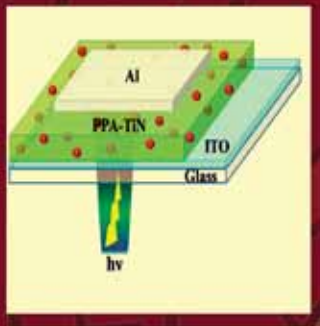
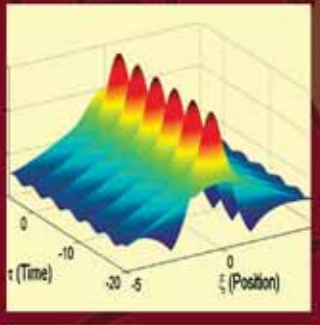
ANNUAL REPORT 15-16

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY (IASST)

An Autonomous Institute under Department of Science and Technology
Govt. of India





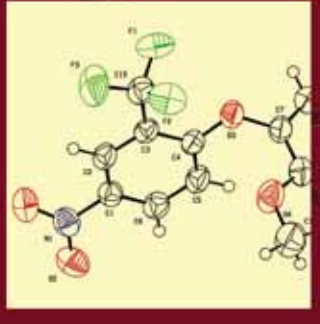


Image description:

- **Front cover:**

o **Left top panel:** TiN based Plasmonic Self-powered Photodetector Ref. Page 44
o **Left middle panel:** Peregrine breathers (left), Protein structure by VMD (right) Ref. Page 21 (left image)
o **Left bottom panel:** ORTEP image of a specific methoxybenzaldehyde (left), Computation and numerical facility, IASST (middle), Outreach programme on Eri silk spinning (right) Ref. Page 136 (left image) Ref. Page 168 (right image)

- **Inside back cover page:** Glimpses of biodiversity inside IASST campus

- **Back cover page:** Glimpses of IASST campus

Cover page design by: Mr. Anupam Bhattacharya, RA, BIF Centre, IASST and Dr. Sourav Kundu, Ramanujan Fellow, LSD, IASST.

CONTENTS

FOREWORD

Institute of Advanced Study in Science and Technology (IASST) has completed the seventh year as an R&D institute under the Department of Science and Technology, Government of India. Previously, it completed 30 years in two phases i.e., under Assam Science Society and the Govt. of Assam's meagre financial support, since its inception in 1979. However, it was only with its taking over in 2009 under the provision of the Assam Accord, the opportunity of fulfilling its original objectives loomed large. IASST's mandates are to (1) emerge as a national centre of excellence with state-of–the-art laboratory facilities in north eastern region, (2) create a strong contingent of scientific manpower for the region and the country and (3) contribute to science in general and generate relevant technologies using rich natural resources of the region through formulations of strong interdisciplinary programmes for societal benefit.The institute is in the transition of rising to the level of excellence by fulfilling these objectives and each year of this phase provides a challenge and opportunities for making accelerated pace of progress to cut short this transition period. To this effect, this Annual Report captures and records activities carried out in different fronts. These include research and developments under the five research programmes, organization of seminar/ workshops/lectures involving distinguished scientists, civil and other engineering works for enhancing research infrastructure, staff and student welfare activity, outreach programmes for ST community and popularization of science among school/college students and general public.

During the year, the institute witnessed nearly doubling of activities and output in a number of fronts. The strength of scientific manpower was 17 core scientists, 8 faculties under different national programmes, 5 post doctoral fellows, 95 Ph.D. scholars and 4 technical officers. It was a fruitful year of engagement of this scientific manpower across five research programmes which resulted in104 publications, 8 patent applications, exposure of scientists and students of IASST to 11 international science events abroad, holding 7 seminars/workshops inside the campus, 21 lectures in IASST auditorium by distinguished scientists from inside and outside the country, award of Ph.D. degrees to 9 SRFs and about 100 hours of lectures by IASST scientists to class IX and X students of seven schools in and around Guwahati city, hosting exposure visits of B.Sc. science students of 10 colleges of North East India and training 47 summer students in different laboratories of IASST.

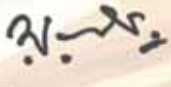
There were several important accomplishments to the credit of the researchers. Basic Plasma Programme group reported first observation of dust acoustic shock waves in strongly coupled dusty plasma and in another experiment they observed for the first time, emergence of dust acoustic multi-solitons from an initial finite amplitude long wavelength perturbation. Plasma based process has been used to prepare Au-polymer nanocomposite and based on this nanocomposite hot hole injection in a photovoltaic device has been demonstrated for the first time. A colorimetric sensor has been developed for heavy metal using nanostructured hybrid biopolymer. Development of antibiotic functionalized silver nanoparticle doped oxygen plasma treated muga silk suture material for quick healing of Methicillin resistant *Staphylococcus aureus* (MRSA) infected post operation wounds was another important innovative research achievement of the institute during the year. Microbial biodiversity group reported for the first time the gut bacterial profile of fifteen Mongoloids and Proto-Austoroids tribes of India. The rise in quality of research and publications is evident from the rise in average Impact Factor (IF) to 2.28/scientist/paper compared to corresponding value of 1.92 of the previous year and several publications in journals with IF above 5.0. This also resulted in enhanced extramural grants including one "unit of excellence" grant to the institute during this year from different funding agencies.

Expansion of research activities demands matching expansion of infrastructure and support system which is motivational for performance of staff. The institute had only one main academic and administrative building without adequate furniture and interior within its 14.1 acre of boundary wall secured land. During the year, eight such research laboratories were upgraded with modular furniture and adequate space for work. While the scientists and staff continue to commute to office on daily basis due to non-existence of residential facility in the campus, accommodation of more than 50% of the research scholars has been ensured in the Students and Scientists Home (SSH) and recreational facility in SSH is enhanced during the year. In fact, several sports and other recreational facility and sessions on yoga, meditation and health camp were organized during the year for physical and mental fitness essential for desired productivity of the entire IASST fraternity.

It was a special year of initiative taken for infrastructure expansion activity. Construction of residential facility for accommodation of essential service staff and the director is in considerable progress. To ensure round the clock power supply, work for installation of a 33 KVA dedicated power line inside the campus has been taken up by the Assam State Power Corporation. Progress has also been made in securing the five acre of institute land, which was lying unused, by earth-filling and the boundary wall raising work. This area will be gradually developed into a Bioresources Conservation Hub (BCH) with focus on conservation of valuable indigenous fruits of the northeastern region of India along with host plant species used in sericulture. Conservation of selected indigenous fishes and provision of breeding and culture of high value protein rich aquatic fauna are other important components planned in the BCH. Flora and fauna of BCH are expected to serve as a treat to eye and education on biodiversity and conservation for visitors to the institute.

The institute has also initiated few societal programmes specially for the scheduled tribe (ST) community of the region. Twenty ST eri silk farmers of two districts, who gave up eri silk production due to disease and other problems, again resumed round the year production by using disease free seeds developed at IASST. These farmers were also provided reeling machine for efficient spinning of eri silk from cocoons. The farmers were able to generate an additional income from this outreach programme of IASST. The institute also introduced high value horticultural crop by raising between perennial coconut and arechanut trees in backyard of households and sustainable nutrient management using farm produced bioinputs in ST villages. Another programme initiated to motivate educated tribal youths to take up mushroom production as an income generating venture.

Overall, the year 2015-16 was very eventful and a step forward in the Insitute's path of progress. This happened due to the able guidance of members of the SAC and GC and contribution of learned members, both from within and outside the institute, of different committees. Above all the resurgent work culture and discharge of duties with sincerity by each and every members of the IASST family were instrumental in giving rise to this upward trend of growth of the institute. Finally, I also compliment the members of the annual report preparation committee whose dedicated efforts and team spirit resulted in the attractive get-up and timely publication of the Annual Report. It is a pleasure to present it to the readers.

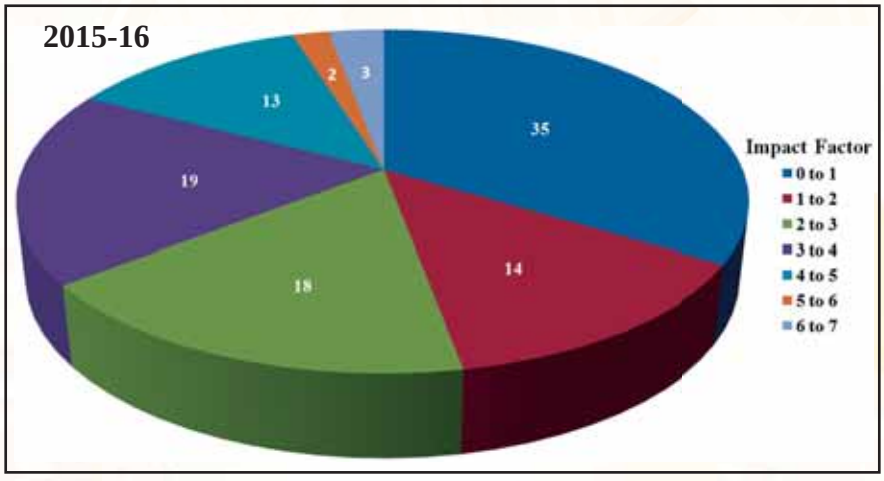


N.C. Talukdar
Director

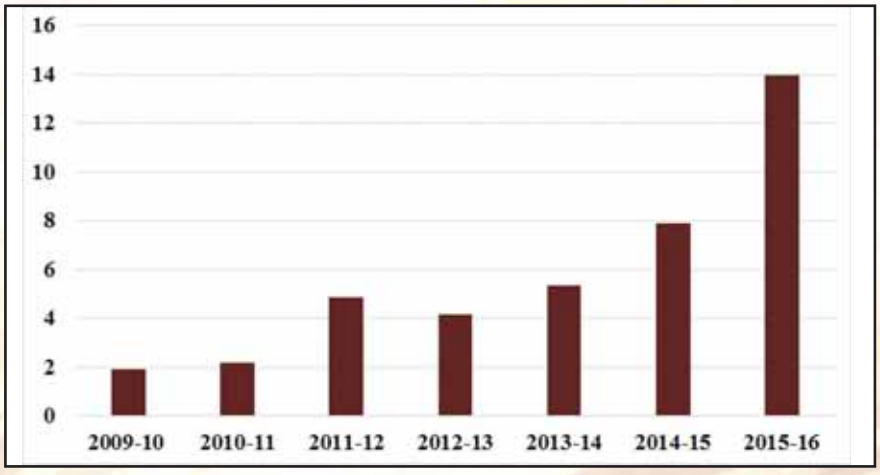
Research output at a Glance: 2015-16

- ❖ **Number of PhD awarded : 9**
- ❖ **Number of MSc/BSc projects guided : 26**
- ❖ **Number of patents : 8 (published)**
- ❖ **Number of peer-reviewed journal publication : 104**
- ❖ **Total journal impact factor : 237.347**

Impact factor publication in chart

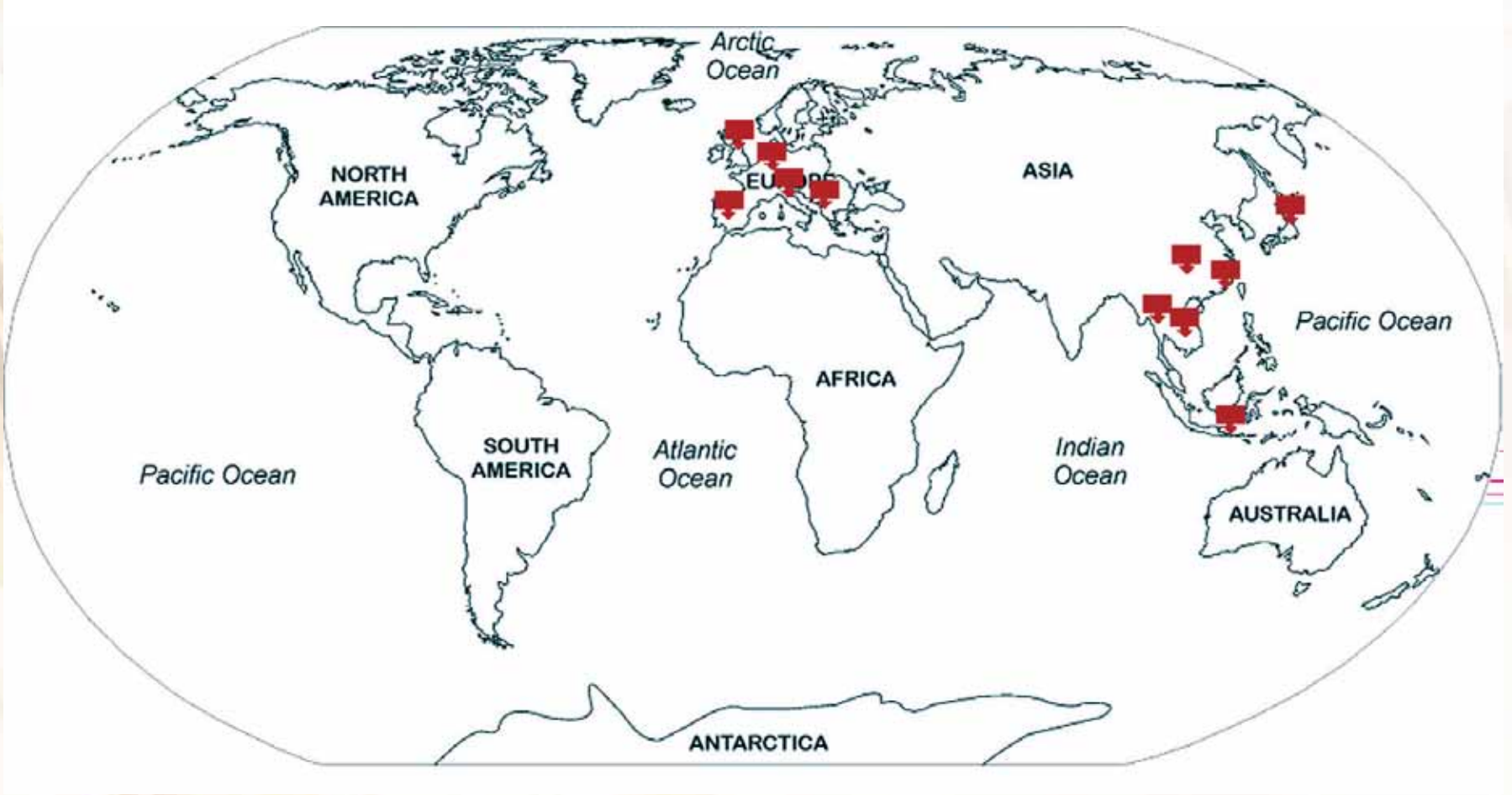


Journal impact factor per scientist



- ❖ **Presentation in conferences/seminar/workshops: 25 (invited talks) & 66 (contributory)**

International visits by researchers of IASST during 2015-16



Highlights of achievements of the year 2015-16

Research

- The average Impact Factor (IF) of research publications per scientist per paper raised to 2.28 from 1.92 of the previous year.
- There are 8 patents filed and published during the year.
- Basic Plasma Physics group of the institute has reported first observation of dust acoustic shock waves in strongly coupled dusty plasma and first observation of emergence of dust acoustic multi-solitons from an initial finite amplitude long wavelength perturbation.
- A plasma based process has been used successfully to prepare Au-polymer nanocomposite and based on this nanocomposite, hot hole injection in a photovoltaic device has been demonstrated for the first time.
- The gut microbial profile of fifteen Mongoloids and Proto-Austoroids tribes of India has been reported for the first time.
- Development of a gold nanoparticle incorporated 'muga' silk suture material for quick healing of stitched wound was another important innovative research achievement.
- The institute received grant of "an unit of excellence" from DBT to study the effect of traditional foods of tribes of north-east, such as rice beer and dairy products, on human gut bacteria and health.

Infrastructure

- Substantial upgradation in the infrastructural facility has been achieved including induction of two new AC vehicles for transportation of staff and research scholars, renovation of the old hostel and upgradation of eight laboratories of research building with modular lab bench and furnitures.
- Work for installation of a 33 KVA dedicated power line inside the campus has been taken up by the Assam State Power Corporation to ensure round the clock power supply in the campus.
- Three faculties under the national programmes of DST & DBT, Govt. of India have joined the scientific community of IASST.

Organization of workshops, seminar and science exposure events

- A number of scientists of national and international repute including Prof. Jitendra Nath Goswami and Prof. P. Balaram visited IASST and delivered lectures.
- IASST hosted and organized 6 workshops and conferences in basic and applied sciences with participation from both academia and industries.
- To ignite the young minds towards science, IASST initiated programmes for school students through motivational lectures in their schools followed by their day long exposure visits in the laboratories of IASST.
- 185 students from 8 schools and science colleges of Assam visited the laboratories of IASST during the year.
- Eleven researchers from IASST received financial support from different funding agencies to present their research works in international seminars/conferences outside India.

Technology outreach for the societal benefit

- IASST took special initiative to enhance income generation venture for the tribal households of Assam through various outreach programmes such as improved techniques of production of *eri* silk, mushroom and cash crops.

BEHIND RESEARCH AND DEVELOPMENT

- **IASST Committees**
- **Institutional Manpower**
- **R&D Facilities at IASST**

IASST Committees

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Department of Science &Technology
Government of India, New Delhi

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Prof. Sibaji Raha
Director
Bose Institute, Kolkata

Prof. Sri Krishna Srivastava
Vice- Chancellor
North-Eastern Hill University (NEHU),
Shillong

Dr. Mridul Hazarika
Vice-Chancellor
Gauhati University, Guwahati

Prof. Rabindranath Pal
Saha Institute of Nuclear Physics (SINP)
Kolkata

Mr. J.B. Mahapatra, IDAS
Joint Secretary and Financial Advisor
Department of Science &Technology
Government of India, New Delhi

Mr. Ashutosh Agnihotri, IAS
Commissioner& Secretary,
Department of Science & Technology
Govt. of Assam, Guwahati

Member -Secretary

Dr. N. C. Talukdar
Director
IASST, Guwahati

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Director
Saha Institute of Nuclear Physics (SINP),
Kolkata

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Vice-Chancellor
North-Eastern Hill University (NEHU),
Shillong

Prof. Sibaji Raha
Director
Bose Institute, Kolkata

Prof. Rahul Mukherjee
Indian Institute of Management, Kolkata

Prof. Veena Tandon
School of Life Sciences, Department of Zoology
North-Eastern Hill University (NEHU),
Shillong

Prof. T. Chakrabarti
Director Grade Scientist
National Environmental Engineering
Research Institute (NEERI), Nagpur

Prof. Arun Chattopadhyay
Chemistry Department
IIT, Guwahati

Dr. D. Ramaiah
Director
North East Institute of Science& Technology (NEIST)
Jorhat, Assam

Member-Secretary

Dr. N. C. Talukdar
Director,
IASST, Guwahati

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Chairperson

Dr. N. C. Talukdar
Director, IASST, Guwahati

Members

Mr. J.B. Mahapatra, IDAS
Joint Secretary and Financial Advisor
Department of Science &Technology
Government of India, New Delhi

Dr. Praveer Asthana
Adviser/Scientist-G, Head (AI and Mega Sc. Prog.)
and Mission Director (Nano Mission)
Department of Science &Technology,
Government of India, New Delhi

Prof. B. C. Tripathy
IASST, Guwahati

Mr. U. C. Das
Registrar
IIT Guwahati

Member-Secretary:

Mr. Pradyut Borkataki
FAO, IASST, Guwahati

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Chairperson

Dr. N. C. Talukdar
Director, IASST, Guwahati

Members

Chief Engineer
CPWD Shillong or his nominee

Prof. Sudeep Talukdar
Department of Civil Engineering
IIT Guwahati

Prof. Heremba Bailung
IASST, Guwahati

Member- Secretary

Dr. Diganta Goswami
Registrar, IASST, Guwahati

Chief Vigilance Officer	:	**Dr. B. K. Shukla,** DST, New Delhi
Vigilance Officer	:	**Prof. (Mrs.) Sabitry Choudhury Bordoloi**, IASST
RTI Officer	:	**Dr. Diganta Goswami**, IASST
Public Grievance Officer	:	**Prof. Binod Chandra Tripathy**, IASST

Institutional Manpower

N. C. Talukdar	DIRECTOR

PHYSICAL SCIENCES DIVISION

Prof. J. Chutia, M.Sc., Ph.D., FNASc.	Emeritus Scientist.
Dr. Heremba Bailung, M.Sc., Ph. D.	Prof.-I & Head
Dr. Neelotpal Sen Sarma, M.Sc., Ph.D.	Associate Professor-1I
Dr. Devasish Chowdhury, M.Sc., Ph.D.	Assoc. Prof.-I
Dr. Arup Ratan Pal, M.Sc., Ph.D.	Assoc. Prof-I
Dr. Sarathi Kundu, M.Sc., Ph.D.	Assoc. Prof.-I
Dr. Nirab Chandra Adhikary. M.Sc., Ph.D.	Technical Officer –B
Dr. Sumita Kumari Sharma, M.Sc., Ph.D.	DST INSPIRE Faculty
Dr. Sagar Sharma, M.Sc., Ph.D.	DST INSPIRE Faculty
Dr. Abhijit Dan, M.Sc., Ph.D.	Ramanujan Fellow
Dr. Biswajit Choudhury, M.Sc., Ph.D.	DST INSPIRE Faculty
Bhabesh Kumar Nath, M.Sc.	SRF
Aziz Khan, M. Sc.	SRF
Neelam Gogoi, M.Sc.	CSIR-SRF
Amreen Ara Hussain, M.Sc.	SRF
Priyanka Dutta, M.Sc.	SRF
Tapan Barman, M.Sc.	SRF
Bedanta Gogoi, M.Sc.	SRF
Sudesna Chakravarty, M. Sc.	SRF
Kaushik Das, M.Sc.	SRF
Upama Baruah, M.Sc.	SRF
Abhijit Baruah, M. Sc.	SRF
Pallabi Pathak, M.Sc.	SRF
Bikash Sharma, M.Sc.	SRF
Manash jyoti Deka, M.Sc.	SRF
Achyut Konwar, M.Sc., M. Tech.	SRF
Ashim Chandra Bhowal, M.Sc.	SRF
Sristi Mazumdar, M.Sc.	JRF
Tonuj Deka, M.Sc.	JRF
Binita Borgohain, M.Sc.	JRF
Hrishikesh Talukdar, M.Sc.	JRF
Deepshikha Gogoi, M.Sc.	JRF
Bandita Kalita, M. Sc.	JRF
Yoshiko Bailung, M.Sc.	JRF
Gautomi Gogoi, M.Sc.	Project Asstt.
Krishna Kanta Swargiary	Technician
Bipul Kumar Das	Multi-Tasking Staff
Babul Ch. Deka	Multi-Tasking Staff
Bijay Kumar Sah	JRF

LIFE SCIENCES DIVISION

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Dr. Debajit Thakur, M.Sc., Ph.D.	Assistant Prof.- II
Dr. Soumyadeep Nandi, M.Sc., Ph.D.	Ramalingaswami Fellow
Dr. Sourav Kundu, M.Sc. Ph.D.	Ramanujan Fellow
Dr. Rosy Mondal, M.Sc. Ph.D.	DST INSPIRE Faculty
Dr. Rupak Kr. Sarma M.Sc. Ph.D.	Research Associate
Dr. Nandana Bhardwaj, M.Sc. Ph.D.	DBT- Bio Care Women Scientist
Anupam Bhattacharya, M.Sc.	Research Associate
Dr. Sushmita Gupta, M.Sc. Ph.D.	DBT Women Scientist
Rictika Das, M.Sc.	DST-DISHA Women Scientist
Juri Pathak, MCA, M.Phil	Technical Officer-A
Julie Bordoloi, B.Sc.	Technical Assistant-II
Subrata Goswami, B.Sc.	Technical Assistant
Sanjeeb Kalita, M.Sc.	SRF
Manasee Choudhury, M.Sc.	SRF
Jintu Dutta, M.Sc.	SRF
Mousumi Saikia, M.Sc.	JRF
Monikankana Kalita, M.Sc.	JRF
Rashmi Rekha Baruah, M.Sc.	JRF
Bhaswati Choudhury, M.Sc.	SRF
Momita Das,M.Sc.	JRF
R Elancheran, M.Sc.	SRF
Raghuram Kandimalla, M.Pharm.	SRF
Himadri Kalita, M.Sc.	SRF
Rahul Sarma , M. Sc.	JRF
Ankita Hazarika, M.Sc.	JRF
Sima Kumari, M.Sc.	JRF
Priyanka Sharma, M.Sc.	SRF
Ranjita Das, M.Sc.	JRF
Garima Raj, M.Sc.	JRF
Manashi Das, M.Sc	SRF
Jilmil Baruah,M.Sc.	JRF
Mohd Shadab , M.Sc.	JRF
Sujata Deka, M.Sc.	JRF
Anurupa Goswami, M.Sc.	DST INSPIRE Fellow
Atlanta Borah, M.Sc.	JRF
Tarun Talukdar	Multi-Tasking Staff
Bolin Das	Multi-Tasking Staff
Sabin Kalita	Multi-Tasking Staff
Haren Medhi	Multi-Tasking Staff

