidism.	J.U	May, 2012	**Dr. Sib Sankar Roy**	Cell Biology and Physiology
19.	**Dr. Dipto Bhattacharyya**	Evaluation of medicinal plants at genetic level	J.U	November, 2012	**Dr. Sharmila Chattopadhyay**	Developm ent, Diagn & Biotecnolo
20.	**Dr. Sanjib Dey**	Functional analysis of single nucleotide polymorphism (SNPs) of matrix metalloproteinases (MMPs) for gastric cancer susceptibility in eastern Indian population	J.U	October, 2012	**Dr. Snehasikta Swarnakar**	Drug Development, Diagn & Biotecnology

21.	**Dr. Srijani Ghanta****	Role of Glutathione as a Signaling Molecule through the Overexpression of γ-ECS in Transgenic Plant System		March, 2012	**Dr. Sharmila Chattopadhyay**	Drug Development, Diagn & Biotecnology
22.	**Dr. Nabendu Biswas**	Redox manipulation: An approach for preferential killing of cancer cells by oxidative stress inducers	CU	December, 2012	**DR. Santu Bandyopadhyay**	Cancer Biology & Inflammatory Disorder
23.	**Dr. Somsubhra nath**	Study of the regulation of spindle assembly checkpoint gene, UBCH10 and its role in genomic instability in human cancer	CU	April, 2012	**Dr. Susanta Roychoudhury**	Cancer Biology & Inflammatory Disorder
24.	**Dr.Susmita Mondal**	Investigation for new targeted therapy in leukemia: modulation of sialic acid regulating enzymes and activation of multi-directional signaling by natural products	JU	June, 2012	**Dr. Chitra Mandal**	Cancer Biology & Inflammatory Disorder
25.	**Dr. Kamal Krishna Halder**	Synthesis and Evaluation of Tc-99m (1) tricarbonyl and Tc-99m(V) oxo chelates of amino carboxy and thiol based ligand systems: Utilisation of this approach towards the development of site specific radiopharmaceuticals.	J.U.	June, 2012	**Dr Mita Chatterjee Debnath**	Infectious Diseases & Immunology
26.	**Dr. Souvik Sen Gupta**	DNA topoisomerases of Leishmania: Modulation of Functional activity and drug induced cell killing of the parasite	J.U	2012	**Dr. H.K. Majumder**	Infectious Diseases & Immunology

27.	**Dr. Neeta V.M. Khalkho**	Molecular cloning and biochemical characterization of universal minicircle sequence binding protein (UMSBP) from unicellular flagellate kinetoplastid protozoan parasite Leishmania donovani"	J.U	December, 2012	**Dr. H.K. Majumder**	Infectious Diseases & Immunology
28.	**Dr. Udayan Bhattacharya**	Assessment of the Antimutagenic and Anticancer Activity of Black Tea Polyphernols Theaflavins and Thearubigins and Different Fractions of Thearubigins in Multiple Test Systems	J.U.	July 2012	**Dr. Ashok K. Giri**	Molecular & Human Genetics
29.	**Dr.Sumit Ranjan Das**	Role of telomere-related proteins in the progression of Oral Cancer	J.U.	May, 2012	**Dr. Keya Chaudhuri**	Molecular & Human Genetics
30.	**Dr. Deblina Banerjee**	Molecular and functional analysis of genes underlying POAG pathogenesis	CU	September, 2012	**Dr. Kunal Ray**	Molecular & Human Genetics
31.	**Dr. Debashree De**	Solution Properties of Proteins: Its Application to Biological Extracts.	J.U	December, 2012	**Dr Debasish Bhattacharyya**	Structural Biol & Bioinformatics
32.	**Dr.Rajesh K. Yadav***	Role of active site residues in catalytic activities of ascorbate peroxidase from Leishmania major	JU	December, 2011	**Dr Subrata Adak**	Structural Biol & Bioinformatics

33.	**Dr. Payel Ghosh***		JU	2011	**Dr. M.C. Bagchi**	Structural Biol & Bioinform atics
34.	**Dr. Sisir Nandi***		JU	2011	**Dr. M.C. Bagchi**	Structural Biol & Bioinform atics