B. RESOURCE MANAGEMENT & ENVIRONMENT SECTION

Prof. (Mrs.) Sabitry Choudhury Bordoloi, M.Sc. Ph.D.	Prof. & Section (i/c) RMES, LSD (up to 29/02/2016)
Dr. Suresh Deka, M.Sc., Ph.D.	Professor –I & i/c RMES, LSD
Dr. (Mrs.) Arundhuti Devi, M.Sc.,Ph.D.	Associate Professor-I
Dr. M.R. Khan, M.Sc., Ph.D.	Assistant Professor-II
Dr. Supriyo Sen, M.Sc., Ph.D.	DBT-RA
Dr. Hemen Deka, M.Sc., Ph.D.	DST (SERB) Young Scientist
Dr. Mrinal Kr. Das, M.Sc.,Ph.D	SRF
Yogesh Babasabeb Chaudhari, M.Sc.	CSIR-SRF
Kaustuvmani Patowary, M.Sc.	SRF
Mihirjyoti Pathak, M.Sc.	SRF
Siddhartha Narayan Borah, M.Sc.	SRF
Jiumoni Lahkar, M.Sc.	SRF
Gitartha Kaushik, M.Sc.	SRF
Madhusmita Dehingia, M.Sc.	SRF
Gitumani Devi, M.Sc.	CSIR-SRF
Jafrin Farha Hussain, M.Sc	JRF
Rupshikha Patowary, M.Sc.	SRF
Priyanka Sarkar, M.Sc.	JRF
Suravi Kalita, M.Sc.	JRF
Vaswati Das M.Sc.	JRF
Rajkumari Sikha, M.Sc.	JRF
Bhuwan Bhaskar, M.Sc.	JRF
Rabiya Sultana, M.Sc	JRF
Suparna Sen, M. Sc.	JRF
Khanindra Sharma, M. Sc.	JRF
Mousumi Bhattacharyya, M.Sc.	JRF
Mamomohan Huzuri, B.Sc.	Technical Assistant
Madan Chandra Kalita	Multi-Tasking Staff
Srikanta Baishya	Multi-Tasking Staff

CENTRAL COMPUTATIONAL AND NUMERICAL STUDIES

Dr. Binod Chandra Tripathy, M.Sc.,Ph.D.	Prof. - I & Head (up to 31/01/2016)
Prof. Jyoti Prasad Medhi , M.Sc., D.Sc.	Honorary Professor
Dr. Gautam Choudhury, M.Sc., Ph.D.	Associate Professor-II & i/c CCNS
Dr. (Mrs.) Lipi B. Mahanta, M.Sc., Ph.D.	Associate Professor-I
Dr. (Mrs.) Munima B. Sahariah, M.Sc.,Ph.D.	Assistant Professor-II
Mr. Niranjan Bhagaboti, M.Sc, ((IT) PGDCA	Technical Officer-B &i/c Internet

Tabassum Yesmin Rahman,M.C.A.	DST Women Scientist
Satyananda Chabungbam, M.Sc.	SRF
Parijat Borgohain, M.Sc	SRF
Santanu Acharjee, M.Sc.	JRF
Manas Jyoti Das, M.Sc.	JRF
Ajay Kr. Saw, M.Sc.	JRF
Ujjal Saikia, M.Sc	JRF
Priyanka Kalita, M.Sc.	JRF
Snigdha Mahanta, M.Sc.	JRF
Karishma Shravan, M.Sc.	JRF
Daisy Das, M. Tech. (CSE)	JRF
Silpisikha Goswami, M. Sc.	JRF
Kangkana Bora, M.Tech.	JRF (DST-INSPIRE)
Balabhadra Pathak	Multi-Tasking Staff

KNOWLEDGE RESOURCE CENTER

Dr. Tarini Dev Goswami, M.L.I.Sc.,M.Phil, Ph.D	Assistant Librarian and i/c KRC
Kumud Baishya	Assistant
Sarala Deka, BA	Multi-Tasking Staff

ADMINISTRATION, ACCOUNTS AND ENGINEERING

Dr. Diganta Goswami, M.Sc. (Agri) Ph.D, PGDIM	Registrar
Pradyut Borkataki, M. Com, LLB, PGDHRM	Finance & Accounts Officer
Bipul Ch. Goswami, B.E. (Civil)	Estate Management Engineer
Rajesh Sharma, B.A.	PRO
Prabodh Kr. Deka, B.A.	Section Officer
Suresh Ch. Sarma, B.Com.	Section Officer
Nayan Talukdar, B.E. (Instrumentation)	Technical Officer (Instrument)
Rabin Ch. Kalita, B.Sc.	Superintendent
Ramen Mahanta, B.Com.	Superintendent
Saraswati Bora, B.A.	Superintendent
Dwijendra Deka, B.A.	Superintendent
Montu Deka, B.E. (Civil)	Junior Engineer
Lelin Gogoi, B.Sc.	PS to Director
Munindra Singh	Technical Assistant
Diganta Das, B.A.	Assistant
Gora Gupta, B.A.	Assistant
Prabhat Ch. Barma	Assistant
Md. Mohmad	Junior Engineer (Civil)
Mrinal Thakuria	Junior Engineer (Electrical)

Sharmina Devi, M.A.	Receptionist
Pinky Taye, M. Com	Assistant
Kalpana B. Das, B.A.	Assistant
Hemanta Sarma, B.Com	Assistant (Accounts)
Nimai Hazam	Driver
Phatik Baishya	Driver
Kumud Patgiri, B.A.	Electrician
Milan Jyoti Das	Innovator
Mukta Ram Kumar, B.A.	Work Supervisor
Sushanta Bharali	Plumber
Ailek Chakhap, B.A.	Driver
Lakshmi Kanta Saud	Multi-Tasking Staff
Madhabi Das	Multi-Tasking Staff
Nripen Ch. Goswami	Multi-Tasking Staff
Satish Ch. Das	Multi-Tasking Staff
Niren Sarma	Multi-Tasking Staff
Ratul Baishya	Multi-Tasking Staff
Binoy Kr. Choudhury	Multi-Tasking Staff
Pradip Das	Multi-Tasking Staff
Madhu Ram Kalita	Multi-Tasking Staff
Munna Basfor	Sweeper
Dinesh Deka	Gardener
Manindra Deka	Cook cum Hostel Care Taker
Madan Kumar Das	Cook
Ajay Baishya, B.A.	Mali
Niru Rajbangshi	Cleaner
Anima Baishya	Cleaner

VISITING RESEARCH PROFESSOR (VRP) AND CONSULTANT

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Dr. Aswani Kumar	Visiting Research Professor
Dr. A.K. Sahu	Visiting Research Professor
Dr. Aswini Bezbaruah	Consultant Medical Officer
Dr. Nalin Mohan	Consultant (Horticulture)
Dr. Jiban Kotoky	Consultant(Public Relation)

R&D Facilities at IASST

Central Instrumentation Facility

Central Instrumentation Facility (CIF) of IASST includes sophisticated equipments to cater to the need of scientists and students of physical, chemical and biological sciences and also for analysis of samples of other researchers of scientific organizations and universities on outsourced basis. Since the time of setting up of this facility a large number of researchers have been benefited by these equipments. The major instruments available in the CIF are Scanning Electron Microscope, *Carl Zeiss, Σigma VP;* X-Ray Diffractometer, *Bruker, D8-Advance;* FT-IR, NICOLATE 6700*;* Gel Permeation Chromatography (GPC), *Waters 2414;* Differential Scanning Calorimetry (DSC), *Perkin Elmer DSC 6000;* Thermogravemetric Analyzer (TGA), *Perkin Elmer TGA 4000;* Tensiometer, *Dataphysics DCAT-11;* Optical Emission Spectrometer, *Andor Technology, Shamrock SR303i;* Microwave digester, *Milstone, Ethos-900;* Ion Chromatograph, *Cecil;* UV-Vis Spectrophotometer, *Shimadzu-1800;* Atomic Absorption Spectrophotometer, *Shimadzu, AA - 7000;* Flame Photometer, *Elico, CL-378;* Biochemical Analyzer, *Merck;* Contact Angle Analyzer, DSA 30E (KRŰSS); DNA-Sequencer, Backman Coulter; Scanning Probe Microscope-NTEFGR Prima, NT-MDT Company, LC-MS-MS, Thermo Fisher and GC-MS-MS -Shimadzu which facilitates determination of known and unknown compounds in environmental samples, food, beverages and microbial and plant metabolite samples.

As a part of ongoing research theme of the institute and also for other researchers of scientific organizations and universities, Plant Tissue Culture room, Plant Growth Chamber, Two-Dimensional (2-D) Gel Electrophoresis facility are the latest edition to the facility created in this year. Plant tissue culture room has been set up to conduct research on microbe free plant, plant microbial interactions, plant secondary metabolites etc. plant growth facility is created within the campus with precise temperature, relative humidity and illumination control to maintain uniform and accurate growth environment for experimental plant growth promotion and other related work like biocontrol of diseases, artificial pathogen inoculation etc.

Plant Tissue Culture Room

Plant growth chamber

Two-Dimensional (2-D) Gel Electrophoresis

Bioinformatics Infrastructure Facility (BIF)

Bioinformatics center at Institute of Advanced study in Science and Technology came into existence in the year 2011 with full financial assistance from the Department of Biotechnology, Govt. of India under DBT-BIF scheme. It is the latest addition to the BTISNet and NEBINet network of DBT, Govt. of India to fulfil the requirements of Bioinformatics tools for research in the life sciences, molecular biology and biotechnology.

The objective of the center is to provide training on bioinformatics both at basic and advanced level in the field of Bioinformatics. The centre organized seminars, workshops and training programmes in order to spread latest knowledge on bioinformatics among the students, teachers and scientists of the entire northeast as a whole. One workshop on Basics of Bioinformatics and two lectures on application of softwares (LeadIT FlexX Basis, LeadIT flex Pharm, LeadIT Corina_F) were organized during the year .

The DBT-BIF is well connected to 100MBPS NKN connectivity of the institute with 24hr high speed Internet connectivity, lecture hall and power backup with 5KV UPS. The hardware facilities of the centre include HP High End Server, HP Desktop PCs, HP Laser Jet CM1415fn color MFP, Linux Enterprise Edition, MS Office 2010. Software facilities include LeadIT FlexX Basis, LeadIT flex Pharm and LeadIT Corina_F.

Institutional Biotech Hub

A biotech hub has been set up in the Institute in 2012 with the financial support from Department of Biotechnology (DBT), Govt. of India. Research scholars of the life sciences division of IASST and undergraduate and postgraduate students of other institutes are trained on basic techniques of microbiology and molecular biology. The hub is also planning to provide exposure of school students to various machines and techniques of biotechnology so that they are motivated towards science as their future career. The hub also organises lectures by eminent scientists for the young faculties and research scholars. Dr. Deepak Sharma, Senior Scientist, Institute of Microbial Technology (IMTECH), Chandigarh delivered a talk on 'The Hsp90 co-chaperone Cpr7 contributes to [URE3] prion stability in *Saccharomyces cerevisae* on 29th December 2015**.**

Medicinal Plant Conservatory (MPC)

IASST life science research programme includes traditional knowledge based drug discovery and development specially using those plants which are used against metabolic syndroms such as diabetic neuropathy and cancer. In the medicinal plant conservatory of IASST, the medicinal plants used in various experiments for scientific validation are planted, multiplied and maintained. Expert plant botanists regularly identify and support in this effort. Currently, the following species of medicinal plants are maintained in MPC of IASST: *Ambellica officinalis, Citrus grandis*, *Citrus morella, Clerodendron colebrookianum, Clerodendron viscosum, Terminalia chebula, Vinca rosea, Eugenia jambolana, Punica granatum, Ocimum sanctum, Cuinamomum tamala, Murrya koenigii, Pepar longum, Rauwalfia serpentina and Terminalia arjuna.*

Animal house

Animal house of IASST is situated in the premises of IASST and it maintains five types of animals viz, Albino rats (Wistar), Albino mice (Swiss) Guinea pigs (Duncan Hartley) and Rabbits (New Zealand white) for use in pre-clinical testing of effect of extracts of herbal formulation, medicinal herbs and also *in-silico* designed synthetic drug on metabolic syndrome, induced in animals model. An Animal Ethics committee constituted as per guidelines for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) which oversees clinical issues in animal experiment. This Animal House is registered with CPCSEA, Government of India, Animal Welfare Division.

Central Computational and Numerical Laboratory

A Central Computational and Numerical laboratory has been established with the aim to provide a up-to-date facility for the students and faculty members of IASST on computation related research work. At present one research group is working on image processing, pattern recognition, simulation of predictive models of epidemiology of lenses and another research group on ab initio electronic structure calculations which require high performance cluster computations.

The laboratory currently has 20 all-in-one PCs each configured for high class performance. Out of these, 14 number of PCs have LINUX Operating system while the rest run on WINDOWS. The laboratory is also equipped with a blade server system presently populated with six number of blades operating on LINUX and is specifically meant for doing cluster computations. The chassis of the blade server system is capable of

accommodating up to fourteen numbers of blades to meet future requirements. The entire laboratory is networked internally through switches and is further connected to institute's network server for external connectivity. The laboratory has some high end softwares like MATLAB-R2012a, Quantum Espresso and VASP (Vienna Ab Initio Simulation Package), apart from the common softwares for data analysis, graphics and documentation.

Knowledge Resource Center

The Knowledge Resource Center (KRC) of IASST continues to extend services and resources for the academic pursuit of the community. The KRC has been mainly catering to the needs of nearly two hundred fifty users comprising of faculty members, research scholars and other staff members of the Institute. In addition, the center also extends services and resources to the users of other academic institutions. The KRC is equipped with modern facilities like scanner, printer, air purifier, provision of remote access etc. and resources (print and electronic) in the forms of online databases, books, journals, theses, reports, etc. It also has an institutional digital repository preserved for institute's intellectual output and wide access within the institute.

The mission of KRC is to facilitate convenient and user friendly access to current, global and relevant information by identifying, acquiring, organizing and retrieving information in various formats (print & non print) to serve the information needs of the academic fraternity of IASST and also to meet their research, consulting, training and learning requirements.

Resource Strength

The resources of KRC are comprised of books, journals and bound volumes (print & online) in the disciplines of plasma physics, polymer science, mathematics & statistics, chemistry, biology, agriculture, biotechnology, environmental science, nano science & technology, bioinformatics, nano- science & technology (Table 1). In addition to these disciplines, there are books on computer science, scientific biographies, general science, literature, short stories, novels, drama, bibliographies etc on both English and Assamese languages. In every financial year the KRC has been adding resources like books, journals and CDs. In addition, being a member of National Knowledge Resource Consortium (NKRC), the KRC gets access to a wide range of online journals and database like Web of Science, SciFinder etc. KRC has a Fiction Section with popular books on English, Hindi, Assamese literature. KRC is subscribed with popular magazines and daily newspapers regularly.

Table 1: Total resource strength of KRC as on March 2015

Resources	Strength
Books	9308
Bound volume of journals	2459
Theses, Dissertations, Reports	2716
Non-Book, materials (CD, DVD, etc.)	646
Gratis books	379
Research papers, IASST	1013

Service Time

The center is open from 9:00 AM to 9:30 PM in two shifts, 9:00 AM to 5:30 PM and 5:30 PM to 9:30 PM in all working days throughout the year except national holidays, Saturdays and Sundays. However, circulation counter is open only from 9:00 AM to 5:30 PM.

The KRC services are available to researchers of other academic institutes. On an average 20 users visit the center per day.

Services and Activities

A number of services and activities of the center during the financial year 2015-2016 are summarized below (Table 2):

Table 2: Summary of Service and activities of KRC during 2015-2016

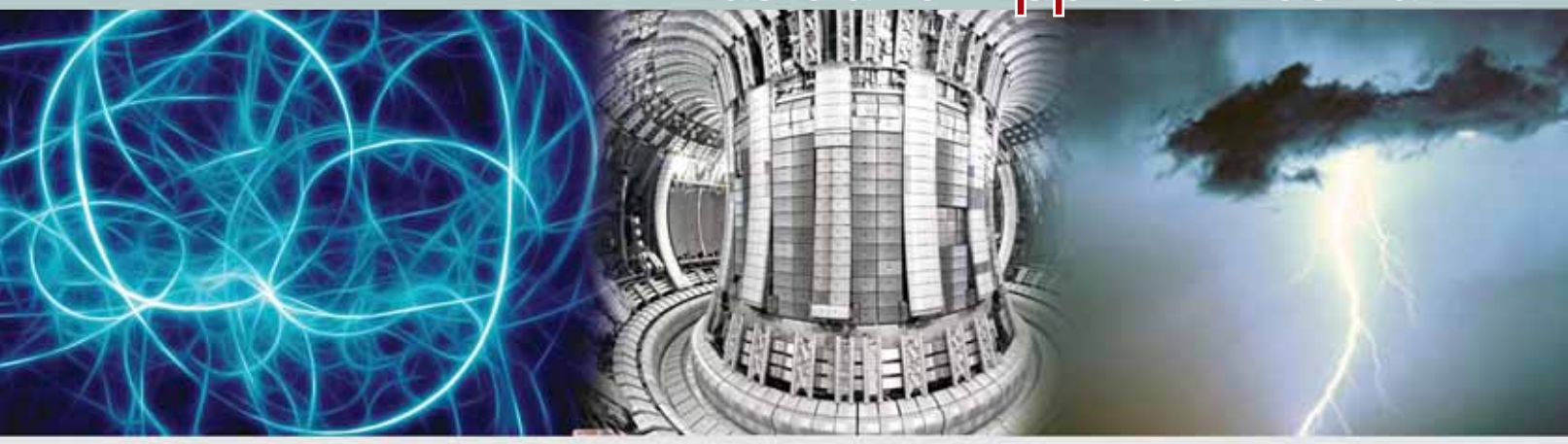
Services	Number
Books newly added	389
Internal visitors	1774
External visitors	163
Circulation of book	1113
Circulation of bound volume journal	140
Photocopy	149655
Annual report mailed	542
Internet applications uses unique visitors	179
Current Awareness Service	163
Selective Dissemination of Information Service	104
Referral service	216
Resource sharing (journal article/ chapter in book)	52
Paper published/ presentation by KRC staff	01
Seminar/ training/ workshop attended by KRC staff	02
Publishers training organized	03
Document Scanning	79
Evening Shift	5:30-9:30 PM

RESEARCH ACTIVITY

- **Reports from research groups**
  - Basic and Applied Plasma
  - Advanced Materials Science
  - Mathematical and Computational Sciences
  - Biodiversity and Ecosystem Reseach
  - Traditional Knowledge Based Drug Development and Delivery
  - Interdisciplinary reports
- **Conference/Seminar/workshops organized**
- **Visit of Distinguished Scientists from other Institutes**

REPORTS FROM RESEARCH GROUPS

Basic and Applied Plasma



In the last few decades theoretical and experimental progress has led to a substantial integration of nonlinear effects in modeling and understanding of plasma dynamics. Dusty plasma is a relatively new field with rich variety of nonlinear processes e.g. shocks and solitons, vortex formation and instabilities relevant to complex dynamics in space or laboratory plasmas. Basic and applied plasma physics group of IASST is engaged in research work on nonlinear characteristics of ion acoustic and dust acoustic shocks and solitons in laboratory plasma. Moreover, the realistic behavior of plasmas in geospace, solar, and laboratory/fusion environments is modulated by strong interactions with adjacent plasmas or boundaries. At IASST, a plasma source with parameters close to the ionospheric condition has been developed to investigate interaction of material surface with ionospheric plasma.

Another frontier area of research within the Basic and Applied Plasma Physics Programme is the development of Proton Exchange Membrane Fuel Cell (PEMFC) by plasma process. PEMFC program is dedicated to develop efficient power source for portable devices. The membrane of the fuel cell through which protons are exchanged by chemical reactions in presence of catalyst has been developed by plasma polymerization and efficient electrode assembly is being prepared by using magnetron discharge sputtering process.

Heremba Bailung
Professor

Joyanti Chutia
Emeritus Professor

Sumita K Sharma
DST INSPIRE Faculty

Nirab C Adhikary
Technical Officer-B

Abhijit Boruah
SRF

Pallabi Pathak
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Binita Borgohain
JRF

Tonuj Deka
JRF

Yoshiko Bailung
JRF

Bhabesh Nath
Project Scientist

Prof. H. Bailung
Programme Head
Dr. Sumita K. Sharma

Basic Plasma Laboratory

Waves, instabilities, solitons, shocks, dynamical structures, sheath

The major research goal of Basic Plasma Physics Laboratory is to explore various fundamental and exotic phenomena which are relevant to space plasmas, laboratory plasmas and some other physical media on earth. Topics of primary interest include waves, instabilities, dynamical structures and sheath in electron-ion plasma, multicomponent plasma and dusty plasma.

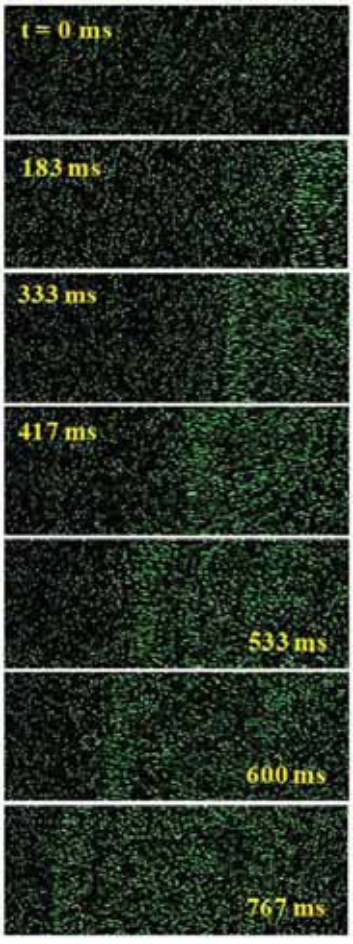


Fig.1: Images showing propagation of dust acoustic shock wave

Dusty plasma is a plasma which contains micrometer to nanometer size charged particles (dust) in addition to electrons and positive ions. Dust exists in almost all plasma space environments such as interstellar clouds, planetary rings, cometary tail etc. Dusty plasma plays an important role in understanding various astrophysical phenomena e.g. cometary tail, spokes in Saturn rings etc. Presence of charged dust in fusion devices have been considered as serious issue for device safety and maintenance of critical parameters. In addition, dusty plasma exhibits several remarkable features like strong coupling effects, plasma crystal formation, propagation of new wave mode namely dust acoustic wave (analogous to sound wave in air), which enable us to study some basic and new physics. In our laboratory we have successfully conducted experiments to study fundamental behavior of dust acoustic wave, dust acoustic soliton (a nonlinear localized wave) and collision between two solitons. Recently we have reported the first

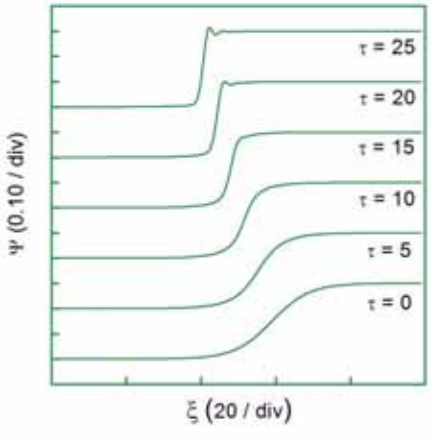


Fig.2: Numerical solution of KdV-Burgers equation showing evolution of dust acoustic shock wave

observation of dust acoustic shock wave in a strongly coupled dusty plasma. A supersonic flow of charged microparticles is allowed to perturb a stationary dust fluid to excite dust acoustic shock wave (Fig. 1). The evolution process beginning with steepening of initial wave front and then formation of a stable shock structure is similar to the numerical results of the Korteweg-de Vries-Burgers (KdV-Burgers) equation (Fig.2). The measured Mach number of the observed shock wave agrees with the theoretical results.

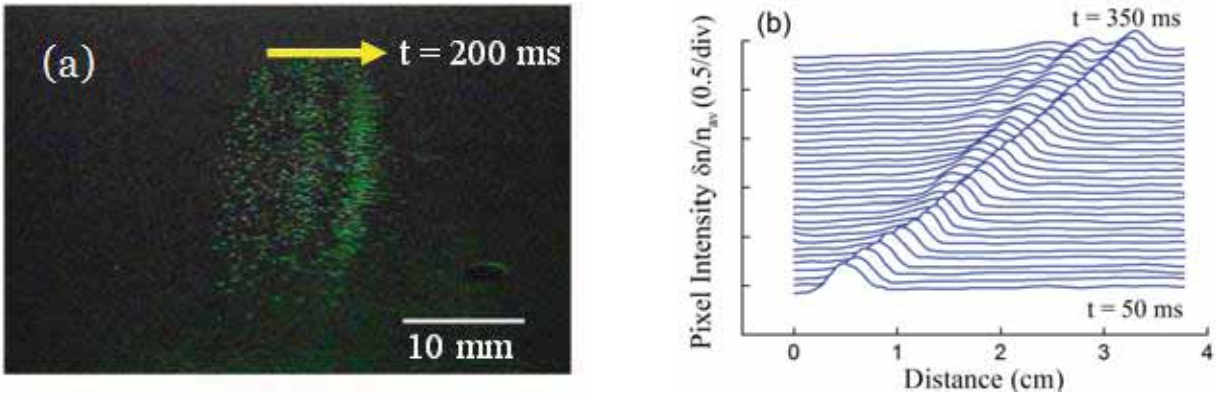


Fig.3: (a) Image showing two dust acoustic solitons, (b) Evolution of dust acoustic solitons at different times.

In another dusty plasma experiment, we observed for the first time emergence of dust acoustic multi-solitons from an initial finite amplitude long wavelength perturbation [Fig.3(a)&(b)]. They propagate at different amplitudes and speeds through the dusty plasma medium and follow the standard KdV soliton route.

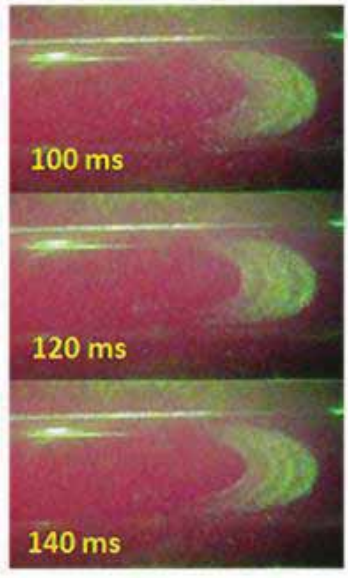


Fig.4 : Images showing dust acoustic instability

We extended our basic experiments in a nano dusty plasma system produced in a small glass tube by externally injecting particle with size distribution ranging from few nanometer to micrometer and with average dust size 50 nm. The formation of void 'a dust free region' is observed (Fig.4) in the middle of the glass tube which is assumed to be due to the interaction of ion drag (outward) and electric field force (inward). We have been able to detect spontaneous dust acoustic instability in the nano dust cloud near the void boundary. The instability frequency is 70-90 Hz and therefore not detectable to human eye. We use a high speed high resolution video camera and recorded the event at 240 – 420 frames per second. Images are extracted frame by frame for analysis using standard image analysis software. Examples of three images frames are shown at an interval of 20 milisecond which indicate clear evolution of bright bands (dust compression) propagating outward from the void boundary. The measured frequency of the observed instability is ~ 75 to 80 Hz which

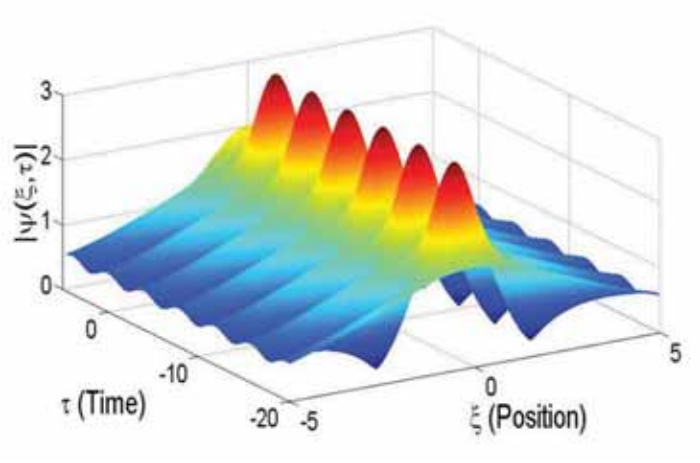


Fig.5: 3D profile of the breather solution obtained from NLSE.

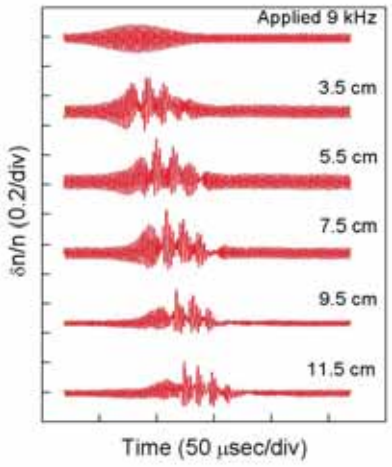


Fig.6: Temporal breathers observed in multicomponent plasma.

is much higher than normal dust acoustic wave frequency (~ 10-20 Hz) for micron size dust grains.

Apart from dusty plasma research, our group is actively involved in studying Peregrine solitons and related breather solutions in multicomponent plasma with negative ions. Peregrine soliton is a doubly localized solution of nonlinear Schrödinger equation (NLSE) which is widely used to describe extreme wave events like rogue waves in ocean. Understanding the evolution process of these high amplitude energetic wave event is essential for timely forecasting to avoid destructive effect. The NLSE also exhibits localized breather solutions which are temporarily or spatially periodic with wave amplitude significantly higher than the background wave (Fig.5). We have experimentally observed the formation of periodic breathers from a slowly varying amplitude modulated wave packet in multicomponent plasma with negative ions (Fig.6). With the increase in modulation frequency of the applied signal, the number of breathers formed inside the envelope increases. The comparison of the experimental results with the theory based on NLSE is going on.

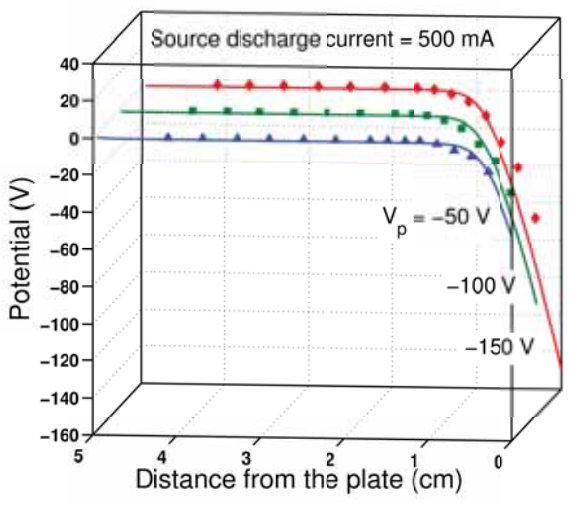


Fig.7: Observed sheath profile (data points) at different plate voltages. The solid line represents theoretical result.

Significant work is performed to achieve Lower Earth Orbit (LEO) plasma conditions (i.e. plasma with

low density and low temperature) in a laboratory device by using a magnetic filter. The magnetic filter has been designed and fabricated indigenously and tested for production of plasma with characteristics close to ionospheric condition. Sheath profile in front of a negatively biased plate in such plasma environment is measured by using an emissive probe. Experimental findings are compared with the theoretical results obtained from the Poisson's equation and are found to be in good agreement (Fig. 7). The study of sheath phenomena in LEO plasma conditions is very important to understand the interaction of ionospheric plasma with spacecraft and satellites.

Prof. Joyanti Chutia

Emeritus Scientist

Applied Plasma Laboratory

Metal Oxide Deposition, Plasma Polymerization, Proton Exchange Membrane, Nanocomposite Solar Cell, Biomaterials, Magnetron Sputtering.

A novel technique has been developed for preparation of nanostructure arrays of electrode catalysts for use in PEMFC (proton exchange membrane fuel cell). This technique is an integration method which involves successive deposition of Pt catalyst arrays one upon another maintaining a uniform time gap. Deposition by integrated approach results in the formation of dense arrays of Pt nanostructure as compared to continuous deposition. These high number density integrated arrays with low Pt loading of 0.10 mg cm^{-2} at the cathode provide enhanced performance compared to non-integrated cathode catalyst prepared by continuous deposition and standard commercial electrodes with Pt loadings of 1 mg cm^{-2}. The performance is compared on the basis of polarization curve measurements and the calculated power density values. PEM fuel cell with dual integrated cathode showed an improved power density of 0.90 W cm^{-2}, which is 25% higher than standard commercial cathodes with maximum power density of 0.67 W cm^{-2} for the Pt loading of 1 mg cm^{-2}.

Table 1: Summary of electrode configurations

Electrode series	E1	E2		E3	
		E2-C	E2-I	E3-C	E3-I
Deposition 1 Pt loading (mg cm-2)	0.05	0.10	0.05	0.15	0.05
Deposition 2 Pt loading (mg cm-2)	--	--	0.05	--	0.05
Deposition 3 Pt loading (mg cm-2)	--	--	--	--	0.05
Total Pt loading (mg cm-2)	0.05	0.10	0.10	0.15	0.15

Table 2: Platinum loading characteristics of prepared MEAs

Sample	Anode Pt loading (mg cm^{-2})	Cathode	
		Sample	Pt loading (mg cm^{-2})
MEA1	1	Standard	1
MEA2-C	0.05	E2-C	0.10
MEA2-I		E2-I	0.10
MEA3-C		E3-C	0.15
MEA3-I		E3-I	0.15

MEAs (Membrane Electrode Assemblies) are assembled by hotpressing Nafion 212 membrane sandwiched between the prepared electrodes at 130 ^{o}C under a pressure of 0.5 tons for 150s. The Pt loading characteristics of the prepared MEAs are presented in Table 2.

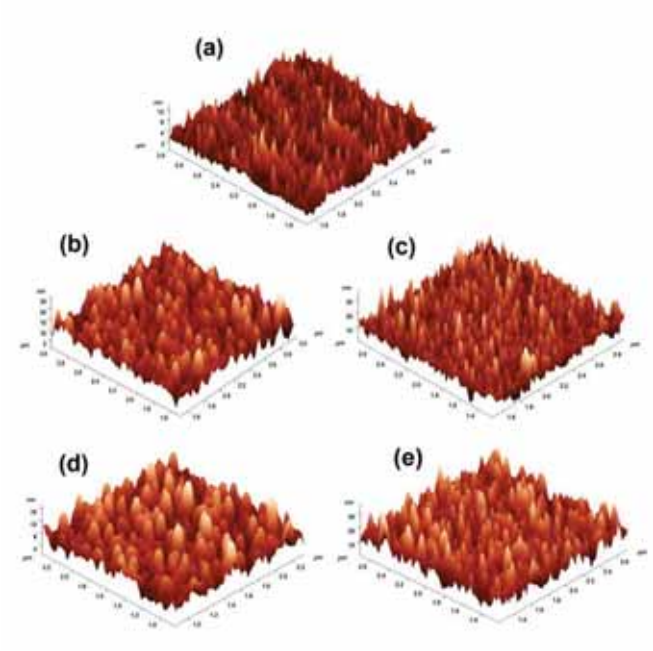


Fig.1: AFM micrographs of (a) E1, (b) E2-C, (c) E2- I, (d) E3-C and (e) E3- I

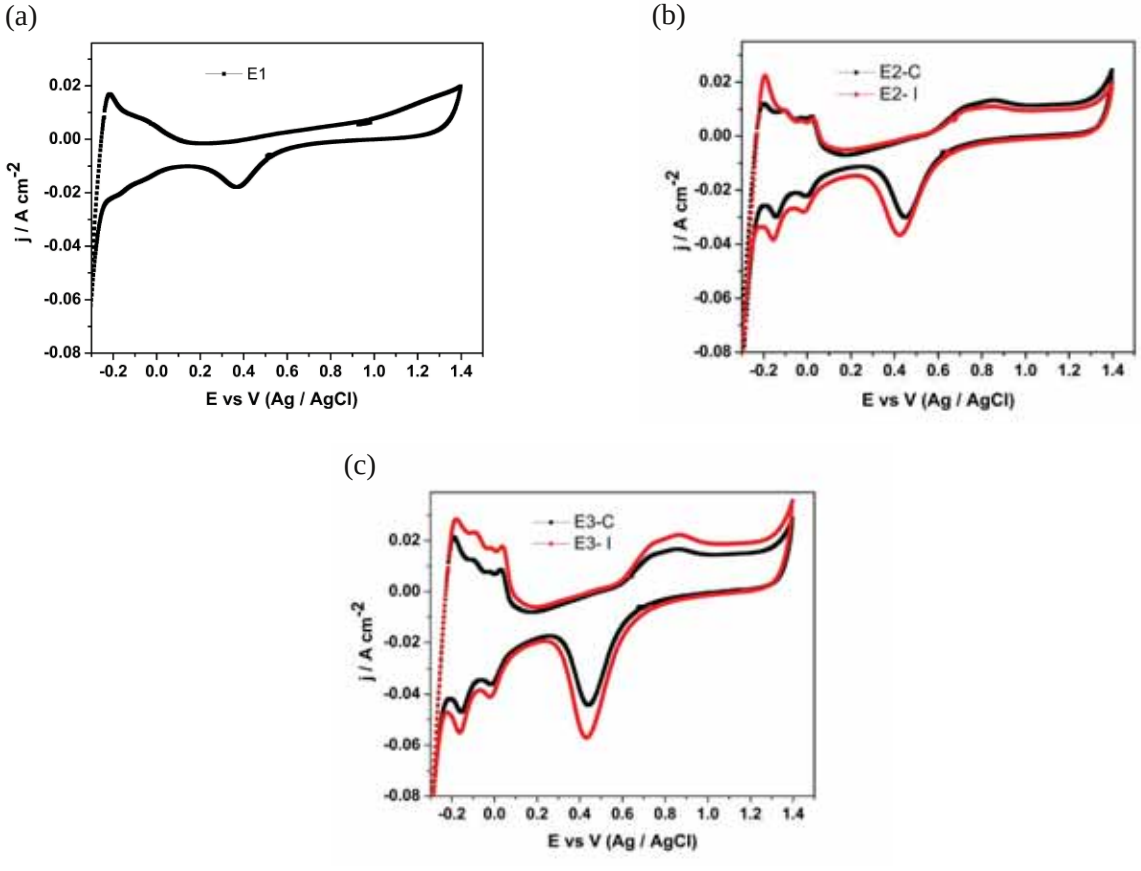


Fig2. : Cyclic voltammograms recorded in 1 M H2SO4 at a scan rate of 50 mV s^{-1} for sample with Pt loading of (a) 0.05 mg cm^{-2}, (b) 0.10 mg cm^{-2} and (c) 0.15 mg cm^{-2}

With a Pt loading of 0.1 mg cm^{-2}, E2-C prepared by continuous deposition has a number density of 6.2 $X10^{9}$ cm^{-2} while E2-I consisting of integrated nanostructure records a density of 1.2 X 10^{10} cm^{-2}, clearly indicating a rise in the number of nanostructures for the same Pt loading. Even for Pt loading of 0.15 mg cm^{-2} the number density increases from 4.4 X 10^{9} to 6.2 X 10^{9} cm^{-2} for E3-C and E3-I respectively.

Table 3: Characteristic electrochemical data of the prepared

Sample	Pt loading ($mg\ cm^{-2}$)	Q_H ($mC\ cm^{-2}$)	$Q_{H/Pt}$ ($mC\ mg^{-1}$)	ECSA ($m^2\ g^{-1}$)
E1	0.05	19.74	394.8	188.0
E2-C	0.10	22.50	225.0	107.1
E2-I	0.10	30.50	305.0	145.2
E3-C	0.15	31.99	213.3	101.5
E3-I	0.15	42.05	280.3	133.5

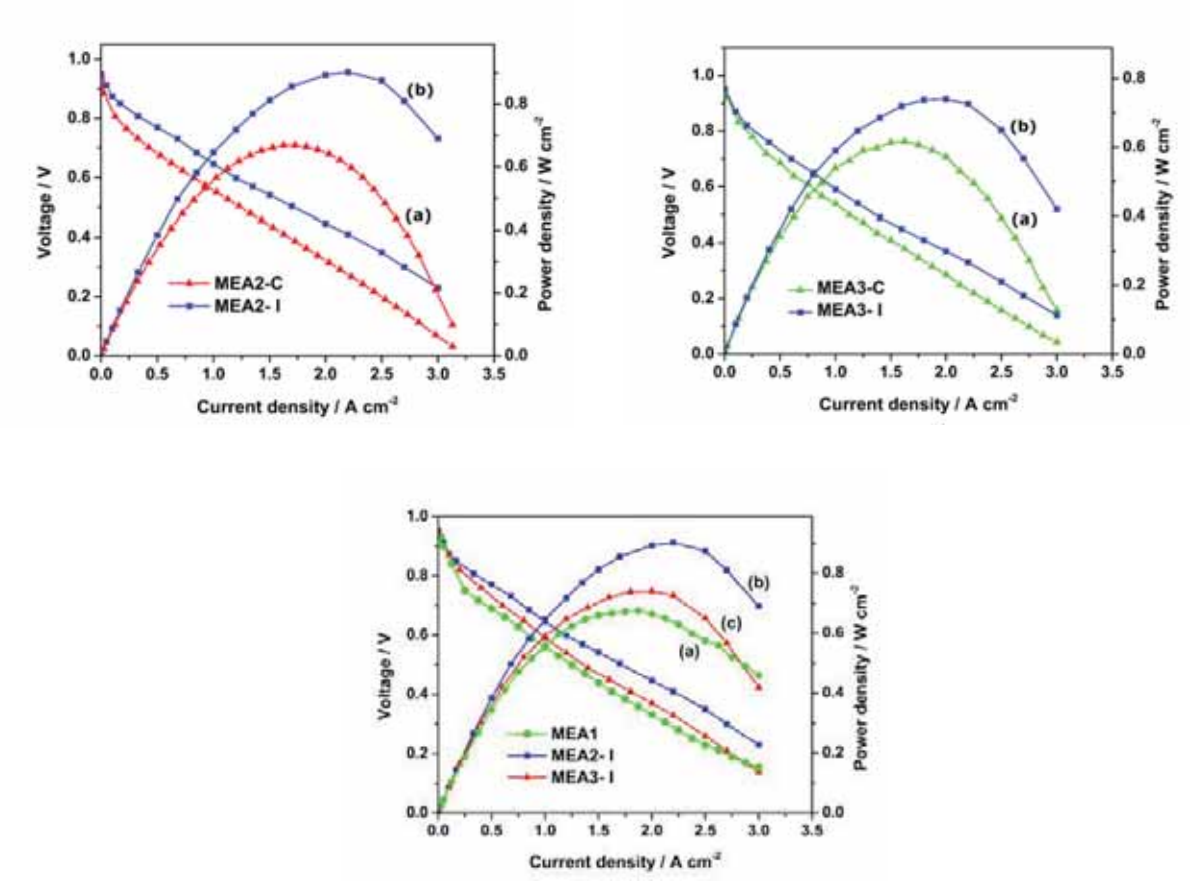


Fig. 3 : Comparison of single cell performance of prepared MEAs

Table 4: Performance measurements of tested MEAs

Sample	Anode Pt loading (mg cm^{-2})	Cathode loading (mg cm^{-2})	Cathode type	Power density (W cm^{-2})
MEA1	1	1	Standard	0.67
MEA2-C	0.05	0.10	Continuous	0.67
MEA2-I		0.10	Integrated	0.90
MEA3-C		0.15	Continuous	0.62
MEA3-I		0.15	Integrated	0.73

The use of integrated catalyst introduces structural advantage over continuously deposited catalysts. The number density of nanopillars is increased by integrated deposition which enhances the rate of electrochemical reactions at the cathode. As a result the overall fuel cell performance of integrated catalyst is better than continuously deposited catalyst with same Pt loading of 0.10 mg cm^{-2}. The maximum power density of 0.90 mg cm^{-2} recorded for 2-fold integrated catalyst is approximately 125% of continuously deposited catalyst that records power density of 0.67 mg cm^{-2}. The performance is also better than 1 mgPt cm^{-2} loaded standard cathodes, suggesting a low loaded catalyst alternative to reduce the overall cost of the fuel cell.

Dr. Nirab C. Adhikary

Plasma Physics, Nanomaterial.

An investigation on the dust acoustic (DA) shock waves with non-thermal and vortex-like ions in dusty plasma is carried out. Propagation characteristics of non-linear dust acoustic (DA) waves in an un-magnetized dusty plasma system containing non-thermal and vortex-like ions and Maxwellian electrons under the effect of a fluctuating charged dust fluid is studied. The three-dimensional (3D) Burgers' equation and a new form of a lower degree modified 3D Burgers' Equation with their analytical solutions are derived to study the features of shock waves in such plasmas. The effect of the population of non-thermal ions, the vortex-like ion parameter as well as the temperature ratios of ions and electrons on the evolution of shock waves in the presence of dust charge fluctuation is presented. This theoretical investigation might be effectively utilized to unveil the nature of many astrophysical plasma environments (Saturn's spokes etc.) where such plasmas are reported to have existed.

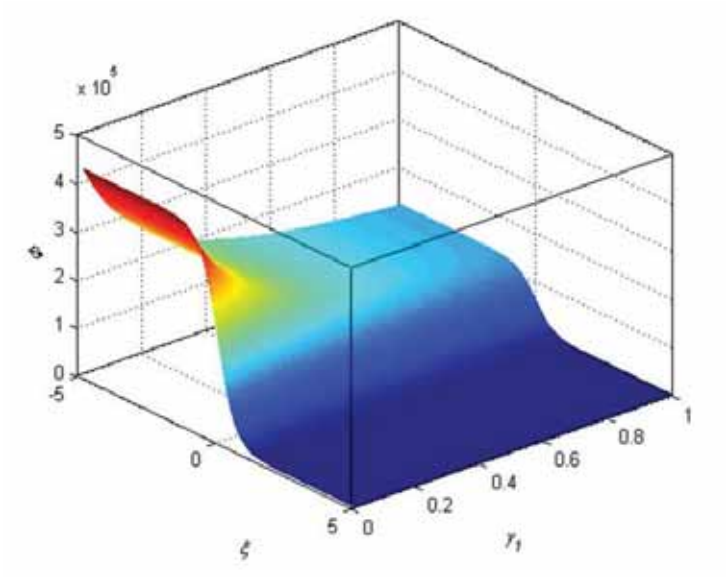


Fig.1: Spatial variation of the shock wave under the effect of the influence of trapped electron and non-thermal ions γ_1

The properties of a dust acoustic shock wave propagating in an adiabatic dusty plasma, including the effect of the negative-ion-rich non-thermal ions and trapped electrons, is also being studied. The reductive perturbation method is employed to derive the modified Burgers equation and a new form of the lower-order nonlinear modified Burgers equation for DA shock waves in a homogeneous, unmagnetized and collisionless plasma whose constituents are electrons, singly-charged positive ions, singly-charged negative ions and massive, charged dust particles. The stationary analytical solution of the Burgers equation and the new analytical solution of the lower-order nonlinear modified Burgers equation are numerically analyzed, and the effects of various dusty plasma constituents on the DA shock wave's propagation are taken into account. Both positive and negative ions in the dusty plasma are observed to play a key role in the formation of both positive, as well as negative, DA shock waves, and the ion concentration can be used to control the transformation from negative to positive potentials of the waves.

It is seen that the amplitude of shock profile depends on the concentration of non-thermal ions present in the plasma, and on increasing the concentration, the dust acoustic shock wave amplitude decreased (Fig.1). The result also shows that the shock amplitude is found to be decreased with increasing the trapped electrons number density and the shock amplitude increases with increase in the concentrations of both the ions (Fig.2). It can be concluded that, the magnitude of nonlinearity in the plasma system remarkably increases with trapped electrons (mBurgers equation) as compared to the plasma system without trapped electrons expressed by Burgers equation.

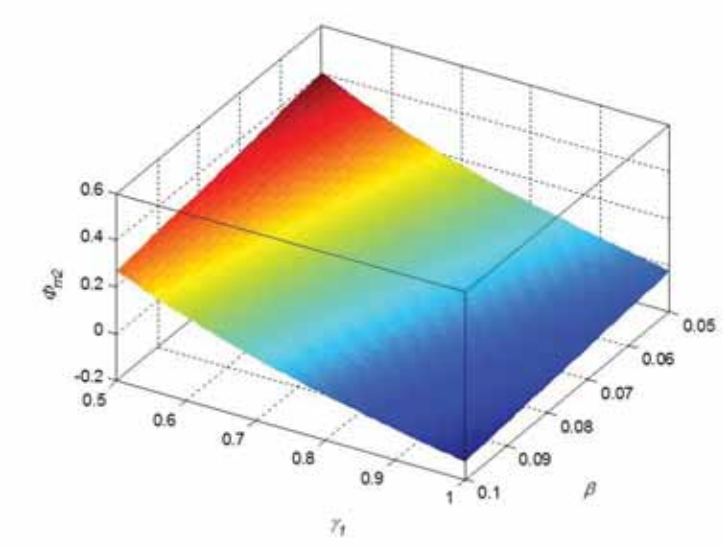


Fig.2: Amplitude variation is plotted with variation of the concentration of non-thermal ions γ_1 and the positive ion to electron temperature ratio β.

Our current research also involves preparation of core/shell quantum dots to be used as a sensor. The Mercaptosuccinic acid (MSA) capped CdTe/ZnS core/shell (CS) quantum dots (QD) is synthesized by using a simple one pot aqueous method, and are characterized with the help of UV–vis, photoluminescence, XRD, TEM and FT-IR analysis. Scheme of the synthesis is described below (Fig.3). As a capping reagent, MSA is very significant in the synthesis of QDs, it efficiently improves the water solubility and stability by forming a Cd–thiol complex over the QD surface (Fig.3). This complex layer occupies surface of the QD and passivates the surface to maintain high quality PL. These QD CS can be used for detecting the metal ions in aqueous media and the work on it is going on.