* Names not included in previous year (AR 2011-12) list
** Names also included in previous year (AR 2011-12) list

STAFF LIST OF CSIR-IICB AS ON MARCH 31, 2013

Staff Strength at a Glance

Director	…	…	1
Scientist – Gr. IV	…	…	62
Engineer	…	…	4
Technical – Gr. III	…	…	46
Technician – Gr. II	…	…	37
Helper – Gr. I	…	…	16
Administrative Officer	…	…	13
Administrative Staff	…	…	43
Gr. C (Non-Technical)	…	…	13
Canteen Staff	…	…	10
TOTAL	…	…	245

Detailed Staff List

Scientific and Technical

Sl. No.	Employee's Name	Emp. ID	Designation
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. Tarun K. Dhar	63	Do
7.	Dr. Syamal Roy	93	Do
8.	Dr. (Mrs.) Keya Chaudhuri	83	Do
9.	Dr. Sumantra Das	87	Do
10.	Dr. Santu Bandyopadhyay	97	Do
11.	Dr. Partha Chattopadhyay	81	Do
12.	Dr. (Mrs.) Chitra Dutta	95	Do
13.	Dr. (Mrs.) Nahid Ali	103	Do
14.	Dr. Susanta Roychowdhury	98	Do
15.	Dr. S.N. Kabir	90	Do
16.	Dr. Debashish Bhattacharya	96	Do
17.	Dr. U.S. Chowdhury	84	Sr. Principal Scientist
18.	Dr. (Mrs.)Tuli Biswas	109	Do
19.	Dr. Nirup Bikash Mondal	107	Do
20.	Dr. G. Suresh Kumar	105	Do
21.	Dr. (Mrs.) Rukhshana Chowdhury	115	Do
22.	Dr. Arun Bandyopadhyay	445	Do
23.	Dr. P. Jaisankar	112	Do
24.	Dr. Rupak Kr. Bhadra	124	Do
25.	Dr. (Mrs.) Nanda Ghoshal	119	Do
26.	Dr. Asish Kr. Banerjee	116	Do
27.	Dr. Samir Kr. Dutta	111	Do
28.	Dr. (Mrs.) Suman Khowala	118	Do

Sl. No.	Employee's Name	Emp. ID	Designation
29.	Dr. (Miss) Moonmoon Bhowmik	110	Principal Scientist
30.	Dr. Tushar Kanti Chakraborty	99	Do
31.	Dr. (Mrs.) S.R. Dungdung	120	Do
32.	Dr. Tanmoy Mukherjee	125	Do
33.	Dr. Sibsankar Ray	443	Do
34.	Dr. Aditya Konar	441	Do
35.	Dr. (Mrs.) Tripti De	433	Do
36.	Dr. Chinmay Chowdhury	520	Do
37.	Dr. Rupasri Ain	563	Do
38.	Dr. Sucheta Tripathi (Ad-hoc)	570	Do
39.	Dr. (Mrs.) Padma Das	17	Do
40.	Dr. Soumen Datta	503	Do
41.	Dr. Uday Bandopadhyay	521	Do
42.	Dr. K.N. Chattopadhyay	523	Do
43.	Dr. Mrinal Kanti Ghosh	524	Do
44.	Dr. (Mrs) Sarmila Chattopadhyay	447	Do
45.	Dr. Subrata Adak	472	Do
46.	Dr. (Miss) Snehasikta Swarnakar	473	Do
47.	Sri U.K. Barua	464	Senior Scientist
48.	Dr. (Mrs.) Debjani Mondal	123	Do
49.	Mrs. N.V.M. Khalko	122	Do
50.	Dr. (Mrs.) Malini Sen	527	Do
51.	Dr. (Mrs.) Jayati Sengupta	532	Do
52.	Dr. S.N. Bhattacharya	530	Do
53.	Dr. Biswadip Banerji	540	Do
54.	Dr. Subhas Ch. Biswas	547	Do
55.	Dr. Nakul Ch. Maiti	551	Do
56.	Dr. Partha Chakrabarti	561	Do
57.	Dr. Sanjoy Datta	566	Do
58.	Dr. Siddhartha Ray (Ad-hoc)	568	Do
59.	Dr. Ranjan Jana (Ad-hoc)	571	Do
60.	Dr. Arindam Talukdar	572	Do
61.	Dr. R. Natarajan	574	Do