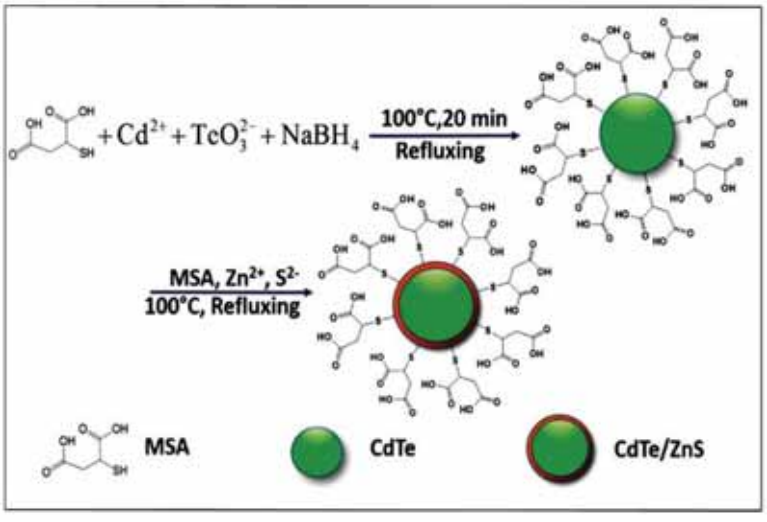


Fig.3: The synthesis procedure of MSA-coated CdTe/ZnS CS QD.

In UV-vis analysis it is found that, due to quantum confinement effect, there is a red shift in the UV-vis spectrum of CdTe/ZnS CS QD as compared to the bare CdTe QD core. This is because of the epitaxial growth of the ZnS shell over the CdTe core resulting in the confinement of the charge carrier in the core. In core/shell QD having a shell material with a wider band gap than that of the core material causes the improvement of the confinement of electrons and holes in the low band gap core.

Extramural Projects

Ongoing Projects

Title of the Project	Funding Agency; Total fund; Duration; PI/Coordinator	Goal
Development of plasma modified bio-membrane and low loaded electrode catalyst for proton exchange membrane fuel by plasma process	SERB,DST, Govt. of India; Rs. 36 lakhs; 2015-2018; **Prof. Joyanti Chutia**	Aim of this research is to develop fuel cell assembly with bio-membrane as well as plasma enhanced modification in the properties associated with proton exchange membrane (PEM) of naturally existing bio- membrane to reduce cost of fuel cell. One of the objectives behind the project is to develop plasma grafted bio-membrane with good proton conduction property, thermal stability at temperature higher than 80 ^{o}C and low fuel permeability.
Investigations on rogue waves in multicomponent plasma with negative ions	DST, Govt. of India; Rs 42 lakhs; 2013-2016; **Prof. Heremba Bailung**	Research in this project aims (1) to study the physical mechanism of Peregrine soliton (a prototype of ocean rogue wave) formation in a multicomponent plasma with negative ions, (2) to investigate characteristic features of extreme rogue waves in a controlled laboratory environment and (3) to explore different forms of Peregrine breathers and their evolution process for possible forecasting of such extreme wave events in real physical environment e.g. hydrodynamics, optical fibre etc.
Investigation of some basic phenomena in a strongly coupled dusty plasma	DST, Govt. of India (under INSPIRE Faculty Scheme); Rs. 35 lakhs; 2012-2017; **Dr. Sumita Kumari Sharma** (DST-INSPIRE Faculty)	Research in this project aims to (1) study fundamental dust processes such as dust charging mechanism, plasma crystal formation and phase transition in a laboratory produced radio frequency discharge dusty plasma, (2) study excitation mechanism and propagation characteristics of dust acoustic wave, soliton and shock in strongly coupled regime and (3) investigate collision properties of dust acoustic soliton in a strongly coupled dusty plasma and compare the observed results with relevant theory.

Publications

In Cited Journals

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
A Khan, B. K. Nath, J. Chutia	Conical nano-structure arrays of platinum cathode catalyst for enhanced cell performance in PEMFC (proton exchange membrane fuel cell)	Energy	90/1769-1774	July/2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
B. K.Nath, A. Khan, J. Chutia	Composite plasma polymerized sulfonated polystyrene membrane for PEMFC	Materials Research Bulletin	70/887-895	June/2015
A. Boruah, S. K. Sharma, H.Bailung, Y.Nakamura	Oblique collision of dust acoustic solitons in a strongly coupled dusty plasma	Physics of Plasmas	22/093706-1-5	September / 2015
P. Pathak, S.K. Sharma, Y. Nakamura, H. Bailung	Observation of second order ion acoustic Peregrine breather in multicomponent plasma with negative ions	Physics of Plasmas	23/022107-1-7	February / 2016
A. N. Dev, M. K. Deka, J. Sarma, N.C. Adhikary	Shock wave solution in a hot adiabatic dusty plasma having negative and positive non-thermal ions with trapped electrons	Journal of the Korean Physical Society	67(2)/ 339-345	July / 2015
A. N. Dev, J.Sarma, M.K. Deka, N.C. Adhikary	Dust acoustic shock waves with non-thermal and vortex-like ions in dusty plasma	Plasma Science and Technology	17(4)/ 268-275	April / 2015

Presentation in Conferences/seminars

Invited Talks

Faculty	Title	Programme Name	Date & Venue
Prof. H. Bailung	Observation of extreme wave event: ion-acoustic Peregrine solitons	URSI-Regional Conference on Radio Science	November 16-19, 2015 at JNU, New Delhi
Prof. H. Bailung	Plasma, the fourth state of matter; A multidisciplinary field of research	Theme based meeting of Physics Association of North-East	February 29, 2016 at Assam University, Diphu Campus
Dr. S. K. Sharma	Nonlinear wave structures in laboratory plasma: Basics, models and recent experiments	PLASMA-2015	December 1-4, 2015 at SINP, Kolkata

Contributory

Author(s)	Title	Conference Name	Oral/ Poster	Date & Venue
P. Pathak, S. K. Sharma, H. Bailung	Observation of ion-acoustic Kuznetsov-Ma soliton in multicomponent plasma with critical concentration of negative ions	PLASMA-2015	Poster	December 1-4, 2015 at SINP, Kolkata

Author(s)	Title	Conference Name	Oral/ Poster	Date & Venue
A. Boruah, S. K. Sharma, H. Bailung	Observation of dust-acoustic shock waves in a strongly coupled dusty plasma	PLASMA-2015	Poster	December 1-4, 2015 at SINP, Kolkata
B. Borgohain, H. Bailung	Plasma characteristics in a very low density and low temperature plasma produced using a magnetic filter	PLASMA-2015	Poster	December 1-4, 2015 at SINP, Kolkata
T. Deka, A. Boruah, S. K. Sharma, H. Bailung	Observation of self-excited oscillations in dusty plasma with nanoparticles	PLASMA-2015	Poster	December 1-4, 2015 at SINP, Kolkata
P. Pathak, S. K. Sharma, H. Bailung	Rogue waves in plasma	APFA-2015	Poster	December 14-18, 2015 at Gandhinagar, India
Abhijit Boruah, S. K. Sharma and H. Bailung	Experiments on dust acoustic solitons in strongly coupled dusty plasma	APFA-2015	Poster	December 14-18, 2015 at Gandhinagar, India

Conferences/Workshops/Meetings Attended

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Prof. H. Bailung	URSI-Regional Conference on Radio Science	November 16-19, 2015 at JNU, New Delhi
Dr. S. K. Sharma	PLASMA-2015	December 1-4, 2015 at SINP, Kolkata
Mr. Abhijit Boruah, Ms Pallabi Pathak, Ms Binita Borgohain and Mr. Tonuj Deka	PLASMA-2015	December 1-4, 2015 at SINP, Kolkata
Mr. Abhijit Boruah and Ms Pallabi Pathak	10th Asia Plasma and Fusion Association Conference (APFA-2015)	December 14-18, 2015 at Gandhinagar, India
Ms Binita Borgohain and Mr. Tonuj Deka	ASEAN School on Plasma and Nuclear Fusion-2016	January 18-22, 2016 at Chulalongkorn University, Bangkok, Thailand

Other Activities

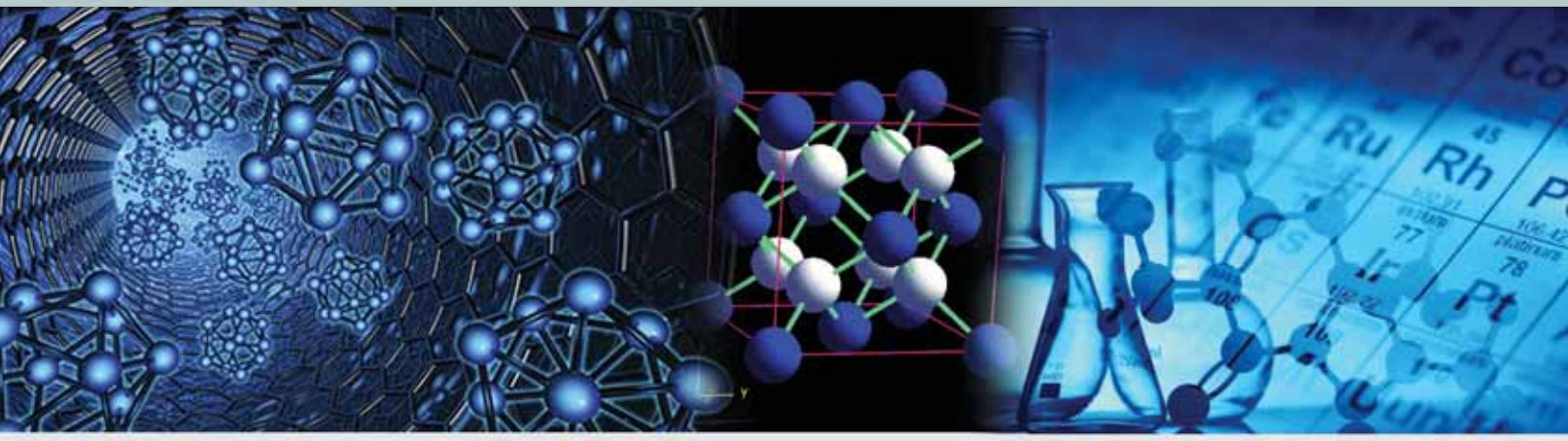
M.Sc. / B. Tech projects/training courses offered at IASST

Name(s) of trainee	Programme and supervisor	Title of work	Duration
Ms Abhilasha Bora	M.Sc Dissertation under Prof. H. Bailung	Study of electron energy distribution function and phase transition in a radio frequency discharge dusty plasma.	6 Months
Ms Snigdha Buragohain	M.Sc Dissertation under Prof. H. Bailung	Study of dust charge measurement techniques in strongly coupled dusty plasma.	6 Months

Awards/Recognitions/Achievements

Name	Particulars
Mr. Abhijit Boruah	Best Poster Award, Exotic Plasma Category, PLASMA-2015 SINP. Kolkata
Ms Pallabi Pathak	Best Poster Award, Basic Plasma Category, PLASMA-2015 SINP, Kolkata
Mr. Tonuj Deka, Ms Priyanka Sharma, Mr. Abhijit Boruah, Mr. Jintu Dutta, Ms Pallabi Pathak, Ms Binita Borgohain and Ms Yoshiko Bailung	2nd Best Presentation Award in IASST Colloquium, 2015

Advanced Materials Science



That the advancement of civilization and search for new materials go hand in hand is an undeniable fact. As such, materials research is probably the most highly populated platform of interdisciplinary research with participation from physical, chemical, biological and industrial sciences. Being a research institute of basic science with multiple disciplines, IASST has therefore formulated Advanced Materials Science to be one of its five core research themes. Scientists and scholars of this research group have acquired recognitions in various national and international forums with substantial contributions made in the field of sensors, nano-bio materials, optoelectronics, functional materials, organic electronic materials and so on. This group has also established collaboration with researchers from within the country and abroad. Here is a brief report on the research activity of this group during the year 2015-16.

Neelotpal Sen Sarma
Associate Prof. -II

Devasish Choudhury
Associate Prof. -I

Arup Ratan Pal
Associate Prof. -I

Sarathi Kundu
Associate Prof. -I

Munima B Sahariah
Assistant Professor-II

Sagar Sharma
DST INSPIRE faculty

Sudesna Chakravarty
SRF

Manash Jyoti Deka
SRF

Neelam Gogoi
CSIR-SRF

Upama Baruah
SRF

Achyut Konwar
SRF

Amreen Ara Hussain
SRF

Bikash Sharma
SRF

Ashim Ch. Bhowal
SRF

Ujjal Saikia
SRF

Parijat Borgohain
SRF

Kaushik Das
SRF

Chabungbam S Singh
SRF

Priyanka Dutta
SRF

Bedanta Gogoi
SRF

Sristi Majumdar
JRF

Deepshikha Gogoi
JRF

Hrishikesh Talukdar
JRF

Bijay Kumar Sah
JRF

Bandita Kalita
JRF

Gautomi Gogoi
Project Assistant

Tapan Barman, SRF Mahananda Baro, SRF

Dr. Neelotpal Sen Sarma

Programme Head

Advanced Materials Laboratory

Solid state Ionics, LC Polymers, Gels, Bio and chemosensors and synthesis of high value polymers.

The Advanced Polymer Material Laboratory accomplishes its activity in the field of solid state ionics, liquid crystalline polymers, hydro and polymer gels, bio and chemosensors and synthesis of high value polymers. Followings are the glimpses of the work done during the year 2015-16.

Ammonia is detected in the environment with the help of various sensors which are developed from optical fibres, metal oxides, solid electrolytes, ionic membranes, ionic salts, carbon nanotubes and semiconducting polymers. Here, we report a highly efficient and selective electrical sensors for

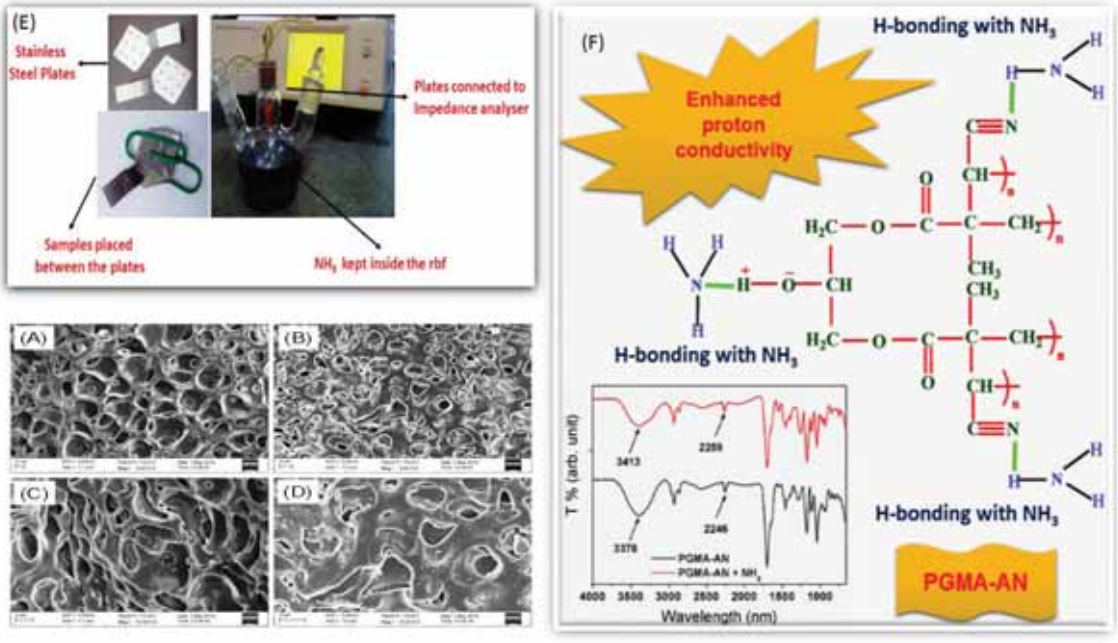


Fig.1: SEM images of (A) PGMA-AN, (B) PGMA-AN after sensing, (C) PGMA-S and (D) PGMA-S after sensing. (E) Experimental setup for the sensitivity experiments and (F) Schematic representation of the mechanism of ammonia sensing.

ammonia and methylamine vapor from conducting co-polyesters glycerylmethacrylate-co-acrylonitrile (PGMA-AN) and glycerylmethacrylate-co-styrene (PGMA-S) synthesized in our laboratory (Fig.1). Scanning electron micrographs clearly shows the macro pores of the gels with pore size ranging about 2-6 µm. Complete electrical studies including impedance, dielectric, ac conductivity, current-voltage

and transport number measurements are carried out which showed significant results. AC conductivity values at 30 ^{o}C for PGMA-AN and PGMA-S are 8.10×10^{-6} and 4.3×10^{-6} Scm^{-1} respectively. The PGMA-AN and PGMA-S gels retain around 68.42 % and 62.95 % ionic conduction. Ammonia sensitivity was monitored with the help of change in impedance with time and current-voltage measurements. PGMA-AN and PGMA-S shows 2 order and 1.7 order decrease in their impedance values when exposed to ammonia vapor for 5 minutes. The limit of detection of ammonia for the polymers PGMA-AN and PGMA-S are 13.9 ppm and 16 ppm respectively.

Terrorist activities throughout the world has led to the urgent need for the development of efficient and selective sensors for the detection of trace amount of explosives. Among the diverse chemicals used in such deadly weapons, nitro containing and nitroaromatic compounds cover a wide range of such explosives. Picric acid (2,4,6-trinitrophenol) is found to be a highly dangerous explosive and its deadly effects are even worse than the well-known explosive 2,4,6-trinitrotoluene (TNT). Besides, being a dangerous explosive material, picric acid is also considered to be a highly toxic environment pollutant. Because of its high solubility in water, its exposure can easily contaminate soil and groundwater

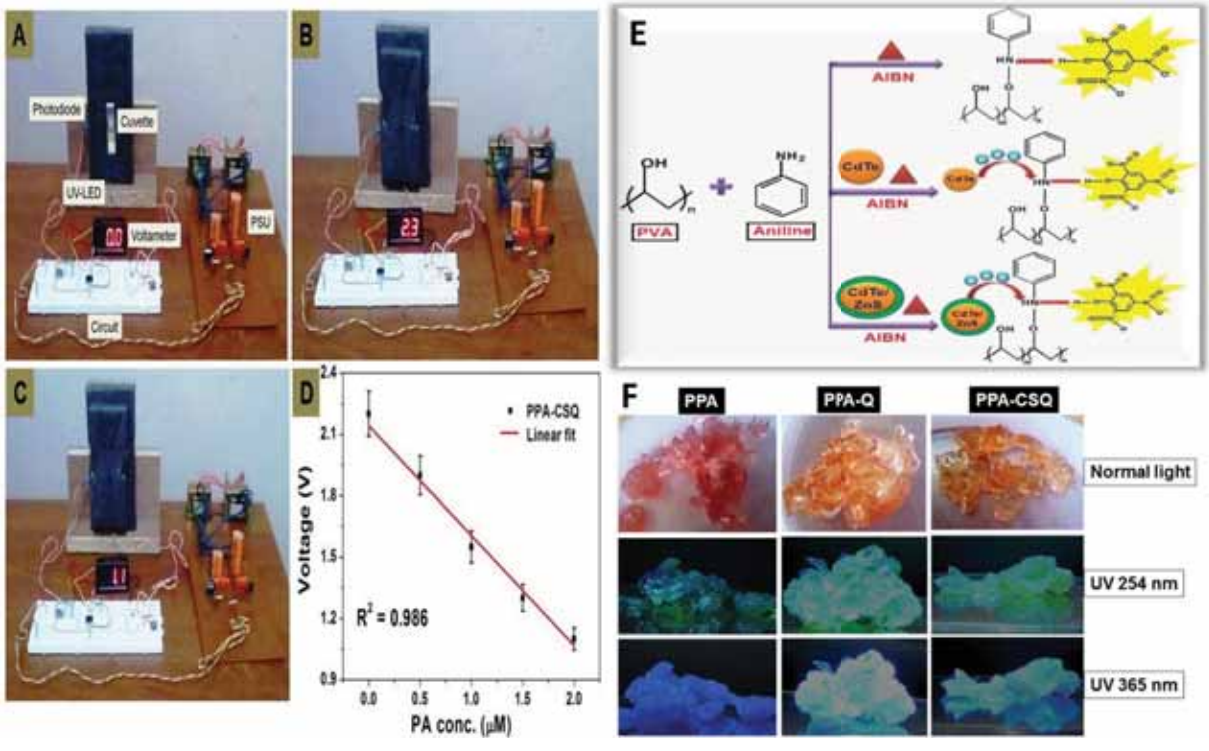


Fig.2 : (A) Photograph of the circuit designed for PA detection, (B) Voltmeter reading of the polymer illuminated by UV LED, (C) Voltmeter reading of the polymer with PA illuminated by UV LED showing the quenching effect, (D) Plot of Voltage vs PA concentration in real samples added to the polymer; Error bar represents the standard deviation of three consecutive voltmeter readings. (E) Schematic representation of the electrostatic interaction and (F) Pictures of the gels under normal light and UV light.

causing serious threat to human health and environment. Thus development of potential picric acid sensors with high sensitivity and selectivity is of utmost importance in the present scientific world.

Among the various analytical techniques used for the detection of picric acid, fluorescence based sensing is highly employed because of its high sensitivity and quick response time. This work reports the development of highly fluorescent materials for the selective and efficient detection of picric acid explosive in the nM range by fluorescence quenching phenomenon. Polyvinylalcohol grafted polyaniline (PPA) and its nanocomposites with MSA capped CdTe quantum dots (PPA-Q) and with MSA capped CdTe/ZnS core/shell quantum dots (PPA-CSQ) are synthesized in a single step free radical polymerization reaction. The thermal stability and photo stability of the polymer increases in the order PPA < PPA-Q < PPA-CSQ. The polymers show remarkably high selectivity and efficient sensitivity towards picric acid and the quenching efficiency for PPA-CSQ reaches up to 99 %. The detection limit of PPA, PPA-Q and PPA-CSQ for picric acid are found to be 23 nM, 1.6 nM and 0.65 nM respectively which is remarkably low. The mechanism operating in the quenching phenomenon is proposed to be a combination of a strong Inner Filter Effect (IFE) and ground state electrostatic interaction between the polymers and picric acid. A portable and cost effective electronic device for the visual detection of picric acid by the sensory system is successfully fabricated. The device was further employed for quantitative detection of picric acid in real water samples (Fig.2).

Folic acid (FA) is the synthetic form of the naturally occurring folate, a member of Vitamin B family. Some previous studies suggest that FA together with vitamin B12 can participate in the synthesis of DNA and RNA. In addition, it plays pivotal role in copying RNA from DNA. Thus, it is essential for accurate replication of DNA. It is well known that FA concentration varies significantly in a number of health disorders like in cancer, cardiovascular disease, alzheimer's disease, depression, reduced cognition and neural tube defect (NTD). Low or high level concentrations of FA in blood serum, plasma and red blood cells are exploited as an efficient biomarker for diagnosis of various disease conditions.

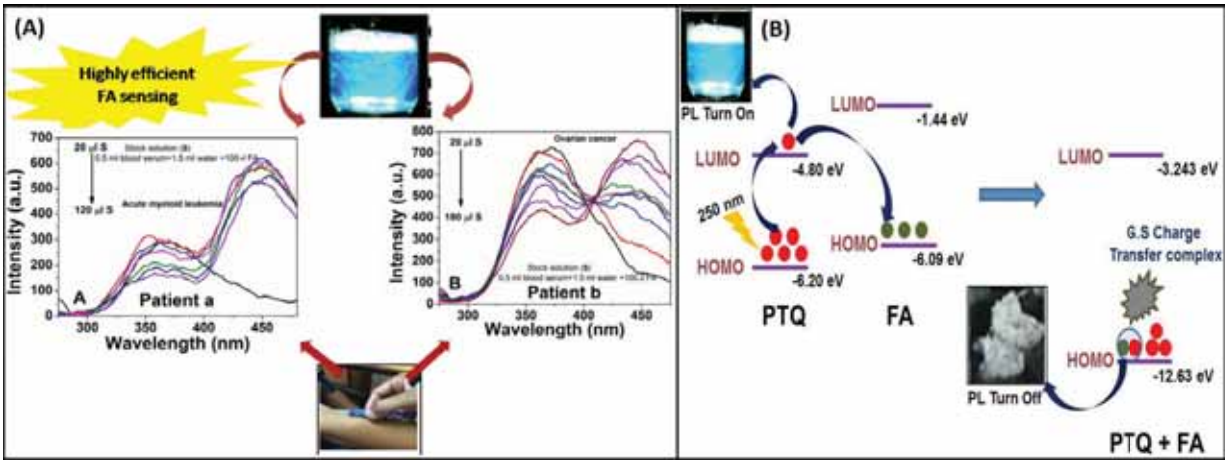


Fig. 3 : (A) Highly sensitive PVA-Tryptophan-QDs (PTQ) sensor for FA sensing in blood serum of cancer patients and (B) Schematic representation of PET process of the sensor system.

Since FA is essential for proper functioning of numerous biological activity, it is pertinent to develop simple and sensitive methods for detection of FA in biological systems. In a nutshell, we have reported a novel, simple, selective and rapid sensor system based folic acid detection pro-kit, which will be helpful in fast and efficient quantitative estimation of folic acid in blood serum (Fig.3). This new sensor PVA-tryptophan-CdTe QDs (PTQ), exhibited better sensing efficiency with an excellent limit of detection (0.57 pg/ml) compared to commercially available ELISA kits.

The real time sensing applications of the sensor was investigated for folic acid present in the blood serum samples of healthy mice and human; and cancer infected mice and human. Our sensor exhibited efficient sensing for folic acid in the blood serum samples of acute myeloid leukemia [limit of detection (LOD) 42.29 ng/ml] and ovarian cancer effected patients (LOD 365 ng/ml). The LOD value indicates that our sensor is highly efficient towards sensing of FA in acute myeloid leukemia as its LOD value lies below 110 ng/ml. Such works will help to bring together material chemists, biologists and clinicians in a single platform to develop cost effective, photostable and specific assays for diagnostic purposes.

Dr. Devasish Chowdhury

Material Nanochemistry Laboratory
Nanomaterials, Carbon nanomaterials, polymer nanocomposites, sensors.

Material Nanochemistry laboratory is fully devoted to the development of hybrid nanomaterials with useful properties. The objective of the laboratory is to develop comprehensive bottom-up synthetic strategy to fabricate variety of hybrid biomaterials, carbon based nanomaterials, polymer nanocomposites for diverse applications.

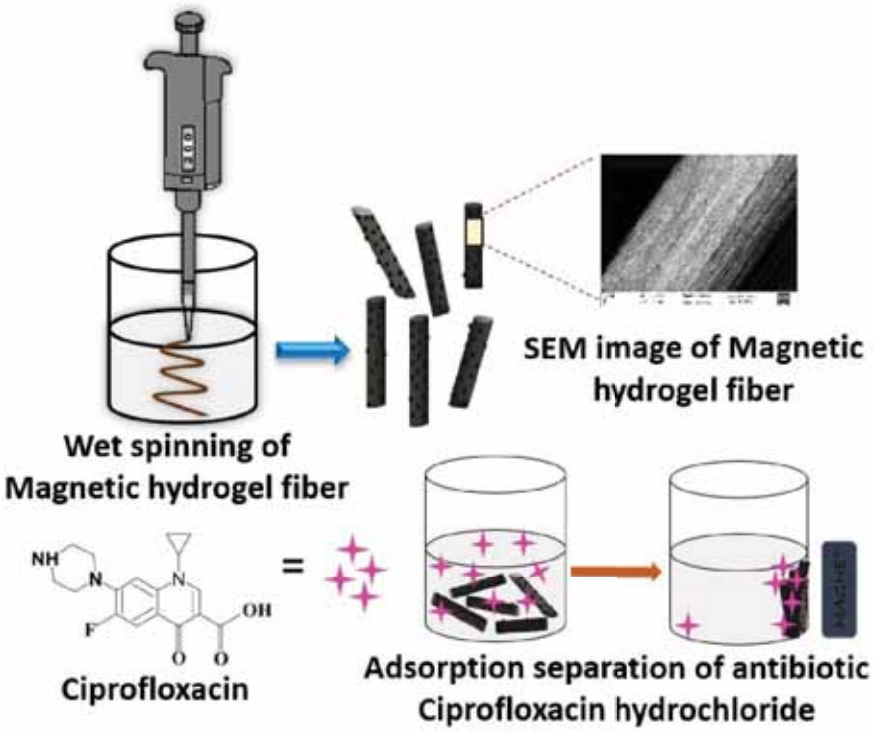


Fig.1 : Schematic representative showing synthesis of magnetic alginate-Fe_2O_3 hydrogel fibers by wet spinning technique and its use of adsorption / separation of antibiotic ciprofloxacin hydrochloride.

With these objectives in mind, last one year we successfully prepared magnetic alginate–Fe_3O_4 hydrogel fiber capable of ciprofloxacin hydrochloride adsorption/separation in aqueous solution. We fabricated gold nanoparticles@agarose film with excellent catalytic activity. We also investigate the electrical properties of functionalized graphene and how in functionalized graphene electrical conductivity can be tuned by interacting with π- stacking organic molecules. We also developed a

colorimetric sensor system using functionalized Graphene Oxide Quantum Dots-PVA hydrogel for Fe^{2+}, Co^{2+} and Cu^{2+} ions detection. We also did a basic work on determining property relationship of alginate and alginate–carbon dot nanocomposites with bivalent and trivalent cross-linker ions.

We show successful preparation of magnetic alginate-Fe_3O_4 hydrogel fibers simply by a laboratory used micropipette employing the basic principle of wet spinning technique discarding use of any sophisticated intruments. Magnetic Fe_3O_4 nanoparticles used in the study were synthesized by conventional co-precipitation method. The prepared magnetic alginate-Fe_3O_4 hydrogel fibers showed ferromagnetic behaviour when studied with the help of Vibrating Sample Magnetometer instrument and can be easily separated by a strong magnet. The magnetic alginate-Fe_3O_4 hydrogel fibers were interestingly found to be very effective in adsorption of the antibiotic ciprofloxacin hydrochloride while the blank alginate hydrogel fiber does not show any significant adsorption. Therefore, such magnetic alginate-Fe_3O_4 hydrogel fibers can work as an easy and cost-effective probe for successful adsorption/separation of antibiotics with additional advantages of easy technique of fabrication, high thermal stability and high mechanical strength (Fig.1).

Thiols are always known for stabilizing gold nanoparticle (Au NPs). We also demonstrate an intriguing feasibility of a group of thiols to non-conventionally fragment supported Au NPs in absence of any auxiliary energy applied. The Au NPs are studded into agarose hydrogel film as a solid support (Au@Agr), and the group of thiols studied includes thioglycolic acid (TGA), cysteine (CS), 2-mercaptoethanol (ME), l-methionine (MET). Interestingly, the thiols are found to be capable of successfully fragmenting Au@Agr. TGA and CS fragmented Au@Agr, i.e, TGA-Au@Agr and CS-Au@Agr films work as an effective catalyst taking ~20/30 seconds of time for the complete reduction of p-nitrophenol (p-NP), an industrial sluggish pollutant. A pseudo-first order rate for the catalytic p-NP reduction reaction is followed by TGA-Au@Agr as well as CS-Au@Agr with rate constant values determined to be 1.6 x 10^{-1} s^{-1} and 1.1 x 10^{-1} s^{-1}, respectively.

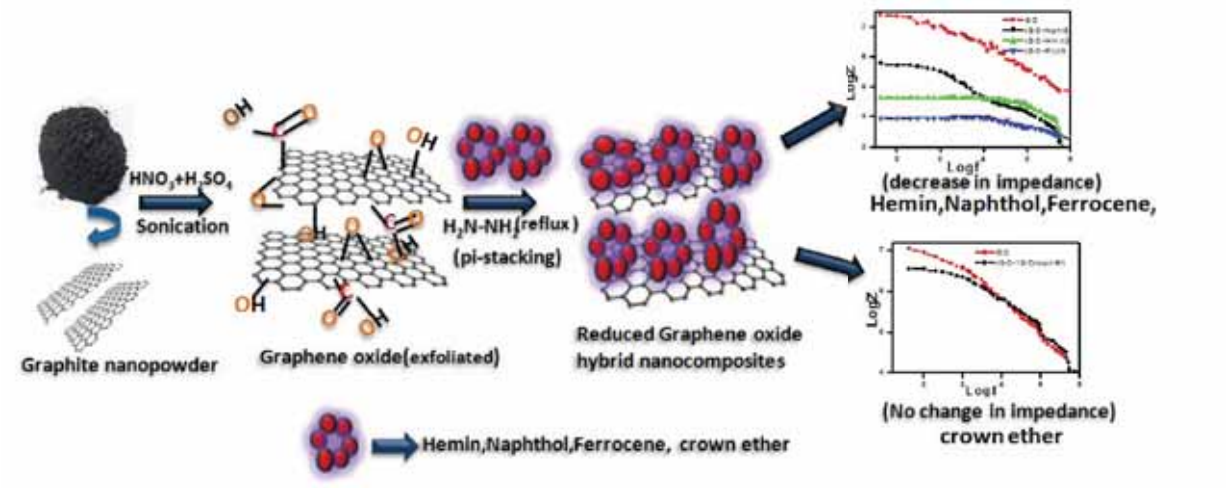


Fig.2 : Pictorial representation depicting Exfoliation of graphite to graphene, its interactions with differentt π- Stacking Organic Molecules to tune the electrical properties.

We also investigated the electrical properties of reduced graphene (r-GO), acid chloride functionalized graphene oxide (GO-COCl), ester functionalized graphene oxide (GO-COOR), and amide functionalized graphene oxide (GO-$CONH_2$). Tuning of the electrical properties of graphene and functionalized graphene is very important to its use in optoelectronic devices. We also studied the electrical properties of graphene and graphene with different π- stacking organic molecules. The noncovalently functionalized reduced graphene oxide show higher a.c conductivity than graphene oxide (GO). The enhancement of conductivity shown can be attributed to higher mobility, and the density of π - electron and higher surface area of hybrid nanocomposites system. The reason is supported by the fact that that interaction of rGO with non π-system like as18-crown-6 didn't help in increasing the a.c conductivity of the system. Thus, the electrical properties of graphene can be tuned through non-covalent interaction with π- stacking organic molecules (Fig.2).

We also developed a sensor using functionalized Graphene Oxide Quantum Dots-Poly(vinyl alcohol) hybrid hydrogels. Graphene Oxide Quantum Dots (GOQDs) bearing different surface functional groups were introduced as the cross-linking agent into the Poly(vinyl alcohol) matrix thereby resulting in gelation. The four different types of hybrid hydrogels were prepared using graphene oxide, reduced graphene oxide, ester functionalized graphene oxide and amine functionalized graphene oxide quantum dots as cross-linking agents. It was observed that the hybrid hydrogel prepared with amine functionalized graphene oxide quantum dots was the most stable. The potential applicability of using this solid sensing platform has been subsequently explored in an easy, simple, effective and sensitive method for optical detection of M^{2+} (Fe^{2+}, Co^{2+} and Cu^{2+}) in aqueous media involving colorimetric detection. Amine functionalized graphene oxide quantum dots-poly(vinyl alcohol) hybrid hydrogel when put into the corresponding solution of Fe^{2+}, Co^{2+} and Cu^{2+} renders brown, orange and blue coloration respectively of the solution detecting the presence of Fe^{2+}, Co^{2+} and Cu^{2+} ions in the solution. The minimum detection limit observed was $1x10^{-7}$ M using UV-Visible spectroscopy. Further, the applicability of the sensing material was also tested for a mixture of co-existing ions in solution to demonstrate the practical applicability of the system.

We also made an attempt to study the property relationship of Alginate and Alginate-carbon dot nanocomposites with different bivalent and trivalent cross-linker ions. Biopolymer Alginate were crosslinked with five different bivalent and trivalent metal ions and their corresponding carbon-dots (CDs) nanocomposites have been prepared successfully. The carbon dots were prepared from Commercially available 'Assam Tea'. The Alginate and Alginate-carbon dot nanocomposite films were characterized with UV-visible spectroscopy, FTIR, SEM, Fluorescence microscopy. The tensile strengths measurements of all the film samples have been carried out. It was observed that Alginate films crosslinked by metal ions with larger size (Ba^{2+}) show higher tensile strength and higher thermostability. Tensile strength values for Ba^{2+} crosslinked Alginate films increased from 24.5 MPa to 43.5 MPa and weight loss at 200^{o}C decreased upto 9% on incorporatopn of 2% CDs. Moreover loading of carbon-dots in the crosslinked Alginate system leads to higher absorption in the UV region showing the potential use of Alginate –carbon dot films as UV blocker. For Ca^{2+} and Ba^{2+} crosslinked films minimum transmittance value significantly reduces to 4 and 5% respectively in the region from 200 to 400 nm for nanocomposite films with maximum 2% CDs.

Dr. Arup Ratan Pal

Plasma Nanotech Laboratory

Plasma synthesis of nanomaterials for electronic, optoelectronic and bio-electronic devices.

Plasma Nanotech Laboratory is involved in the research work on the synthesis of nanomaterials suitable for advanced electronic, optoelectronic and bio-electronic devices. We develop thin/ultrathin films of conducting polymer, nanocomposites of conducting polymers with metal nanoparticles and with some inorganic nanocrystals by solvent free as well as water free plasma based processes. We are also working on preparing carbon nanomaterials e.g. nanofibers and nanotubes using atmospheric pressure plasma at low temperatures suitable for fabrication of electronic and optoelectronic devices. In the device development area we are mainly working on bulk heterojunction as well as plasmonically enhanced optoelectronic devices, specifically, on fabrication of flexible organic and hybrid photodetectors using the nanomaterials developed by plasma processes. We put strong emphasis on understanding the device physics of such devices.

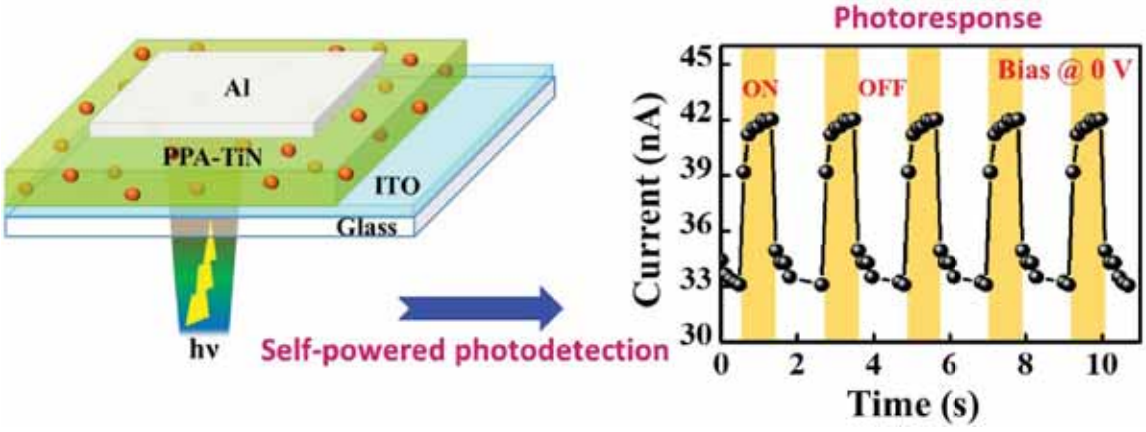


Fig.1: Device layout and photoresponse of TiN based plasmonic photodetector.

Titanium nitride (TiN) has been demonstrated as a plasmonic absorber for fabrication of an efficient hybrid photodetector (Fig.1). A novel synthesis method based on plasma nanotechnology is utilized for producing air stable plasma polymerized aniline-TiN (PPA-TiN) nanocomposite and its integration in photodetector geometry. The device performs as a self-powered broadband detector that responds to ultraviolet and visible light at zero bias. The self-powered photodetector exhibited high spectral responsivity, detectivity, and fast response speed simultaneously for low-intensity irradiance (3.5 mW/cm^2), which demonstrate one of the best results in terms of device performance trade-off. From these observations, it is revealed that plasmonic TiN-based hybrid nanocomposite opens up a new trend of applications in optoelectronics including imaging, light-wave communication and wire-free route for artificial vision.

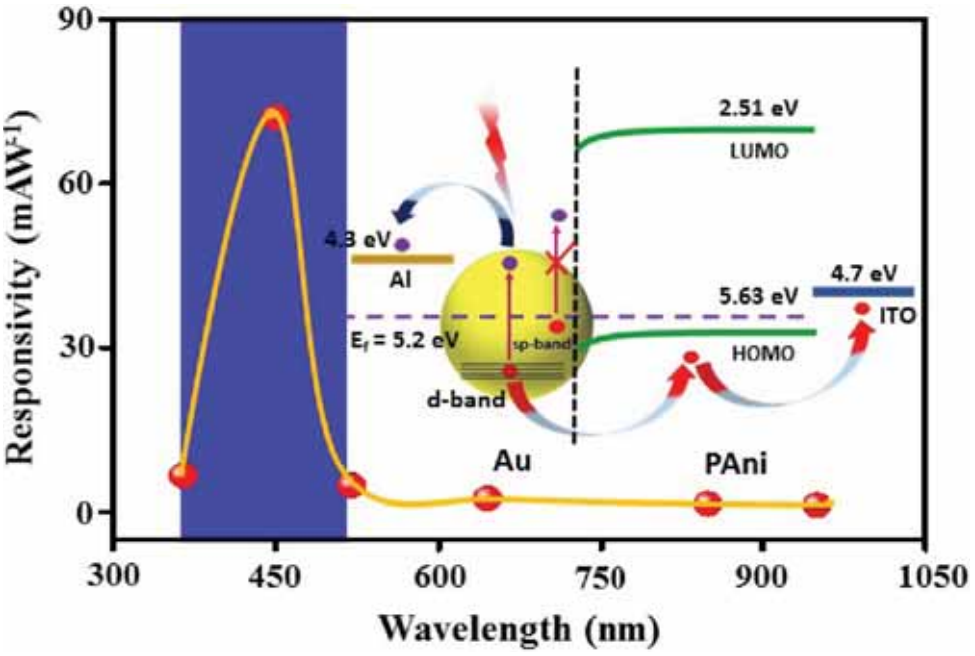


Fig.2 : Wavelength response and energy level diagram of Au-polymer plasmonic photovoltaic device showing hot hole generation by interband transition.

In an attempt to understand the device physics of plasmonic photovoltaic devices a novel synthesis method has been developed for synthesis of plasma polymerized aniline-gold (PPA-Au) nanocomposite thin films with gold nanostructures (AuNs) of desired shape and size uniformly incorporated in the polymer matrix. According to shape as well as size variation of AuNs, two tunable plasmonic UV-Visible absorption bands are observed in each of the nanocomposites. Plasmonic devices are fabricated using PPA-Au nanocomposite having different UV-Visible plasmon absorption bands. Surprisingly, all the devices show strong photoelectrical response in the blue region (400–500 nm) of the visible spectrum. From the detailed study of the energy levels it has been revealed that the d-band to sp-band (d-sp) transition of electrons in AuNs produces hot holes that are the only carriers in the material responsible for photocurrent generation in the device (Fig.2). From this investigation, we highlight two important points. At first, an interesting physics of plasmonic hot hole generation by d-sp transition in PPA-Au nanocomposite device is revealed. Secondly, we have shown that the mechanism of plasmonic hot hole generation is useful for the development of self-powered photodetector selective to blue light that corresponds to d-sp transition.

Dr. Sarathi Kundu

Soft-Nano Laboratory
Experimental Soft Matter Physics including Nanomaterials and Biomaterials.

Structures, patterns and optical responses of organic molecules, biomolecules, polymers, nanoparticles, etc. at air-water and air-solid interfaces have been studying to explore interesting physicochemical properties. Protein-protein interactions in solution have also been investigating for different experimental conditions. X-ray and neutron scattering techniques together with microscopic and spectroscopic methods are using to investigate such behaviours.

Optical responses of globular proteins, lysozyme and bovine serum albumin (BSA), from their bulk and thin film conformations have been studied in presence of mono-, di- and tri-valent ions by using fluorescence and UV-Vis spectroscopy at two different temperatures and the morphology of the protein thin films have been studied by using atomic force microscopy. Protein- and ion-dependent dynamic and static quenching behaviors have been identified. While dynamic quenching is observed for lysozyme for all the three different valent ions, BSA shows no quenching for mono-valent (Na^{+}) ions, dynamic quenching for di-valent (Ni^{2+}) ions and static quenching for tri-valent (Fe^{3+}) ions at pH ≈ 5.5. After heat treatment, as the conformation of the protein molecules changes, the quenching efficiency for lysozyme in presence of ions decreases but shows enhancement for BSA. In thin film geometry, the molecular conformation of both lysozyme and BSA modifies on the solid surfaces and hence quenching efficiency also modifies in comparison with that of bulk and as a result the quenching efficiency for lysozyme increases but decreases for the BSA film.

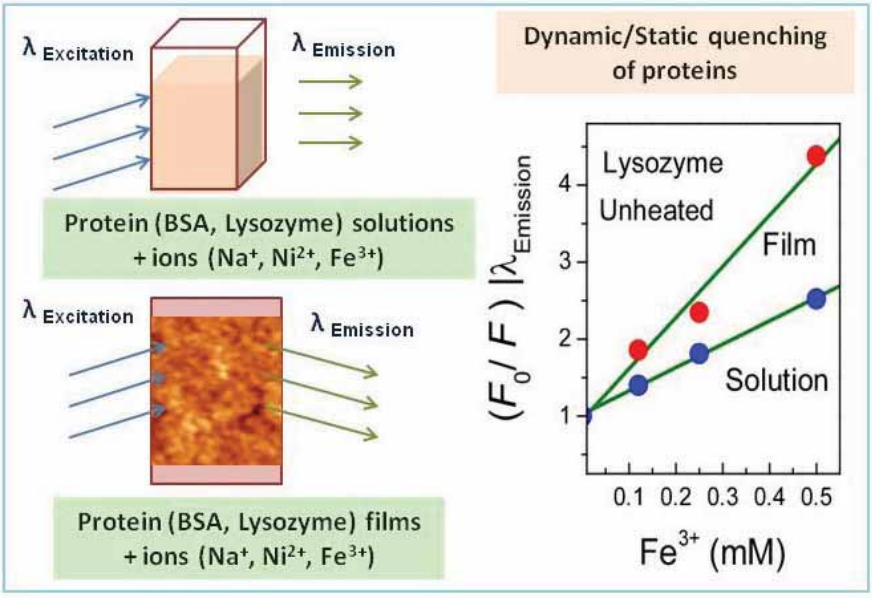


Fig.1: Photoluminescence behaviour of globular proteins (BSA and lysozyme) in presence of different valent ions depends upon their bulk and thin film conformations.

Subphase pH induced monolayer to multilayer collapse at very low surface pressure of barium stearate Langmuir monolayer has been confirmed from the surface pressure versus specific molecular area (π-A) isotherms, X-ray reflectivity (XRR) and atomic force microscopy (AFM) studies. From the π-A isotherms it is clear that stearic acid molecules form a monolayer on the water surface in the presence of Ba^{2+} ions at pH ≈ 5.5 (low) and ≈ 6.8 (moderate) and remain as a monolayer before collapse pressure (πc ≈ 55 mN/m). However, at high subphase pH (≈ 9.5), 2D to 3D structural transition starts to occur from the very low surface pressure as indicated by the π-A isotherm and is verified by both XRR and AFM as the barium stearate multilayer structure deposits in the single up stroke of hydrophilic Si substrate at π ≈ 25 mN/m. Subphase pH induced monolayer to multilayer formation at such lower surface pressure is unusual. Fourier transform infrared spectroscopy results confirm that the formation of bidentate chelate coordination in the metal containing headgroup is the reason for such monolayer to multilayer transition. Relatively longer chain fatty acid molecules like arachidic and behenic acids do not show such type of monolayer collapse.

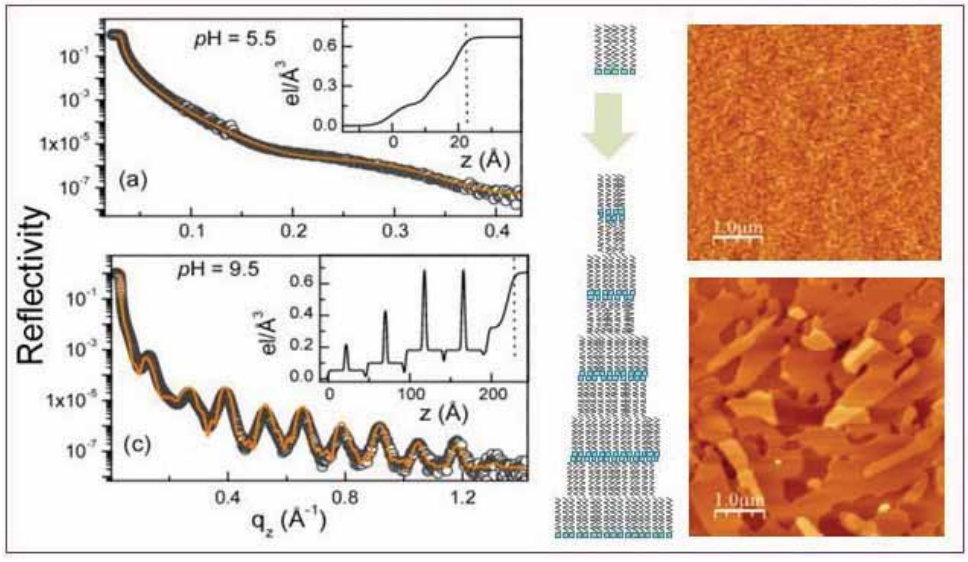


Fig.2: Monolayer to multilayer collapse at very low surface pressure of barium stearate Langmuir monolayer.