Sl. No.	Employee's Name	Emp. ID	Designation
62.	Dr. Saraswati Garai	528	Scientist
63.	Dr. Indrajit Das	560	Scientist
64.	Dr. (Mrs.) Mridula Misra	142	Principal Technical Officer
65.	Dr. (Mrs.) Krishna Das Saha	143	Do
66.	Dr. (Mrs.) S.E. Besra	145	Do
67.	Sri A.K. Das	151	Do
68.	Dr. (Mrs) Mita Chatterjee Debnath	432	Do
69.	Dr. Siddhartha Majumdar	164	do
70.	Sri Chirantan Debdas	535	Senior Technical Officer (3)
71.	Sri Mohan Lal Jana	167	Do
72.	Dr. Prashanta Kr. Chakraborty	169	Do
73.	Dr. Kalidas Paul	168	Do
74.	Sri Shekhar Ghosh	467	Do
75.	Sri Samir Kr. Roy	171	Do
76.	Dr. Ashok Kumar Dasgupta	172	Do
77.	Sri Surajit Mohan Roy	166	Do
78.	Sri Narayan Ch. Ghosh	499	Do
79.	Sri Binayak Pal	448	Do
80.	Dr. (Mrs.) Aparna Laskar	449	Do
81.	Sri Sandip Saha	494	Supdt. Engineering Gr. III(6)
82.	Sri Susanta Ray	514	Asst. Exec. Engineer Gr. III(4)
83.	Sri B. Jayakumar	517	Do
84.	Mrs. Nirali Bage	466	Asstt. Engineer/ TO
85.	Dr. Sankar Kumar Maitra	174	Senior Technical Officer (2)
86.	Dr. Ardhendu Kr. Mandal	175	Do
87.	Dr. Tapas Sarkar	177	Do
88.	Dr. (Miss) Subhagata Ghosh	179	Do
89.	Sri Arupesh Majumdar	180	Do
90.	Sri R.N. Mandi	185	Do
91.	Dr. Ramdhan Majhi	184	Do
92.	Sri P. Gangopadhyay	186	Do
93.	Sri Asish Mullick	187	Do
94.	Mrs. Dipika Roy	188	Do

Sl. No.	Employee's Name	Emp. ID	Designation
95.	Mrs. Purnima Chatterjee	173	Do
96.	Mrs. Banasri Das	176	Do
97.	Sri Diptendu Bhattacharya	178	Do
98.	Sri Pratap Ch. Kayal	182	Do
99.	Sri E. Padmanaban	496	Do
100.	Sri Kshudiram Naskar	162	Senior Technical Officer (1)
101.	Sri Sandip Chowdhury	411	Technical Officer
102.	Mrs. Arti Khetrapaul	463	Do
103.	Sri Swapan Kr. Mondal	465	Do
104.	Sri Jishu Mandal	495	Technical Assistant
105.	Sri Debashis Banik	513	Do
106.	Sri Sandip Chakraborty	516	Do
107.	Sri T. Muruganandan	539	Do
108.	Sri Karri Suresh Kumar	550	Do
109.	Sri Vigneshwaran M.	552	Do
110.	Sri Santu Paul	556	Do
111.	Sri Sandip Kundu	557	Do
112.	Ms. Debasree Roy	559	Do
113.	Sri Pradeep Sypureddi	569	Do
114.	Sri Ajoy Kr. Pramanik	195	Senior Technician (2)
115.	Sri S.K. Basak	220	Do
116.	Sri Goutam Malik	224	Do
117.	Sri P.K. Chanda	236	Do
118.	Sri S.N. Mondal	237	Do
119.	Sri S.C. Das	241	Do
120.	Sri S.R. Tudu	251	Do
121.	Sri Swapan Kumar Naskar	244	Do
122.	Md. Ayub Shah	344	Do
123.	Sri Sheo Shankar Verma	242	Do
124.	Sri Tapas Chowdhury	246	Do