Protein-protein interactions in solution have been studied using neutron scattering technique. Both short range attraction and long range electrostatic repulsion exists among globular protein Bovine Serum Albumin in solution below its isoelectric point (pI ≈ 4.8). At pD ≈ 4.0, below pI, protein has a net positive surface charge although local charge inhomogeneity presents. Small angle neutron scattering study reveals that in the presence of both mono-(Na^{+}) and di-(Ni^{2+}) valent ions attractive interaction increases and repulsive interaction decreases with the increase of salt concentration. However, for tri-valent (Fe^{3+}) ions, both attractive and repulsive interaction increases with increasing salt concentration but the relative strength of repulsion is more than the attraction.

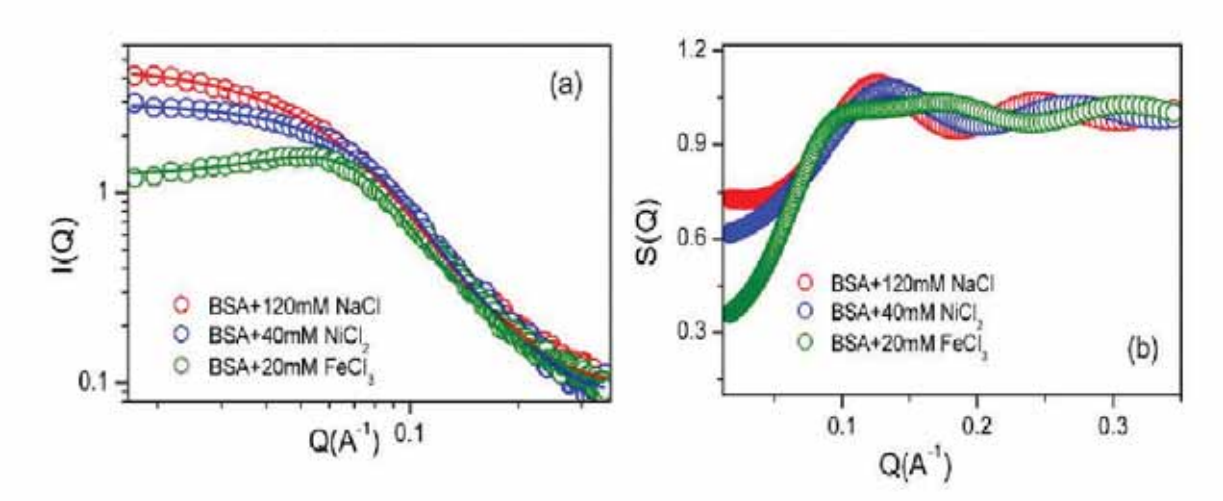


Fig.3: SANS data (open circle) and fitted curves (solid line) for 10 wt% BSA in aqueous solution in presence of salts having equal ionic strength, i.e., 120, 40 and 20 mM NaCl, NiCl2 and FeCl3 respectively at pD ≈ 4.0.

Structure and interaction among BSA protein and nanoparticle mixtures in solutions have also been studied by varying the solution temperature. Our study shows that in absence of nanopaticles and up to 70°C, an intermediate range repulsive and one long range attractive interaction potentials between the proteins exist. Above that temperature, fractal structure forms and the fractal dimension increases with the increase of BSA concentration and solution temperature.

Dr. Munima B Sahariah

Computational and Numerical Laboratory
Smart Materials, Functional properties, layered Nanocomposites.

Understanding the behaviour of materials in the light of their physical and chemical properties through modeling and simulation is the broad area of research in our group at IASST. Properties are probed at microscopic level by representing the systems with quantum mechanical models. Approximations are made to make the models solvable with least compromisation as far as accuracy of results is concerned. Calculations are done both in the finite and infinite limit.

Last one year's activity in our research group involved primarily two problems. The first problem was to study the effect of disorders in the electronic and magnetic properties of the Heusler alloy Ni-Fe-Ga. For last couple of years we have been working on this particular alloy with an objective to investigate theoretically the possibility of using it as a Shape Memory Material. Few experimental and fewer theoretical works on this material predicting superior shape memory properties in many respects over the prototype Ni-Mn-Ga inspired us to take up the problem. While both the static as well as dynamic characteristics of the alloy have already been studied by our group in its stoichiometric composition, probing the system in its disordered states in terms of compositions and chemical ordering assumes importance owing to its high order of sensitivity with respect to disorder. Six different offstoichiometric compositions were selected for investigation using a 16 atom supercell, three of which are Fe-rich and others Ni-rich. The calculated magnetic exchange parameters indicate that the interactions in these

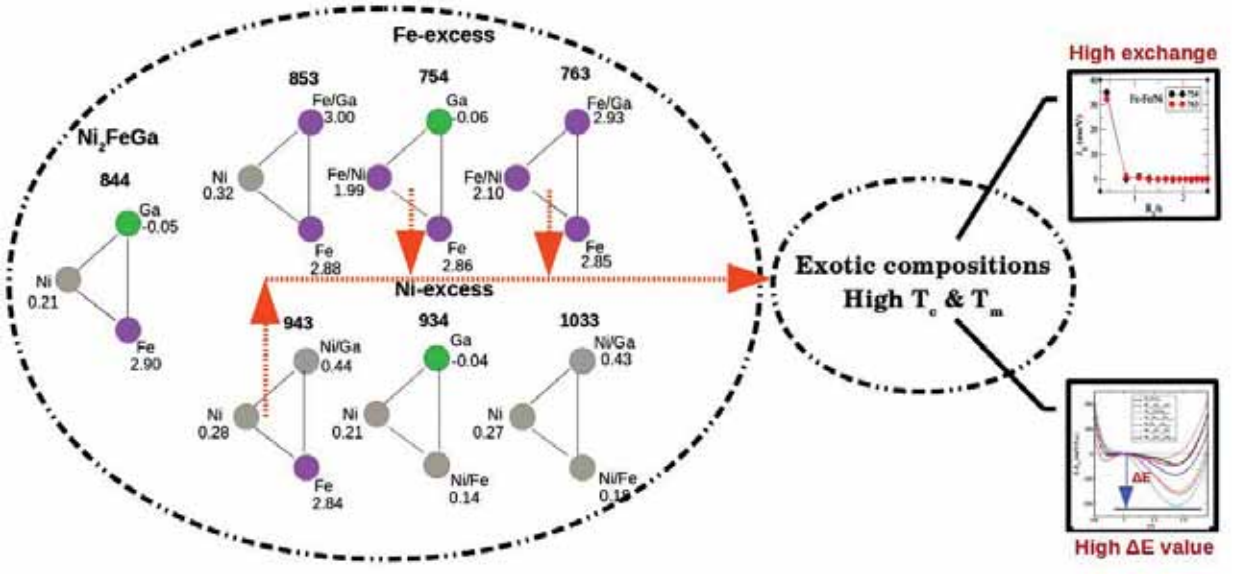


Fig.1: Prediction of exotic compositions (two from Fe-excess and one from Ni-excess compositions) from magnetic exchange parameter and total energy calculations.

systems are predominantly ferromagnetic in nature. Curie temperatures were estimated using mean field approximation method. Fe-excess compositions are found to give elevated Curie temperatures as desired for real field applications. Three out of the six compositions have been identified as exotic compositions showing higher magnetic and structural transition temperatures (Fig.1). Experimental investigations to our proposed exotic compositions might prove useful in finding a more promising shape memory alloy that caters the need of the present time.

Besides Heusler alloy, the other problem that our group did put efforts on during last one year is the stability of layered Cu-Nb system from chemical bonding. Layered metallic nanocomposites with tailored interfaces have been recognized as structural materials with ultra-high mechanical strengths.

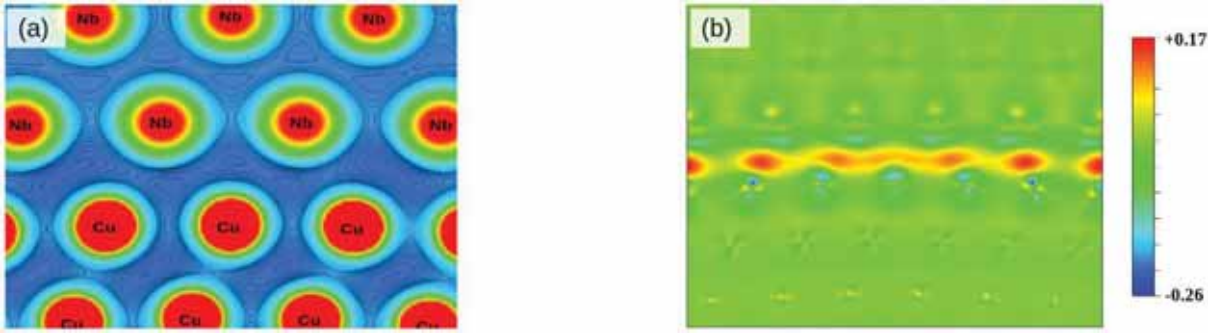


Fig.2: (a) The contour plot of charge density of layered Cu-Nb projected perpendicular to the interface. (b) Calculated charge transfer plot projected along (110) plane perpendicular to the interface. Positive values show the charge accumulated regions and negative values show charge depleted regions.

Multilayered Cu-Nb nanocomposites are one such material whose potential for the next generation nuclear reactors has already been explored by theoretical and experimental studies. However the existing theoretical and experimental works mainly focussed on understanding the interface structure and effect of radiation induced defects in this composite material. Little effort was made to understand the bonding nature and electronic structure of the system which plays a very crucial role in determining the macroscopic behaviour of the material. This motivated us to study the chemical bonding and electronic properties of Cu-Nb composite system in the light of quantum chemical calculations. We have performed a detailed analysis of the nature of its bonding via charge density and charge transfer analysis (Fig.2), Bader charge analysis, electron localization function and total and projected density of states (DOS) calculations. To further confirm the nature of bonding, we have also done Quantum theory of atoms in molecules (QTAIM) analysis through the calculation of electron density topology, the Laplacian at the critical points, kinetic energy density Gc and potential energy density Vc at the critical points. Moreover, it is known that some transition metals show spin-orbit coupling (SOC) effect in their structural as well as electronic properties. For example, in systems like 2D layered MoS2 , Pt clusters etc. which contain transition metals, SOC changes the electronic and structural properties significantly. Therefore in our present work, we have also probed the role of SOC in Cu-Nb system.

Work is in progress on Heusler alloys with a fourth element added to it, resulting in Quaternary Heusler alloys. Recently many interesting changes in properties have been reported with the inclusion of the fourth element. At the same time, we are extending our work on Cu-Nb composite by increasing the size of the model system and introducing defects into the system in terms of vacancy.

Dr. Sagar Sharma

Organic Electronic Materials.

Organic semiconductors have been one of the emerging area in advanced material sciences and their development is fueled by their applications in various fields including organic photovoltaics, field effect transistors (OFET), organic light emitting diodes (OLED) etc. They offer various advantages over their inorganic counterparts such as low cost, biodegradablility, easy processability, mechanical flexibility, and large-area production. So, the rational design of new organic semiconductor materials has been an important facet for the evolution of next-generation optoelectronic devices. Our group at IASST utilizes modern computational chemistry tools as well as synthetic routes to design new class of organic semiconductors with desired properties. The focus of our research has been investigation of novel p-type as well as n-type organic electronic materials.

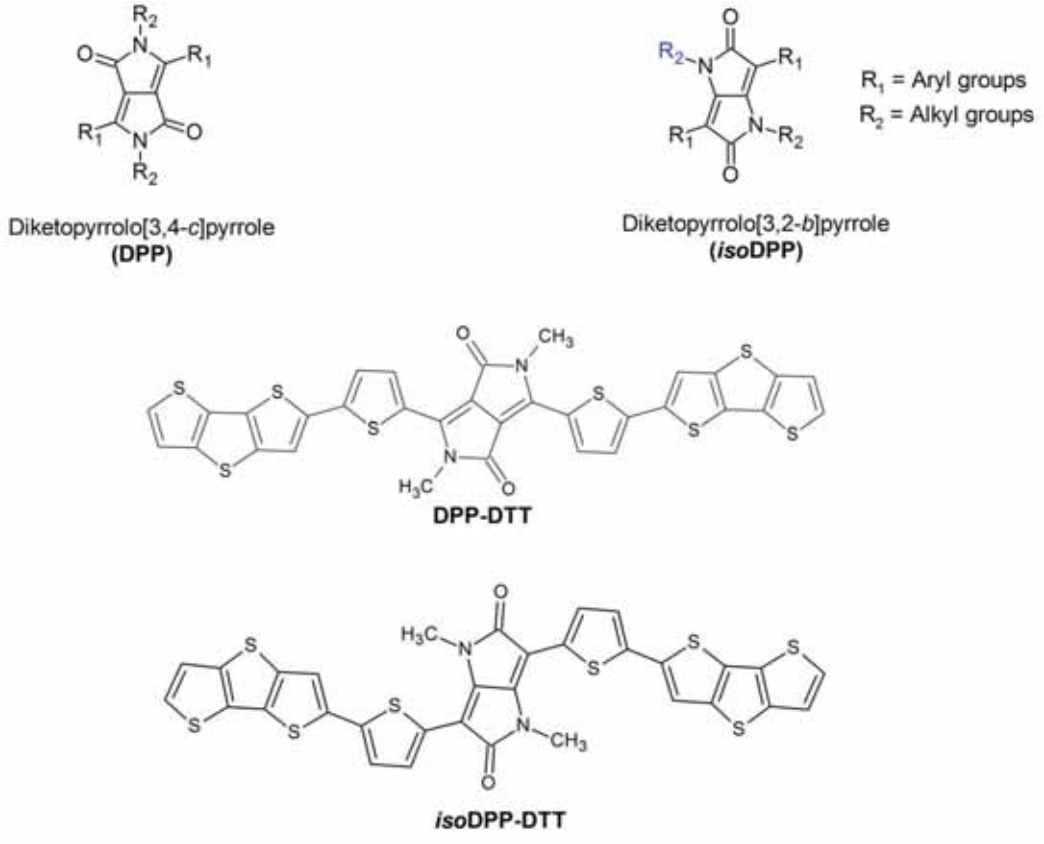


Fig.1: General structural formula of Diketopyrrolo[3,4-c]pyrrole, Diketopyrrolo[3,2-b]pyrrole and representative example of D-A-D type of compounds under study.

One of the systems of our interest includes compounds based on diketopyrrolopyrroles. Compounds

based on diketopyrrolo[3,4-c]pyrrole have been extensively employed for the synthesis of large number of oligomers and polymers for their applications in the OFETs as well as in polymer solar cells, while the regioisomer of diketopyrrolo[3,4-c]pyrrole, which is known as diketopyrrolo[3,2-b]pyrrole (Figure 1) has remained relatively unexplored. We have carried out a detailed comparative computational study (B3LYP/6-31G**) of Donor-Acceptor-Donor (D-A-D) types of architecture based on the regioisomers of diketopyrrolopyrroles with different types of fused tricyclic aromatic/heteroatomic ring systems as donors. A representative example of D-A-D type of compound with dithienothiophene (DTT) as donor is shown in Figure1. In general, we found that the compounds of DPP with different types of donors are planar as compared to relatively twisted geometry of isoDPP based compounds. This has also an effect on their band gap as the HOMO-LUMO gap of DPP based compounds (1.91 – 2.17 eV) were found to be much lower than their isoDPP counterparts (2.12 - 2.56 eV). Both the categories of compounds are expected to show predominant p-type of behaviour on account of their low hole injection barrier, lower ionization potential and small reorganization energies and hence point towards the suitability of these types of compounds as p-type materials.

Another aspect of our study includes organic compounds that can act as n-type materials. In our study, we envisaged systems accommodating at least two different types of electron acceptor moiety (such as diketopyrrolopyrrole and benzenethiadiazole) in order to have access to new class of n-type materials. The calculations performed at B3LYP/6-31G(d) level of theory revealed that the optimized molecular geometries of these systems are nearly planar and they exhibit a relatively low band gap in the region of 1.7-1.9 eV. It was observed that the electron affinity of such materials vary from 2.0 eV to 2.4 eV which is close to the desired range of electron affinity (of 3.0-4.0 eV) for them to behave as n-type materials. The two major factors that affect the transport properties (or charge mobility) of materials are internal reorganization energy (λ) and charge transfer integral. Small reorganization energy is a favorable parameter that enhances the charge transfer process. An analysis of reorganization energies of these materials revealed that they possess electron reorganization energy within the range of 0.14-0.18 eV and is smaller than that of perfluoropentacene (0.22 eV), which is one of the well-known n-type organic semiconductors. Thus these compounds can be expected to exhibit good charge transport character. Further studies to evaluate the charge mobility of these compounds for their applicability as n-type organic semiconductors as well as calculations at higher level of theory for improved results are underway.

Extramural Projects

Completed Projects

Title of the project	Funding Agency; Total fund; Duration; PI/Coordinator	Achievement
Development of atmospheric pressure glow discharge plasma system for growth of vertically aligned carbon nanotubes	BRNS-DAE, Govt. of India; Rs 23.80 lakhs; 2013-2016; **Dr. Arup R. Pal**	Atmospheric pressure glow discharge plasma system has been developed successfully, and carbon nanotubes and nanofibers have been grown on Inconel substrate without using any additional catalyst layer. Optimized growth condition has been achieved for vertical alignment of the nanostructures. Field emission property has been studied which shows that the grown nanostructures could be useful for development of efficient cold cathode.

Ongoing Projects

Title of the Project	Funding Agency; Total fund; Duration; PI/ Coordinator	Goal
Electronic, magnetic and lattice dynamical properties of magnetic shape memory alloys	DST, Govt. of India; Rs. 26 lakhs; 2013-2016; **Dr. Munima B. Sahariah**	Aim of this research is to understand the microscopic mechanism of structural transformation and the stability of phases which are responsible for the characteristic behaviour of shape memory alloys.
Investigating physico-chemical properties of new hybrid carbon nanomaterials and its applications as sensors	SERB, New Delhi; Rs. 48.7 lakhs; 2013-2016; **Dr. Devasish Chowdhury**	Aim of this research is to develop new hybrid carbon based nanomaterials from bio-polymers like chitosan, alginate and agarose and use them as sensing probe for detection of host of environment hazardous chemical contaminants like heavy metals (Pb^{2+}, Co^{2+}, Cd^{2+}, Cu^{2+} , Fe^{2+} etc) and water hardening metals ions (Ca^{2+} and Mg^{2+}).
Physico-chemical study of carbon dots and its applications as sensors	BRNS, Mumbai; Rs. 22.1 lakhs; 2014-2017; **Dr. Devasish Chowdhury (PI)** **Dr. Debajit Thakur (Co-PI)**	Aim of this research is to fabricate functionalized carbon dot from physical methods (pyrolysis, solvolysis techniques) and biological methods (use of microbes). The functionalized carbon dots prepared from these two techniques can be used as sensor for detection of milk adulteration.
New n-type organic semiconductors for optoelectronics: Synthesis, characterization and device fabrication	DST, Govt. of India; Rs 35 lakhs; 2014-2019; **Dr. Sagar Sharma**	Aim of this research is to computationally investigate the properties of new types of n-type organic semiconductor and synthesis of n-type organic semiconductors and their application in organic field effect transistor devices.

Title of the Project	Funding Agency; Total fund; Duration; PI/ Coordinator	Goal
Polymer and polymer nanocomposites: structure and property correlation	DAE-BRNS, Govt. of India; Rs 24.27 Lakhs; 2014-2017; **Dr. Sarathi Kundu**	Aim of this research is to study the structure and morphology of polymer and polymer nanocomposite thin films and to study their variation in optical and electrical behaviors.
Structure, pattern and elastic behaviour of model membranes in presence of nanomaterials	DST, Nano Mission, Govt. of India; Rs 57 Lakhs; 2015-2018; **Dr. Sarathi Kundu**	Aim of this research is to explore structure, pattern, mechanical and optical properties of lipid layer at interfaces.

Publications

In Cited Journals

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
A. A. Hussain, B. Sharma, T. Barman, A. R. Pal	Self-powered broadband photodetector using plasmonic titanium nitride	ACS Applied Materials and Interfaces	8/4258	January/ 2016
B. K. Sarma, A. Das, P. Barman, A. R. Pal	Biomimetic growth and substrate dependent mechanical properties of bone like apatite nucleated on Ti and magnetron sputtered TiO_2 nanostructure	Journal of Physics D: Applied Physics	49 (14)/145304	March/ 2016
T. Barman, A. A. Hussain, B. Sharma, A. R. Pal	Plasmonic hot hole generation by interband transition in gold-polyaniline	Scientific Reports (Nature Publishing Group)	5/18276	December/ 2015
M. Baro, A. R. Pal	One-step grown multi-walled carbon nanotubes with Ni filling and decoration	Journal of Physics D: Applied Physics	48 (22)/225303	May/2015
U. Baruah, D. Chowdhury	Functionalized graphene oxide quantum dot-PVA hydrogel: a colorimetric sensor for Fe(2+), Co(2+) and Cu(2+) ions	Nanotechnology	27(14)/145501	February/ 2016
M.J. Deka, D. Chowdhury	Tuning electrical properties of graphene with different π-stacking organic molecules	Journal of Physical Chemistry C	120(7)/4121-4129	February/ 2016
N. Gogoi, D. Chowdhury	Fragmentation of supported gold nanoparticles @ agarose film by thiols and the role of their synergy in efficient catalysis	RSC Advances	5(123)/ 101860-101870	December/ 2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
A. Konwar, A. Gogoi, D. Chowdhury	Magnetic alginate-Fe_3O_4 hydrogel fiber capable of ciprofloxacin hydrochloride adsorption/separation in aqueous solution	RSC Advances	5/81573-81582	September/ 2015
M. J. Deka, D. Chowdhury	Electrical conductivity of graphene and functionalized graphene: Role of lateral dimension of graphene sheet	Materials Chemistry and Physics	163/236-244	July/2015
A. Konwar, D. Chowdhury	Property relationship of Alginate and alginate-carbon dot nanocomposite with bivalent and trivalent cross-linker ions	RSC Advances	5/62864	July/2015
P. Kalita, M. Barthakur, N. Gogoi, D. Chowdhury	Protecting role of AuNP conjugated insulin on piamater and granular region of mice brain damaged by PTZ induced seizure	International Journal of Pharma and Bio Sciences	6(2)/271-278.	April/2015
S. Chakravarty, P. Dutta, S. Kalita, N. Sen Sarma	PVA-based nanobiosensor for ultrasensitive detection of folic acid by fluorescence quenching	Sensors and Actuators B	232/243-250	March/2016
P. Dutta, S. Chakravarty, N. Sen Sarma	Detection of nitroaromatic explosives using Π- electron rich luminescent polymeric nanocomposites	RSC Advances	6/3680-3689	January/2016
P. Dutta, D. Saikia, N. C. Adhikary, N. Sen Sarma	Macromolecular systems with MSA capped CdTe and CdTe/ ZnS core/ahell quantum dots as superselective and ultrasensitive optical sensors for picric acid explosive	ACS Applied Materials & Interfaces	7/24778-24790	October/2015
B. Gogoi, N. Paul, D. Chowdhury, N. Sen Sarma	Instant detection of picric acid vapour by developing layer by layer polymer detectors and an electronic prototype	Journal of Materials Chemistry C	3/11081-11089	September/ 2015
A. Gogoi, N. Sen Sarma	Conductivity study of poly(acrylonitrile-co-2-vinylpyridine) complexed with vinyl acetic acid and 4-pentenoic acid	Ionics	22(1)/77-84	August/2015
B. Gogoi, N. Sen Sarma	Poly-glycerol Acrylate and Curcumin Composite: Its Dual Emission Fluorescence Quenching and Electrical Properties for Sensing 2-vinyl pyridine	Journal of Materials Science	50 (23)/7647-7659	August/2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
P. Dutta, B. Kalita, B. Gogoi, N. Sen Sarma	Development of macroporous co-polyesters of glyceryl methacrylate with acrylonitrile and styrene for electrical sensing of ammonia vapor	Journal of Physical Chemistry C	119 (30)/17260-17270	July/2015
B. Gogoi, N. Sen Sarma	Curcumin-cysteine and curcumin–tryptophan conjugate as fluorescence turn on sensors for picric acid in aqueous media	ACS Applied Materials & Interfaces	7/11195-11202	May/2015
A. Gogoi, N. Sen Sarma	Solid state ionic conductivity of 2-vinylpyridine - acrylonitrile copolymer and its hydroiodide and hydrofluoride salts	Ionics	21/2543-2549	May/2015
S. Chakravarty, B. Gogoi, N. Sen Sarma	Fluorescent probes for detection of picric acid explosive: A greener approach	Journal of Luminescence	165/6-14.	April/2015
P. Dutta, N.N. Dass, N. Sen Sarma	Stimuli responsive carbon nanocomposite hydrogels with efficient conducting properties as a precursor to bioelectronics	Reactive & Functional Polymers	90/25-35	April/2015
A. Gogoi, N. Sen Sarma	Improvement in ionic conductivities of poly-(2-vinylpyridine) by treatment with crotonic acid and vinyl acetic acid	Bulletin of Materials Science	38 (3)/797-803	June/2015
P. Dutta, P. Saikia, S. Hoque, N. N. Dass, N. Sen Sarma	Synthesis of novel liquid crystalline polyesters of cholesterol: thermal, electrical conductivity and dielectric properties	Molecular Crystals and Liquid Crystals	616 (1)/112-122	September/ 2015
S. Kundu, K. Das, S. Mehan, V.K. Aswal, J. Kohlbrecher	Structure and interaction among protein and nanoparticle mixturein solution: effect of temperature	Chemical Physics Letters	641/68	November/ 2015
A. C. Bhowal, K. Das, S. Kundu	Fluorescence behavior of globular proteins from their bulk and thinfilm conformations in presence of mono-, di- and tri-valent ions	Colloids and Surfaces B: Biointerfaces	133/263	September/ 2015
J. K. Bal, S. Kundu	Molecular packing of metal-organic Langmuir-Blodgett films on differently passivated si (001) surfaces	Journal of Nanoscience and Nanotechnology	15/5280	July/2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
K. Das, S. Kundu, S. Mehan, V.K. Aswal	Modified interactions among globular proteins below isoelectric pointin the presence of mono-, di- and tri-valent ions: A small angleneutron scattering study	Chemical Physics Letters	645/127	February/ 2016
K. Das, S. Kundu	Subphase pH induced monolayer to multilayer collapse of fatty acid salt Langmuir monolayer at lower surface pressure	Colloids and Surfaces A: Physicochemical and Engineering Aspects	492/54	March/ 2016
S. Chabungbam, G. C. Loh, M. B. Sahariah, A. R. Pal, R. Pandey	Atomic level understanding of site-specific interactions in Polyaniline/TiO_2 composite	Chemical Physics Letters	645/144-149	February/ 2016
S. Chabungbam, M. B. Sahariah	Correlation between phonon anomaly along [211] and the Fermi surface nesting features with associated electron-phonon interactions in Ni_2FeGa: A first principles study	Journal of Alloys and Compounds	647/70-74	October/ 2015
P. Borgohain, M. B. Saharia	Effect of compositional and antisite disorder on the electronic and magnetic properties of Ni–Mn–In Heusler alloy	Journal of Physics: Condensed Matter	27/ 175502-175511	April/2015