Sl. No.	Employee's Name	Emp. ID	Designation
125.	Sri Pradip Mondal	383	Do
126.	Sri A.K. Sen	478	Senior Technician (1)
127.	Sri Tarak Prasad Nandi	247	Do
128.	Mrs. Sutapa Ganguly	248	Do
129.	Sri Sanjib Biswas	249	Do
130.	Sri R.P. Gorh	250	Do
131.	Sri Sarit K. Sarkhel	245	Do
132.	Sri Nishikanta Naskar	252	Do
133.	Sri Pallab Mukherjee	253	Do
134.	Sri Ranjit Das	345	Do
135.	Sri Abhijit Paul	450	Do
136.	Sri Anirban Manna	410	Do
137.	Sri Samir Majumder	426	Technician (2)
138.	Md. M. Ahmed	360	Do
139.	Sri Paresh Sarkar	409	Do
140.	Sri Sujit Kr. Majumdar	416	Do
141.	Mrs. Mahua Bhattacharjee	419	Do
142.	Sri Prabir Kr. Das	418	Do
143.	Sri Atanu Maitra	417	Do
144.	Sri Tapan Das	460	Do
145.	Sri Ujjal Roy	529	Technician (1)
146.	Sri Arup Karmakar	534	Do
147.	Sri Soumalya Sinha	546	Do
148.	Nita Chakraborty Ms	553	Do
149.	Akash Gupta Sri	554	Do
150.	Samir Thami Sri	555	Do
151.	Sri Sunil Nath	272	Laboratory Assistant
152.	Sri R.N. Jana	274	Do
153.	Sri Prahlad Das	275	Do
154.	Sri Bhaskar Basu	440	Do
155.	Sri Shyamal Das	279	Do

Sl. No.	Employee's Name	Emp. ID	Desgnation
156.	Sri Madan Halder	479	Do
157.	Sri Amerika Das	280	Do
158.	Sri Nimai Charan Prodhan	282	Do
159.	Sri Sambhu Raul	351	Laboratory Attendant (2)
160.	Sri Suresh Balmiki	353	Do
161.	Sri U.N. Mandi	358	Do
162.	Sri Nandalal Routh	352	Do
163.	Sri S.K. Banik	361	Do
164.	Sri Ashoke Sardar	501	Laboratory Attendant (1)
165.	Sri Ram Kumar Sarkar	502	Do
166.	Sri Shyamal Nath	519	Do

Administration

Sl. No.	Employee's Name	Emp. ID	Designation
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 Asim Kr. Jha	518	*Section Officer (F&A)*
8.	Sri Abhimanyu Kr. Tiwary	533	do
9.	Sri Tapan Kumar Mitra	320	*Section Officer (Stores & Purchase)*
10.	Sri Ratan Bage	397	*Section Officer (Stores & Purchase)*
11.	Sri S.K. Chhatui	312	*Private Secretary*
12.	Sri Debdas Guhathakurta	313	do
13.	Sri Sabyasachi Karmakar	567	*Security Officer*
14.	Sri Kanu Mondal	392	*Assistant (General) Gr. I (Acp)*
15.	Sri K.C. Das	302	*Assistant (General) Gr. I (MACP)*
16.	Mrs. Anjana Mandi	308	do
17.	Mrs. Sanhita Ganguly	427	do
18.	Mrs. Monalisa Bhattacharjee	428	*Assistant (General) Gr. I*
19.	Miss Lily Das	330	do
20.	Mrs. Indira Kundu	331	do
21.	Sri R.N. Hansda	334	do
22.	Sri Prem Singh	335	do
23.	Sri D.K. Kisku	340	do
24.	Sri Alok Ray	396	*Assistant (General) Gr. Ii (MACP)*
25.	Sri Jayanta Pal	510	*Assistant (General) Gr. Ii*
26.	Sri Tarun Kr. Sinha Roy	508	do
27.	Sri Raju Pal	507	do
28.	Sri Ranjit Debnath	509	do
29.	Sri Saugata Das	511	do
30.	Sri Sukhendu Biswas	512	do
31.	Sri Anirudha Das	565	*Assistant (General) Gr. IiI*
32.	Sri A.K. Chanda	327	*Assistant (F&A) Gr. I (MACP)*
33.	Mrs. Banani Dutta	476	*Assistant (F&A) Gr. I (MACP)*
34.	Sri Sanjoy Mukhopadhyay	343	*Assistant (F&A) Gr. I (MACP)*
35.	Mrs. P.L. Saha	332	*Assistant (F&A) Gr. I*
36.	Sri Asit K. Roy	336	*Assistant (F&A) Gr. Ii (MACP)*
37.	Sri M.K. Dutta	338	do
38.	Sri Vishal Agarwal	506	*Assistant (F&A) Gr. Ii*
39.	Sri Panchanan Naskar	322	*Assistant (S&P) Gr. I (MACP)*