Book chapters:

Author (s)	Other details
N. Gogoi, D. Chowdhury	"*An Introduction to Electron Microscopy*" in the book named "Biotechnology and Bioinformatics: Tools, Techniques and Applications" ISBN no. 978-81-925698-6-4.(2015)

Presentation in Conferences/Seminars

Invited Talks

Faculty	Title	Programme Name	Date & Venue
Dr. Arup R. Pal	Hybrid material based optoelectronic devices by plasma nanotechnology	7th International Conference on the Frontiers of Plasma Physics and Technology (FPPT-7)	April 13-17, 2015 at Kochi, Kerala, India

Faculty	Title	Programme Name	Date & Venue
Dr. Devasish Chowdhury	Carbon based Biopolymer nanocomposites	Conference on Advancements in Polymer Science & Technology	October 29-31, 2015 at Saurashtra University, Rajkot, Gujarat, India
Dr. Devasish Chowdhury	When Nano meets Bio	National Seminar "Molecular Biology and Biotechnology Research in NE India (MBBRNEI)	August 19-21, 2015 at PUB Kamrup College, Baihata Chariali, Kamrup, Assam, India
Ms Anna Gogoi	Solid Polyelectrolytes based on Poly(acrylonitrile-co-2-vinylpyridine): their Conductivity study	UGC-SAP National Seminar on Emerging Trends in Chemical Sciences-2015	November 05-06, 2015 at Department of Chemistry, Gauhati University, Guwahati, Assam, India
Dr. Munima B. Sahariah	Probing Ni_2FeGa as a prospective Magnetic Shape Memory Alloy using first principles calculations	Energy, Materials, and Nanotechnology (EMN) Meeting	September1-4, 2015 at San Sebastian, SPAIN

Contributory

Author(s)	Title	Conference Name	Oral/ poster	Date & Venue
A. A. Hussain, A. R. Pal	Single-step synthesis of ternary rubrene/ polyaniline/TiO_2 nanocomposite film for fabrication of hybrid photodetector	International Conference on Nanoscience and Technology (ICONSAT 2016)	Poster	February 29 – March 02, 2016 at IISER, Pune
T. Barman, A.A. Hussain, B. Sharma A. R. Pal	Plasmonic hot hole generation by d-sp transition of AuNPs for organic self-powered photodetector	India International Science Festival 2015	Oral	December 04 – 08, 2015 at IIT Delhi
B. Sharma, A. R. Pal, D. S. Patil	Atmospheric pressure synthesis of high density carbon nanotubes by RF PECVD process	National Conference on Carbon Materials (NCCM-2015)	Oral	November 26-28, 2015 at New Delhi
U. Baruah, D. Chowdhury	Functionalized graphene oxide quantum dots-poly vinyl alcohol hybrid hydrogel: a colorimetric sensor for detection of Fe^{2+}, Co^{2+} and Cu^{2+} ions in aqueous media	Nanoparticle Assembly - From Fundamentals to Applications, Faraday Discussion 2016	Poster	January 7-9, 2016 at IIT Bombay

Author(s)	Title	Conference Name	Oral/ poster	Date & Venue
S. Majumdar, G. Majumdar, D. Thakur, D. Chowdhury	Extracellular synthesis of carbon dots from microorganisms	Molecular Biology and Biotechnology Research in NE India (MBBRNEI)	Oral	August 19-21, 2015 at Kamrup College, Baihata Chariali, Guwahati
S. Majumdar, G. Majumdar, D. Thakur, D. Chowdhury	Au^{3+} capped paper carbon dots for fluorimetric detection and differentiation of organic and inorganic sulfur bearing analytes	Nanoparticle Assembly: From Fundamentals to Applications (Faraday Discussion)	Poster	January 7-9, 2016. At IIT Bombay
N. Gogoi, D. Chowdhury	Carbon dots rooted agarose hydrogel hybrid platform for optical detection and separation of heavy metal ions	International conference in Nanoscience, Nanotechnology and Advanced Materials (NANOS-2015)	Oral	December,14-17, 2015 at the GITAM University, Vishakhapatnam
N. Gogoi, D. Chowdhury	Fragmentation of supported gold nanoparticles@agarose film by thiols and the role of their synergy in efficient catalysis	Fourth International Conference on Frontiers in Nanoscience and Technology (Cochin Nano-2016) Kerala.	Poster	February 20-23 , 2016 at the CUSAT, Cochin
M. J. Deka, D. Chowdhury	Investigating electrical bevaviour of non-covalently functionalized reduced graphene oxide hybrid nanocomposites	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN2015)	Poster	December 0811, 2015 at IIT Guwahati
M. J. Deka, D. Chowdhury	Tuning electrical properties of graphene with different π-stacking organic molecules	International Conference on Nanoscience and Technology (ICONSAT 2016)	Poster	29th February to 2nd March 2016 at IISER,Pune
A. Konwar, A. Gogoi, D. Chowdhury	Magnetic alginate-Fe_3O_4 hydrogel fiber having adsorption/separation capability of Ciprofloxacin hydrochloride from aqueous solution	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN2015)	Poster	December 0811, 2015 at IIT Guwahati
B. Gogoi, N. Sen Sarma	Co-polysulfone of cholesterol and curcumin-amino acid conjugates for the detection of nitroaromatic explosives	11th International Conference on Advanced Polymers via Macromolecular Engineering 2015	Oral	October 18-22, 2015 at Pacifico Yokohama in Yokohama, Japan
B. Gogoi, N. Sen Sarma	Curcumin polymers as efficient nitroaromatic explosive sensor to biosensor	11th International Conference on Advanced Polymers via Macromolecular Engineering 2015	Poster	October 18-22, 2015 at Pacifico Yokohama, Japan

Author(s)	Title	Conference Name	Oral/ poster	Date & Venue
S. Chakravarty, N. Sen Sarma	Cost effective and environmentally benign luminescent probes aqueous picric acid explosive detection	National Conference on Challenges in Environmental Research	Poster	June 4- 6, 2015 at IIT Guwahati
S. Chakravarty, N. Sen Sarma	*B. mori* silk as a versatile biodegradable material for next generation sensing applications	UGC-SAP National Seminar on Emerging Trends in Chemical Sciences 2015,	Poster	November 5-6, 2015 at Gauhati University, Guwahati
S. Chakravarty, N. Sen Sarma	Explosive vapour detection using light weight and flexible carbon nanoparticles coated 3D macroporous composite silk scaffolds as green chemiresistor	Nanoparticle Assembly: From Fundamentals to Applications (Organized by RSC) Faraday Discussion	Poster	January 7-9, 2016 at IIT Bombay, India
S. Chakravarty, N. Sen Sarma	Cationic and anionic polysaccharides as efficient "Green" biosensor for hemin	National Seminar on Science and Technology for Sustainable Development (61st Annual Technical Session of Assam Science Society, 2016)	Oral	January 23, 2016 at Goalpara College, Assam
S. Chakravarty, N. Sen Sarma	Advanced green materials for biosensing and chemosensing	Materials Research Society of India Symposium Advanced Materials for Sustainable Application & 27th Annual General Meeting of MRSI (Organized by IITG, CSIR-NEIST & TEZPUR UNIVERSITY)	Poster	February 18-20, 2016 at CSIR-NEIST, Jorhat, Assam
B. Kalita, N. Sen Sarma	Synthesis and characterization of SWCNT grafted phenylalanine doped clay nanopowder	National Seminar (61st Annual Technical Session of Assam Science Society) on "Science and Technology for Sustainable Development	Oral	January 23, 2016 at Goalpara College, Assam
B. Kalita, N. Sen Sarma	Bioconjugate of riboflavin-cysteine as optical sensor for the selective detection of nitroaromatic explosives	Materials Research Society of India Symposium Advanced Materials for Sustainable Application & 27th Annual General Meeting of MRSI (Organized by IITG, CSIR-NEIST & TEZPUR UNIVERSITY)	Poster	February 18-20, 2016 at CSIR-NEIST, Jorhat, Assam
K. Das, S. Kundu	Collapse of Langmuir monolayer at lower surface pressure: effect of hydrophobic chain length	60th Solid State Physics Symposium (SSPS-2015)	Poster	December 21-25, 2015 at Amity University, Noida, Uttar Pradesh

Author(s)	Title	Conference Name	Oral/ poster	Date & Venue
K. Das, S. Kundu	Self-assembled nanostructure induced protein adsorption on solid surface	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	Poster	December 8-11, 2015 at IIT-Guwahati, Assam
A. C. Bhowal, S. Kundu	Effect of divalent ions on the optical emission behavior of protein thin films	International conference on Condensed Matter and Applied Physics (ICC 2015)	Poster	December 30-31, 2015 at Govt. Engineering College - Bikaner, Bikaner, Rajasthan
A. C. Bhowal, S. Kundu	Protein induced gold nanoparticles formation at air-solid interface and their growth behavior	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	Poster	December 8-11, 2015 at IIT-Guwahati, Assam
H. Talukdar, Sarathi Kundu	Structural and morphological modifications of polymer thin film in the presence of nonsolvent	60th Solid State Physics Symposium (SSPS-2015)	Poster	December 21-25, 2015 at Amity University, Noida, Uttar Pradesh
H. Talukdar, Sarathi Kundu	Nanopattern formation by thiol-capped Au nanoparticles on hard and soft surfaces	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	Poster	December 8-11, 2015 at IIT-Guwahati, Assam
S.Chabungbam, G. C. Loh, A. R. Pal, M.B. Sahariah, R. Pandey	Charge transfer and bandgap tuning in polyaniline/TiO_2 hybrid structures from first principles	NanotechITALY-2015	Poster	November 25-27, 2015 at CNR, Bologna, Italy.
S. Chabungbam, M. B. Sahariah	effect of disorders in the martensitic transformation temperature and exchange parameters in Ni-Fe-Ga alloy	CCP-2015	Poster	December 2-5, 2015 at IIT Guwahati, India.
P. Borgohain, M. B. Sahariah	First principles investigation of electronic and magnetic properties in Ni-Co-Mn-In Heusler alloy	CCP-2015	Poster	December 2-5, 2015 at IIT Guwahati, India
U. Saikia, M. B. Sahariah	To study the structural stability and effect of spin orbit coupling on Cu-Nb layered nanocomposite	CCP-2015	Poster	December 2-5, 2015 at IIT Guwahati, India.
U. Saikia, M. B. Sahariah	A quasi unit cell approach to study the interface topology and nature of bonding in Cu-Nb layered nanocomposite	ICANN-2015	Poster	December 8-11, 2015 at IIT Guwahati, India.

Conferences/Workshops/Meetings Attended

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Ms Amreen A. Hussain	International Conference on Nanoscience and Technology	February 29 – March 02, 2016 at IISER, Pune
Mr. Tapan Barman	India International Science Festival 2015	December 04 – 08, 2015 at IIT Delhi
Mr. Bikash Sharma	National Conference on Carbon Materials (NCCM-2015)	November 26-28, 2015 at New Delhi
Dr. Devasish Chowdhury	Conference on Advancements in Polymer Science & Technology	October 29-31, 2015 at Saurashtra University, Rajkot.
Dr. Devasish Chowdhury, Ms. Sristi Majumdar	National Seminar "Molecular Biology and Biotechnology Research in NE India (MBBRNEI)	August 19-21, 2015 at PUB Kamrup College, Baihata Chariali, Kamrup
Ms. Upama Baruah, Ms. Sristi Majumdar	Nanoparticle Assembly - From Fundamentals to Applications, Faraday Discussion 2016	January 7-9, 2016 at IIT Bombay, Powai, Mumbai
Ms. Neelam Gogoi	International conference in Nanoscience, Nanotechnology and Advanced Materials (NANOS-2015)	December 14-17 , 2015 at GITAM University, Vishakhapatnam
Ms. Neelam Gogoi	Fourth International Conference on Frontiers in Nanoscience and Technology (Cochin Nano-2016)	February 20-23 , 2016 at the CUSAT, Cochin, Kerala
Mr. Manash, Jyoti Deka, Mr. Achyut Konwar	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN2015)	December 811, 2015 at IIT Guwahati
Mr. Manash, Jyoti Deka, Mr. Achyut Konwar	International Conference on Nanoscience and Technology (ICONSAT 2016)	29th February to 2nd March 2016 at IISER, Pune
Ms Sudesna Chakravarty	Elsevier Author's Workshop.	March 5, 2016 at Gauhati University, Guwahati,.
Ms Sudesna Chakravarty	International Training Program on Leadership & Career Development for Women Scientists &Technologists. (Organized by DST &IUSSTF)	September 2 -6, 2015 at IIE, Guwahati
Ms Sudesna Chakravarty	INUP '2-day Familiarization workshop on Nanofabrication Technologies. (Organized by INUP, IIT Bombay)	April 25-26, 2015 at Tezpur University, Tezpur
Ms. Sudesna Chakravarty, Ms. Bandita Kalita	National Seminar on Science and Technology for Sustainable Development	January 23, 2016 at Goalpara College, Assam, India
Ms. Sudesna Chakravarty, Ms. Bandita Kalita	Materials Research Society of India Symposium Advanced Materials for Sustainable Application & 27th Annual General Meeting of MRSI	February 18-20, 2016 at CSIR-NEIST, Jorhat
Ms. Sudesna Chakravarty	Nanoparticle Assembly – From Fundamentals to Applications, Faraday Discussion 2016	January 7-9, 2016 at IIT Bombay, Powai, Mumbai

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Ms. Sudesna Chakravarty	The Welcome Trust/DBT India Alliance Sci. Comm.	March 21-22, 2016 at Lemon Tree Premier, Hyderabad
Dr. Sarathi Kundu	National Workshop on Advanced Probing Techniques in TEM (APTTEM-2016)	February, 15-16, 2016 at IIT-Guwahati, Guwahati, India
Dr. Sarathi Kundu	NIAS-DST Workshop on Science Policy and General Management	February 29 –March 11, 2016 at NIAS, Bangalore, India
Mr. Kaushik Das	60th Solid State Physics Symposium (SSPS-2015)	December 21-25, 2015 at Amity University, Noida, Uttar Pradesh, India
Mr. Kaushik Das	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	December 8-11, 2015 at IIT- Guwahati, Assam, India
Mr. Ashim Chandra Bhowal	International conference on Condensed Matter and Applied Physics (ICC 2015)	December 30-31, 2015 at Govt. Engineering College - Bikaner, Bikaner, Rajasthan, India
Mr. Ashim Chandra Bhowal	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	December 8-11, 2015 at IIT- Guwahati, Assam, India
Mr. Hrishikesh Talukdar	60th Solid State Physics Symposium (SSPS-2015)	December 21-25, 2015 at Amity University, Noida, Uttar Pradesh, India
Mr. Hrishikesh Talukdar	International Conference on Advanced Nanomaterials and Nanotechnology (ICANN-2015)	December 8-11, 2015 at IIT- Guwahati, Assam, India
Mr. Chabungbam S. Singh	National Workshop on Atomistic Simulation Techniques for Materials Science, Nano Technology and Biosciences-2015	December 21-24, 2015 at IIT Guwahati, India
Ms Parijat Borgohain	National Workshop on Atomistic Simulation Techniques for Materials Science, Nano Technology and Biosciences-2015	December 21-24, 2015 at IIT Guwahati, India
Mr. Ujjal Saikia	National Workshop on Atomistic Simulation Techniques for Materials Science, Nano Technology and Biosciences-2015	December 21-24, 2015 at IIT Guwahati, India

Lectures delivered at other institutes

Faculty	Topic	Date & Venue
Dr. Arup R. Pal	Plasma for nanomaterial synthesis and device realization	November 27, 2015 at Dept. of Physics, Gauhati University
Mr. Chabungbam S. Singh	First principles prediction of the phase properties in Ni-Fe-Ga shape memory alloy	January 22, 2016 at Harish-Chandra Research Institute, Allahabad India

Other activities

Visits to National/International Institutes/Laboratories

Faculty/Research scholar	National/international institutes/ laboratories	Date
Dr. Sarathi Kundu	BARC, Mumbai	January 25- 29, 2016

M.Sc. / B. Tech projects/training courses offered at IASST

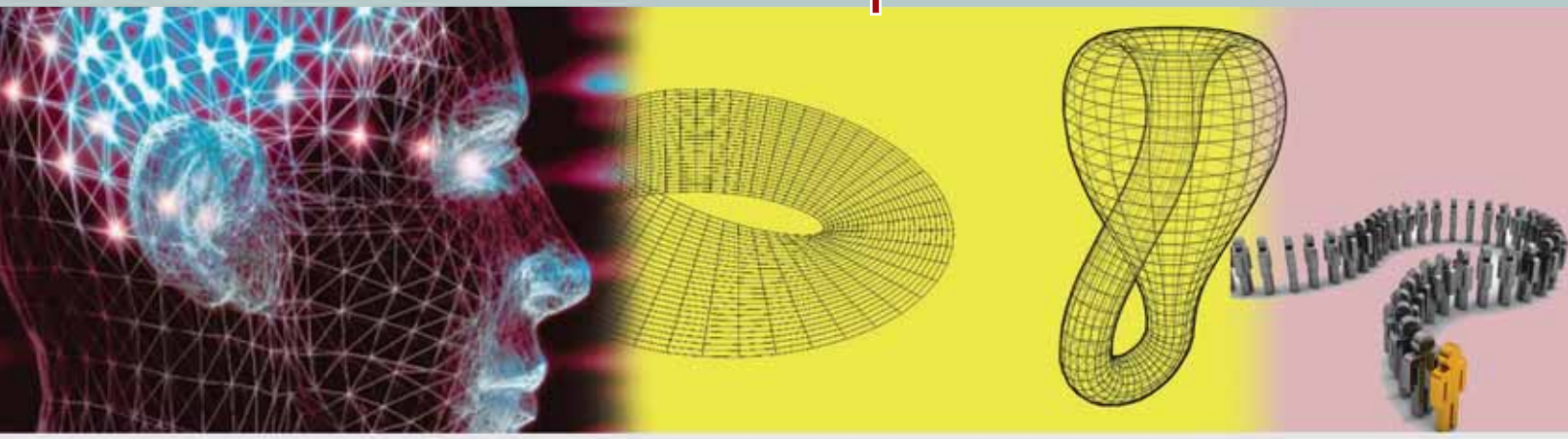
Name(s) of trainee	Programme and supervisor	Title of work	Duration
Mr. Dipjyoti Sarkar and Mr. Mosoke Joseph	M. Sc. under Dr. A. R. Pal	Thin film deposition by magnetron sputtering	5 days
Mr. Mrinmoy Jyoti Borah	BS under Dr. Devasish Chowdhury	Synthesis of graphene and multi-walled carbon nanotube by thermal chemical vapour deposition	7 months
Ms. Ansumi Gogoi	BS under Dr. Devasish Chowdhury	Synthesis and characterization of magnetic hydrogel fiber	7 months
Ms Susmita Buragohain	BS under Dr. N. Sen Sarma	Greener Strategy Selective Detection of Hazardous Picric Acid Explosive Using *Cleodendrum infortunatum*	6 months
Ms Susma Das	M.Sc. under Dr. N. Sen Sarma	Synthesis And Characterization Of Cholesterol-Amino Acid Bioconjugates	2 months
Ms Trishnajyoti Kalita	M.Sc under Dr. N. Sen Sarma	Synthesis And Characterization Of Solid Polyelectrolyte Based On Poly 2- Vinylpyridinium Salt Of Ortho Phosphoric Acid	2 months
Mr. Shohidur Rahman	M. Sc. under Dr. Sagar Sharma	Computational Study of Compounds of Diketopyrrolopyrrole and its Regioisomer Containing Fused Ring Systems as Electron Donor Groups	2 months

Name(s) of trainee	Programme and supervisor	Title of work	Duration
Ms Shilpi Shikha Gogoi	M.Sc. under Dr. Sagar Sharma	Density Functional Theory Studies of the Electronic and Optical Properties of Fused Borepin Molecules	5 months
Mr. Rajesh Deb	M. Sc. under Dr. Sarathi Kundu	Growth and characterization of protein induced gold nanomaterials	5 months
Ms Kashmiri Kumari	M. Sc. under Dr. Sarathi Kundu	Biosynthesis and characterization of silver nanomaterials	5 months

Awards/Recognitions/Achievements

Name	Particulars
Dr. Devasish Chowdhury	American Chemical Society (ACS) membership Award, 2015
Ms. Neelam Gogoi	Best Poster Presentation (3rd prize) at the Fourth International Conference on Frontiers in Nanoscience and Technology (Cochin Nano-2016) held on 20-23 February, 2016 at the CUSAT, Cochin, Kerala.
Dr. Sarathi Kundu	Life member of Neutron Scattering Society of India (NSSI)
Mr. Chabungbam S. Singh	Awarded International Travel Support (ITS) by SERB, Govt. of India for attending-NanotechITALY2015-an International Conference at CNR-Center, Bologna, Italy, 25-27th November, 2015.
Ms. Sudesna Chakravarty	Best Poster award at the National Conference on Challenges in Environmental Research held on 4-6 June, 2016 at the IIT Guwahati, India

Mathematical and Computational Sciences



The Mathematical and Computational Sciences programme was originated with the main objective to emphasize on the theoretical development of some aspects on thrust areas of research applicable for mathematical modelling. It is evident that mathematical modelling plays an important role in the research in almost all the branches of science, whether it is theoretical research or data analysis. In this context the original Mathematical Sciences Division has focused on the development of different new concepts, their theories, investigations and applications on the emerging areas of research such as topological spaces, functional analysis, stochastic process, summability theory, fixed point theory, image processing of different types of data on real life problems, fuzzy set theory, multiset theory, soft set theory and their applications.

Binod Chandra Tripathy
Professor

Gautam Choudhury
Associate Prof.-II

Lipi B Mahanta
Associate Prof.-I

Ajay Kumar Saw
JRF

Karishma Shravan
JRF

Silpisikha Goswami
JRF

Priyanka Kalita
JRF

Snigdha Mahanta
JRF

Tabassum Yesmin Rehman
Women Scientist

Kangkana Bora
Inspire Fellow

Daisy Das
JRF

Santanu Acharjee, SRF

Prof. Binod C. Tripathy

Programme Head

Mathematical Sciences

Sequence Spaces, Functional Analysis, Summability Theory, Topology, Soft Sets, Multi Sets, Fuzzy Set Theory and its applications.

Research in our group encompasses topics like Spectra theory, Sequence spaces, Series and Summability theory, Topological spaces, Soft Sets, Multi Sets, Fuzzy Sets and their applications.

Iteration process is very important in finding the approximate value of a solution of an equation. The concept of convergence of sequences plays a vital role in this process. Studies on sequence spaces, series and summability theory is an established area of research in Mathematical Analysis. Sometimes the data is multidimensional. To handle such cases, the concept of multiple sequences has been introduced. We have studied the properties of approximation of multiple sequences using Orlicz functions. Lacunary sequences give us an idea of the behavior of a sequence in blocks, the blocks are defined in such a way that the number of elements in the block increases and tends to infinity. It may so happen that a bounded sequence is transformed to a convergent sequence by means of linear transformation, which has a matrix representation. The arithmetic mean of the blocks, which are arbitrary, if it converges, then we say that the sequence is almost convergent. We have combined the notions of lacunary and almost convergence for double sequences and have studied their different properties. The important feature of our study is, the way we have introduced the lacunary double sequences is different from the existing one. According to the need of situation and environment, the properties of sequences are examined with different metrics. During the course of our investigation, we have used the metric deduced from norm, probabilistic norm, metric on fuzzy sets etc. We have also used the concept of ordered sets for studying different algebraic and topological properties of sequence spaces those we have introduced.