Sl. No.	Employee's Name	Emp. ID	Designation
40.	Sri A.B.S. Roy	328	*Assistant (S&P) Gr. I*
41.	Sri Rajib Ray	536	do
42.	Sri Bisweswar Das	342	do
43.	Mrs. Bula Pal	363	*Assistant (S&P) Gr. Ii*
44.	Sri Pradipta Sarkar	505	do
45.	Sri Arnab Sen	504	do
46.	Mrs. Ambalika Nag	321	*Senior Hindi Translator*
47.	Sri Sankar Prasad Dutta	316	*Senior Stenographer (MAcp)*
48.	Sri Dipak Kr. Guin	318	do
49.	Sri Asim Roy	323	*Senior Stenographer (Acp)*
50.	Mrs. Pratima Banerjee	324	*Senior Stenographer (MAcp)*
51.	Sri Shankar Bhakta	325	do
52.	Sri Rabindranath Das	393	*Senior Stenographer*
53.	Sri Gautam Saha	453	do
54.	Sri Saibal Giri	405	do
55.	Sri Sankar Santra	490	do
56.	Smt Moumita Majumdar	491	*Junior Stenographer*
57.	Sri Ashok Ram	348	*Gr-C (Nt) (Acp & MACP)*
58.	Sri Kailash Chandra Nayak	365	*Gr-C (Nt) (MACP)*
59.	Mrs. Gita Ghosh	364	*Gr-C (Nt) (Upgraded)*
60.	Mrs Soma Devi Sharma	401	do
61.	Sri Gopal Ch. Mandal	412	do
62.	Sri Asit Mitra	413	do
63.	Sri Janmanjoy Midya	431	do
64.	Sri Pasupati Midya	430	do
65.	Sri Shyamal Kr. Ghosal	423	do
66.	Sri P.C. Dehury	414	do
67.	Sri Dinesh Mahali	451	do
68.	Sri Manoranjan Adhikary	425	do
69.	Sri Tapan Sarkar	424	do
70.	Sri Tarun Dutta	367	*Asstt. Manager-cum-Store Keeper*
71.	Sri Amal Dutta	369	*Clerk*
72.	Sri Balaram Panda	368	*Halwai-cum-Cook*
73.	Sri Sudhangshu Halder	373	*Tea Maker*
74.	Sri Bimal Das	372	*Bearer*
75.	Sri Ashok Sadhukhan	371	*Bearer*
76.	Sri Badal Haldar	370	*Bearer*
77.	Sri Jagabandhu Biswas	374	*Wash Boy*
78.	Sri Nirapada Halder	375	*Sweeper*
79.	Sri Mantu Das	376	*Sweeper*

Name of Emeritus Scientists / Prestigious Fellowship Holders

1.	Dr. Sibabrata Mukhopadhyay	Emeritus Scientist
2.	Dr. Anil Kr. Ghosh	do
3.	Dr. Nirmalendu Das	do
4.	Dr. A.K. Giri	do
5.	Dr. Prakas R. Maulik	do
6.	Prof. Samaresh Mitra	Sr. Scientist (INSA)
7.	Dr. Alok Kr. Dutta	Sr. Scientist (INSA)
8.	Dr. HK Majumdar	Raja Ramanna Fellow (DAE)
9.	Dr. Saikat Chakraborty	Ramalingaswami Fellow
10.	Dr. Surojit Ghosh	Ramanujan Fellow
11.	Dr. Sujoy Mukherjee	Ramanujan Fellow
12.	Dr. Amitava Sengupta	Ramalingaswami Fellow
13.	Dr. Debabrata Biswas	Ramalingaswami Fellow
14.	Dr. Dipyaman Ganguly	Ramanujan Fellow

Name of the Staff resigned / joined on transfer

Sl.No	Name	Designation	Date	Reason
01	Ms. Moumita Chakrabortty	Tech. Assistant	30.04.2012	Resignation
02	Shri T.K. Dey	SO(SP	02.04.2012	Joined on transfer

Retirees from 1st April, 2012 to 31st March, 2013

Dr. Hemanta Kr. Mazumder
Chief Scientist (G)
31/05/2012

Dr. Ashok. K Giri
Chief Scientist
30/06/2012

Mr. Shyamal Kr. Dey
Section Officer
30/06/2012

Retirees from 1st April, 2012 to 31st March, 2013

Dr. Kunal ray
Chief Scientis
31/07/2012t

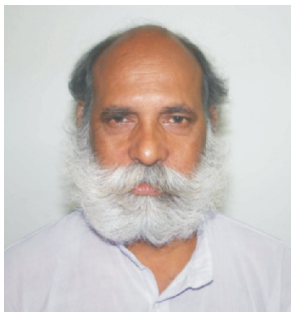
Mr. Niru Kr. Saha
Sr. Purchase Officer
31/ 07/ 2012

Dr. Aparna Gomes
Chief Scientis
30/09/2012t

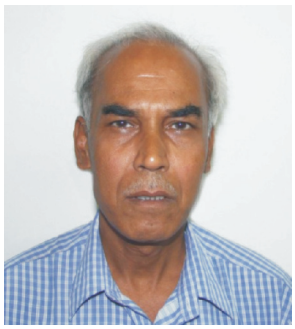
Dr. Sukhdeb Banerjee
Sr. Principal Scientist
30/09/2012

Dr. Pratap Das
Senior Scientist
30/09/2012

Mr. Tapan Kr. Dey
Section Officer
30/09/2012



Mr. Rajendra Mahato
Laboratory Asst.
31/10/2012



Mr. Tapan Kr. Mukherjee
Principal Technical Officer
30/11/2012

Mr. Swades Kr. Sahoo
Principal Technical Officer
30/11/2012

Retirees from 1st April, 2012 to 31st March, 2013

Mr. Swapan Kr. Das
F& Accounts Officer
30/11/2012

Dr. Asish Kr. Sen
Chief Scientist
31/12/2012

Dr. Sukhendu Bikas Mondal
Chief Scientist
31/01/2013

Mr. Sekhar Mukherjee
Sr. Technical Officer
31/01/2013

Mr. Swaqpan Kr. Pradhan
Sr. Technician (2)
31/01/2013

Dr. Shyamal Kr. Dana
Chief Scientist
28/02/2013

Mr. Asit Kr. Das
Principal Technical Officer
28/02/2013

Dr. Tuli Biswas
Senior Principal Scientist
31/03/2013

Mr. Sankar Prasad Dutta
Sr. Stenographer
31/03/2013

New Appointment from 1st April, 2012 to 31st March, 2013

Mr. Pradeep Sypureddi
Technical Assistant
27/08/2012

Dr. Sanjoy Dutta
Senior Scientist
01/06/2012

Mr. Sudipto Chatterjee
Finanace & Accounts Officer
18/02/2013

Dr. Sucheta Tripathy
Principal Scientist(Ad-hoc)
01/10/2012

Dr. Ranjan Jana
Principal Scientist(Ad-hoc)
01/10/2012

Dr. Ramalingam Natarajan
Senior Scientist
18/02/2013

Mr. Sabyasachi Karmakar
Security Officer
01/06/2012

Dr. Siddharta Roy
Principal Scientist(Ad-hoc)
21/08/2012

Dr. Arindam Talukder
Senior Scientist
21/01/2013

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Dr. Mita Chatterjee Debnath, Principal TO, CSIR-IICB	Member
Finance & Accounts Officer, CSIR-IICB	Member
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