Some times it may so happen that the solution of a linear equations may not be a discrete and finite set. It will be a region. This type of situation arises when we have the linear transformation represented by an infinite matrix. Then for such a region, it becomes important to find the boundary of the region. The concept of spectral theory plays a vital role in finding the region. Sometimes it may so happen that it divides the whole region and sometimes it is bounded by a curve. During the course of our investigation, we have obtained the spectra of certain matrix operators transforming one class of sequences into another class of sequences. We have obtained the spectra of the matrix operator U (r, s) and lower triangular Matrix B(r,0, s) over the class of all convergent series, which is a sequence space. In fact we are among the few researchers who have studied the spectra of matrix operator on convergent series. We have also obtained the Spectrum of the operator D(r,0,0,s) over the bounded variation and null sequence space. Our next objective under the investigation was finding the spectrum of the operator D(r, 0, s, 0, t) over the p-absolutely summable and p-bounded variation sequence spaces.

Topology plays an important role on the solution of equations, structural study of different bodies, bonding of atoms considering their properties etc. The concepts have been widely used in different branches of science and technology. We have studied about different topological concepts and properties. Bitopological spaces help in the comparative study of two dimensional data set. We have introduced different the notions and have studied its different properties using some extension operators, sometimes ideal and their combination.

The set whose boundary is not sharp or precise has been studied by the notion of fuzzy sets and its logic introduced by L.A. Zadeh in 1965. It is worthy mentioning that this notion originated a new theory of uncertainty, distinct from the notion of probability. We have applied the notion of fuzzy sets and have introduced some classes of sequences of fuzzy numbers. The count for the repetition of elements in a set plays a crucial role in application of set theory in other branches of science and technology. This is different from the concept of Cantor's set. R. Dedikind in 1888 hinted about it, but it did not attract scientists and technologists of that time. This idea lead to introduction of the notion of multiset. We have studied about its application is topology and studying the class of b-open sets in multiset tpological spaces.

Another application of impreciseness is about the properties of different attributes of similar type. In this case we say that two completely different attributes are approximately the same. This is found to have lot of applications, since two different colors are approximately same if they are within our requirement. This lead us to the introduction of the new notion called soft set. We have applied this for studying soft bitopological space.

Dr. Gautam Choudhury

Mathematical Sciences

Queues with Vacation Models, Retrial Queueing Models, Control of Queues related to Optimization problems.

Queueing theory is a branch of Applied Stochastic Process. Its progress and development both in methodology and in applications are ever growing. As a result of which it is an important area of current research. In this context, some important contributions have been made on different branches of queueing theory as given below.

Retrial Queueing System

Retrial queues are characterized by the following feature that a customer who finds the server busy upon arrival is obliged to leave the service area to repeat his demand after some random amount of time called retrial time. Between trials, the blocked customer joins a pool of unsatisfied group of customers called “orbit” or “retrial group”. This type of queueing models have potential applications in modern telecommunication systems. In this context we have made some investigation for unreliable queueing systems.

Vacation Queueing System

Vacation models are characterized by the fact that the idle time of the server may be utilized for some secondary job beside primary job, during which the server remains unavailable in the main system. Different types vacation policies such as Bernoulli vacation policy, Randomized vacation policy , Restricted Admissibility vacation policy, Optimized vacation policy and Random vacation policy have been studied for both reliable and unreliable vacation models. These types of models have potential applications in many real life situations such as production systems, manufacturing systems and mobile network systems like IEEE802.16e, LTE4G, etc.

Control of Queues

Control of queue is one of the most significant area of research. It is customary to classify models into two general categories: descriptive and prescriptive models. Descriptive models are models which describe some current real world situation, while prescriptive models are models which prescribe what real world situation should be, that is, optimal behavior at which to aim. The determination of an optimal policy for a queueing system is an important issue. This is usually done by developing the total expected cost function per unit time for the system and then deriving the relevant optimal system parameters. In this context we develop dynamic optimization technique and Heuristic approach technique to obtain the optimized threshold values of the system parameter for both reliable and unreliable queueing models.

Dr. Lipi B Mahanta

Computational and Numerical Laboratory

Image processing and Pattern Recognition.

Bio-medical image analysis has emerged as an active research area having applications in various domains based on cytological, histological and radiological imaging. The clinical features of any medical image may be segregated into 3 types: shape, texture and colour, each generating a large subset of computer features. The challenge is to segregate the ROI (region of interest) as accurately as possible, then extract the features from them, next 'mine' those features which furnish meaningful information and finally recoginse the pattern hidden within. Keeping in mind the aim of the team to develop robust and efficient techniques for detection of any abnormality in the image under study, the following developments and achievements were attained.

PAP-SMEAR: Pap smear segmentation is still a challenging task in this field and is an open problem ongoing for nearly fifty years. A novel technique was proposed and evaluated on real indigenous Pap smear image database by us consisting of 1610 cell level images and 1337 smear level images collected from local sources. Main objective of database generation is to categorise the cells into NILM, LSIL and HSIL categories of the Bethesda system along with the ground truths. Segmentation work of present study is inspired by Maximally Stable Extremal Region (MSER) technique introduced by

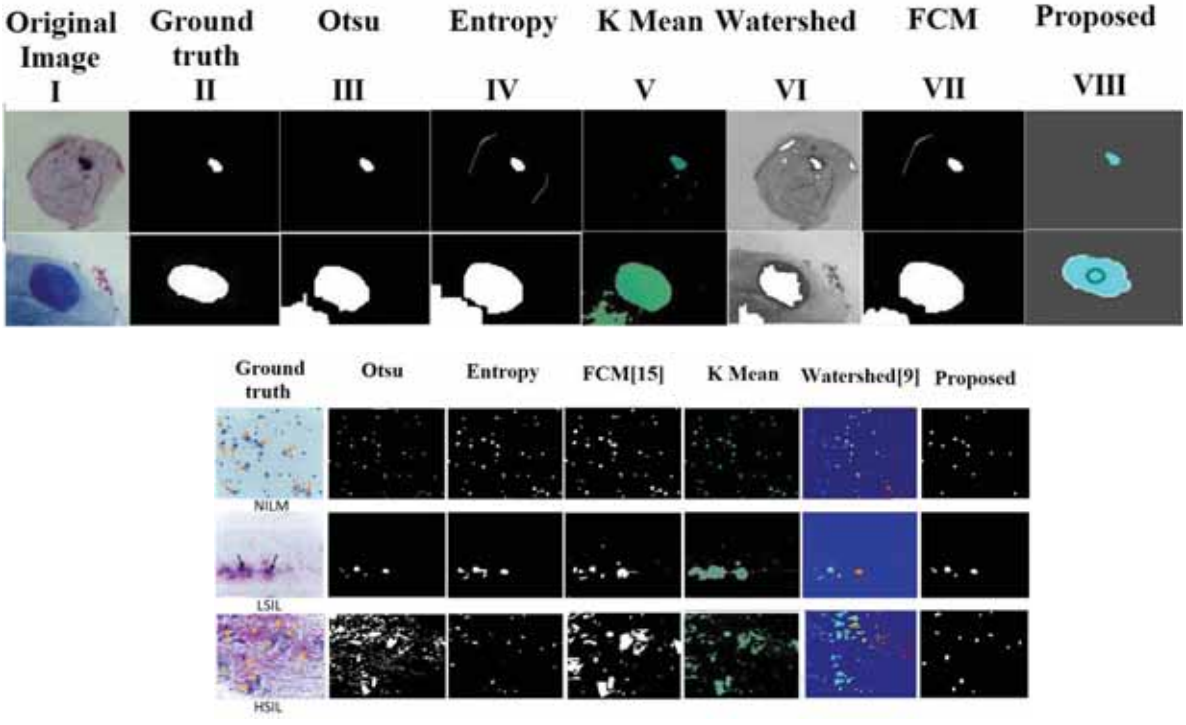


Fig.1: Cell level (top) and smear level (bottom) segmentation.

Matlas. In MSER the regions are de_ned exclusively by the intensity functions in the region and the outer border, this leads to many key characteristics of the regions which make them useful. The system is also tested on Herlev database which is publicly available. The proposed system achieved an accuracy of 93.14% on Online Herlev dataset, 98.77% accuracy using generated cell level database and 92.75% at smear level database (Fig.1). It is also compared with the existing techniques in the literature.

CT-LUNG: Analysis of the texture of lung computed tomography (CT) images is done with the help of different feature vector that we obtain from wavelet transform of the CT images. To characterise texture of the lung we need a descriptor to describe various types of textures, called feature vector or feature descriptor. This feature vector is composed of five parts:

1. Modulus values for a wavelet ψ_1, more suited to analyse the edges of the texture.
2. Modulus values for a wavelet ψ_2, more suited to analyse the surface of the texture.
3. The directional information contained in the Argument of ψ_1.
4. The directional information contained in the Argument of ψ_2.
5. Evolution of the Modulus values of feature 1 and 2, with respect to increase in scale.

We consider four categories of lung textures for classification, viz. Normal (NL), Linear and reticular opacities (LRO), Parenchymal opacification (PO) and Air-filled cystic lesion (ACL).

The performance of tissue classification based on the top five feature vectors are fairly satisfying as shown in Table 1.

Table 1: The Performance of tissue classification based on the top five feature vectors.

	NL	LRO	PO	ACL
Recall	80.00	76.00	84.00	72.00
Precision	77.92	79.00	77.00	85.70

Also the above feature descriptor developed from wavelet transform is implemented on histological images of lung. Initially the classification is done on small cell lung carcinoma (SCLC) and non-small cell lung carcinoma (NSCLC). The classification results thus obtained are presented in Table 2.

Table 2: Classification results on small cell lung carcinoma (SCLC) and non-small cell lung carcinoma (NSCLC).

	NSCLC	SCLC
Recall	84.30	86.20
Precision	85.60	82.20

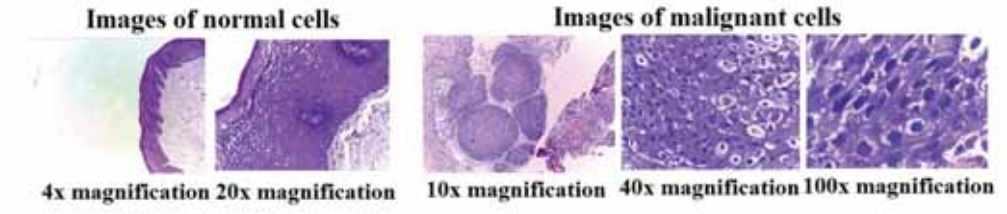


Fig.2: Examples of Oral SCC biopsy images.

BIOPSY (ORAL): Oral squamous cell carcinoma (OSCC) has contributed 90% of oral cancer worldwide. In situ histological evaluation of tissue sections is the gold standard for oral cancer detection. A database is generated with 2068 images consisting of which 566 are images of normal cells and 1502 are images of abnormal cells (Fig.2).

Channel Identification was carried out to identify the highest information-giving colour space. Presently textural feature extraction is being studied where two approaches (Histogram and GLCM) have been used. Using histogram approaches, six features namely mean, variance, skewness, kurtosis, energy and entropy were extracted. Using GLCM approach, eighty eight features were extracted (Fig.3). t-tests revealed a highly significant difference between the values of both the classes.

1	4.505083084	2.054076742	0.356153334	2.255409275	0.199466837
1	4.811183294	3.117817973	0.671289359	2.211091727	0.210250401
1	4.807265917	2.611792388	0.761268214	2.603076277	0.229949085
1	4.33525308	2.823867185	0.878671654	2.831822972	0.212502162
1	4.573397636	3.498838836	0.657839815	2.203285721	0.191868107
1	4.691367177	4.095520275	0.461637626	1.791324571	0.180370631
1	4.78243796	3.741407235	0.511054751	1.922514912	0.187248914
1	4.842649142	3.266117414	0.553396594	2.156389219	0.194697304
1	5.203206062	4.242253426	0.194880802	1.552522529	0.185635786
1	4.668800354	2.372172995	0.339680217	2.388260303	0.181968653
1	4.559362729	1.417027366	0.389829349	2.95077413	0.258876612
1	4.759297053	2.052624734	0.024373317	2.063915653	0.189574846
1	4.188171705	1.557482785	0.55200431	2.921241591	0.250880423
1	4.410303752	1.933721958	0.338917843	2.491912439	0.212154074
1	4.494696935	1.28065158	0.206391459	3.092303806	0.264618626
1	4.261154175	1.036082783	0.225017517	3.452840869	0.324353177
2	6.209727287	1.940392326	-0.787347042	3.39760157	0.215282201
2	5.515814145	1.69659465	0.011445161	2.721411646	0.21628209
2	6.876287142	1.695541394	-1.165744223	3.61416019	0.287494392
2	6.805044492	1.962754336	-1.168531897	3.552609098	0.279479848
2	6.824862162	1.636194948	-0.937308541	3.096117738	0.275469776
2	5.104612033	1.232794815	0.40988697	2.8349976	0.258162107
2	6.070011775	1.327711979	-0.258703698	2.674904731	0.239320849
2	6.518451055	1.668108325	-0.604989809	2.655527779	0.233327598
2	5.978324254	1.946880346	-0.201081197	2.592665527	0.211091729
2	6.099889119	1.952079277	-0.530760707	3.202336393	0.220577919
2	5.881634394	1.952053401	-0.434889858	3.075282951	0.211746141
2	6.074199041	1.360404715	-0.73470868	4.042727028	0.26100526

1	31.27006	31.23468	31.25692	31.24245	0.0888	0.140983	0.098786
1	24.08859	24.05736	24.08757	24.04609	0.159849	0.212758	0.155059
1	22.14555	22.11892	22.14748	22.12263	0.111716	0.156783	0.106473
1	24.64866	24.61226	24.64186	24.62611	0.109063	0.165093	0.106576
1	19.04849	19.01963	19.04168	19.02152	0.094082	0.13829	0.099663
1	21.32868	21.3062	21.32443	21.29363	0.107453	0.136223	0.103933
1	21.43825	21.41978	21.43279	21.4099	0.08863	0.115989	0.090755
1	19.14305	19.11617	19.14163	19.12456	0.099142	0.144561	0.095443
2	40.42496	40.39596	40.42637	40.38998	0.148989	0.199106	0.141591
2	32.0466	32.02453	32.0462	32.01042	0.14309	0.186273	0.148231
2	48.92772	48.90146	48.92615	48.90683	0.096632	0.144293	0.10057
2	48.2088	48.17756	48.20863	48.1835	0.125339	0.179786	0.117466
2	48.16436	48.13654	48.15941	48.13612	0.092997	0.13518	0.097587
2	27.21721	27.18778	27.22429	27.19501	0.144082	0.198522	0.126707
2	38.11306	38.08655	38.11834	38.09867	0.115828	0.17168	0.111675
2	44.11341	44.08965	44.11218	44.09864	0.089217	0.133719	0.089247
2	37.61166	37.57327	37.60867	37.5791	0.143128	0.214584	0.151827
2	39.09739	39.06755	39.10296	39.07696	0.116078	0.174361	0.114147
2	36.46399	36.42866	36.47248	36.43552	0.14921	0.216067	0.142592
2	38.17709	38.14406	38.1799	38.14303	0.14834	0.207925	0.146303
2	40.67939	40.64294	40.67892	40.64232	0.151655	0.216406	0.152444
2	42.18402	42.14329	42.18432	42.14421	0.157149	0.232343	0.160039
2	34.24429	34.1949	34.22874	34.2007	0.12664	0.199141	0.140273
2	37.02799	36.998	37.02818	36.99256	0.148359	0.202628	0.146886
2	42.75829	42.73588	42.75629	42.72939	0.108692	0.152606	0.114953

Fig.3 : Extracted feature set of images of normal (left) and malignant (right) cells.

MAMMOGRAM (BREAST): Mammogram images are analyzed for the identification of potential malignant masses. Mammography is the mostly used diagnostic technique for early diagnosis of breast cancer. But mammogram images usually possess low contrast and are highly fuzzy. In that scenario extracting the masses directly is very difficult and highly challenging. In this study the masses are enhanced, by subtracting the background using morphological top-hat operation and Gaussian filtering,

before applying a segmentation technique. The masses possess higher intensity value than it's backgrour This characteristic is exploited to design a segmentation technique for mass segmentation. A combination Max, Mean and Variance measures along with thresholding technique will be analyzed for mass segmentati (Fig.4).

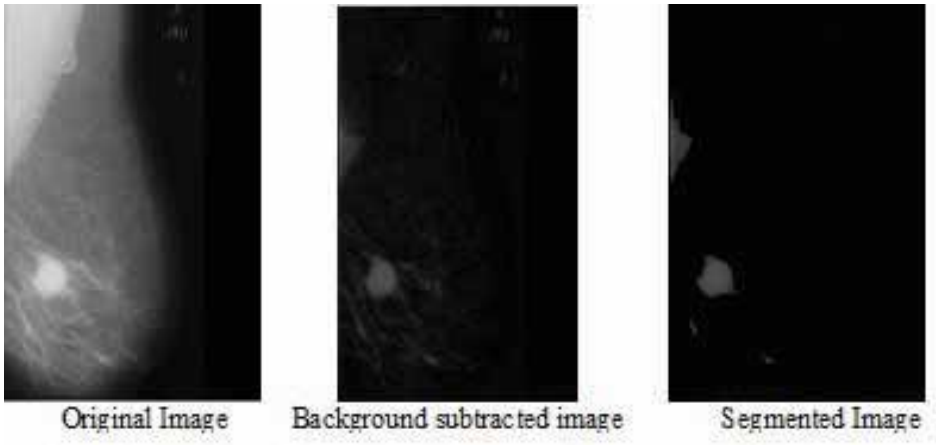


Fig.4: Segmented image of mammogram.

Publications

In Cited Journals

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of publication
B.C. Tripathy, R. Goswami	Vector valued multiple sequences defined by Orlicz functions	Boletim da Sociedade Paranaense de Matemática	33(1) / 67-79	2015
B.C. Tripathy, M. Sen	On lacunary strongly almost convergent double sequences of fuzzy numbers	Annals of the University of Craiova - Mathematics and Computer Science Series	42(2)/ 254-259	December/ 2015
B.C. Tripathy, R. Das	Spectrum and fine spectrum of the upper triangular matrix $U(r, s)$ over the sequence space cs	Proyecciones Journal of Mathematics	34(2)/ 107-125	June/2015
B.C. Tripathy, A.J. Dutta	Lacunary I-convergent sequences of fuzzy real numbers	Proyecciones Journal of Mathematics	34(3)/205-218	September/ 2015
B.C. Tripathy, A. Paul	The spectrum of the operator $D(r,0,0,s)$ over the sequence space bv_0	Georgian Journal of Mathematics	22(3)/ 421-426	September/ 2015
B.C. Tripathy, R. Dey, N.R. Das	Ordered vector valued statistically convergent sequence space	Afrika Matematika	26/433–441	June/2015
B.C. Tripathy, R. Goswami	Multiple sequences in probabilistic normed spaces	Afrika Matematika	26(5-6)/753-760	September/ 2015
B.C. Tripathy, A. Paul	The spectrum of the operator D(r, 0, s, 0,t) over the sequence spaces and bv_p	Afrika Matematika	26(5-6)/1137-1151	September/ 2015
B.C. Tripathy, R. Goswami	Fuzzy real valued p-absolutely summable multiple sequences in probabilistic normed spaces	Afrika Matematika	26 (7-8)/1281-1289	December/ 2015
B.C. Tripathy A. Paul	Subdivisions of the spectra for the operator $D(r,0,0,s)$ over certain sequence	Boletim da Sociedade Paranaense de Matemática	34(1)/75-84	2016
B.C. Tripathy, R. Dey, N.R. Das	Ordered vector valued double sequence spaces	Fasciculi Mathematici	55(1)/29-34	December/ 2015
A.Mahanta, H.K.Sarmah, R.Paul, G. Choudhury	Julin set and some of its properties.	International Journal of Applied Mathematics and Statistical Sciences	5(2)/97-124	March/2016

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of publication
G.Choudhury, L.Tadj , M.Deka	An unreliable server retrial queue with two phases of service and general retrial times under Bernoull vacation schedule	Quality Technology and Quantitative Management	12(4)/443- 460	December/ 2015
G.Choudhury, A.Mahanta, H.K.Sarmah	Cantor set and some of its generalizations as fractals	International Journal of Mathematical Sciences and Engineering Applications	9(4)/1–25	December/ 2015
C.C.Kuo , J.C.Ke, G.Choudhury	Optimal NT policies for two phase service system with Bernoulli vacation schedule	Quality Technology and Quantitative Management	12(3)/341-351	September/ 2015
G.Choudhury, M.Deka	An M/G/1 unreliable server queue with two phases of service and Bernoulli vacation schedule under randomized vacation policy	International Journal of Applied Management Science	7(2)/309-337	July/2015
G.Choudhury, M.Deka	A batch arrival unreliable Bernoulli vacation model with two phases of service and general retrial times	International Journal of Applied Management Science	7(2)/309-337	June/2015
N. Rajbongshi, L.B. Mahanta, D.C. Nath, J. D. Sarma	A matched case control study of risk indicators of breast cancer in Assam, India	Mymensingh Medical Journal	24(2)/385-91	April/2015
L. B. Mahanta, M. Choudhury, A. Devi, A. Bhattacharya	On the study of pre-pregnancy BMI and weight gain as indicators of nutritional status of pregnant women belonging to low socio-economic category: a study from Assam	Indian Journal of Community Medicine	40(3)/198-202	July/2015
N. Rajbongshi, L. B Mahanta, D. C. Nath	Evaluation of female breast cancer risk among the betel quid chewer: a bio-statistical assessment in Assam, India	Nepal Journal of Epidemiology	5(2)/494-498	July/2015
T. Y. Rahman, L. B. Mahanta, A. Das	Image based methods available for early detection of oral cancer: a review	International Journal of Innovative Research in Computer and Communication Engineering	3(8)/7826	August/2015

Presentation in Conferences/seminars

Invited talks

Faculty	Title	Programme Name	Date & Venue
Dr. Binod Chandra Tripathy	Development of Different Types of Sets and Their Applications	2nd Bi-Annual Conference at of Jharkhand Society of Mathematical Sciences	November 21-22, 2015 at Ranchi
Dr. Binod Chandra Tripathy	Rate of Convergence of Sequences	10th International Society for Analysis, its Application and Computation (ISAAC) Conference,	August 3-8, 2015 at the University of Macau, China

Contributory

Author(s)	Title	Conference name	Oral/Poster	Date & Venue
A. K. Saw, B.C. Tripathy	On bicontinuity and connectedness in ditopological texture spaces	International Conference on Nonlinear Dynamics, Analysis and Optimization (ICNDAO 2015)	Oral	December 9-11, 2015 at Dept. of Mathematics, Jadavpur University, Kolkata

Conferences/Workshops/Meetings attended

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Ms. Karishma Shravan	National Meet of Research Scholars in Mathematical Sciences	November 24-28, 2015, at Gauhati University
Ms. Karishma Shravan	National seminar on “Advances in Mathematical Sciences”	December 22, 2015, at Gauhati University
Ms. Karishma Shravan	“Indian Women and Mathematics Regional Workshop on Research and Opportunities”	February19-20, 2016, IIT Guwahati.
Ms. Karishma Shravan	Elsevier Workshop for Authors	March 5, 2016, Gauhati University
Mr. Ajay Kumar Saw	North-East Summer Workshop in “Analysis and Probability”	June 27-30, 2015 at Indian Statistical Institute, Kolkata and Tripura University
Mr. Ajay Kumar Saw	International Conference on Nonlinear Dynamics, Analysis and Optimization (ICNDAO 2015)	December 9-11, 2015 at Jadavpur University, Kolkata
Mr. Ajay Kumar Saw	International School on “Computer Algebra”	February 22-26,2016 at IIT, Gandhinagar
Ms. Silpisikha Goswami	National seminar on “Advances in Mathematical Sciences”	December 22, 2015 at Gauhati University

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Ms. Silpisikha Goswami	Indian Women and Mathematics Regional Workshop on Research and Opportunities	February19-20, 2016 at IIT Guwahati.
Ms. Silpisikha Goswami	School on “Analysis and Topology”	February 22-March 4, 2016 at ISI- Tezpur University
Dr. Binod Chandra Tripathy	2nd Bi-Annual Conference of Jharkhand Society of Mathematical Sciences	November 21-22, 2015
Dr. L. B. Mahanta	A NEQIP of AICTE sponsored Two Day Workshop on ‘Utilizing Cloud and Cloud computing for engineering applications’	March 11-12, 2016 at Assam Engineering College. Guwahati

Awards/Recognitions/Achievements

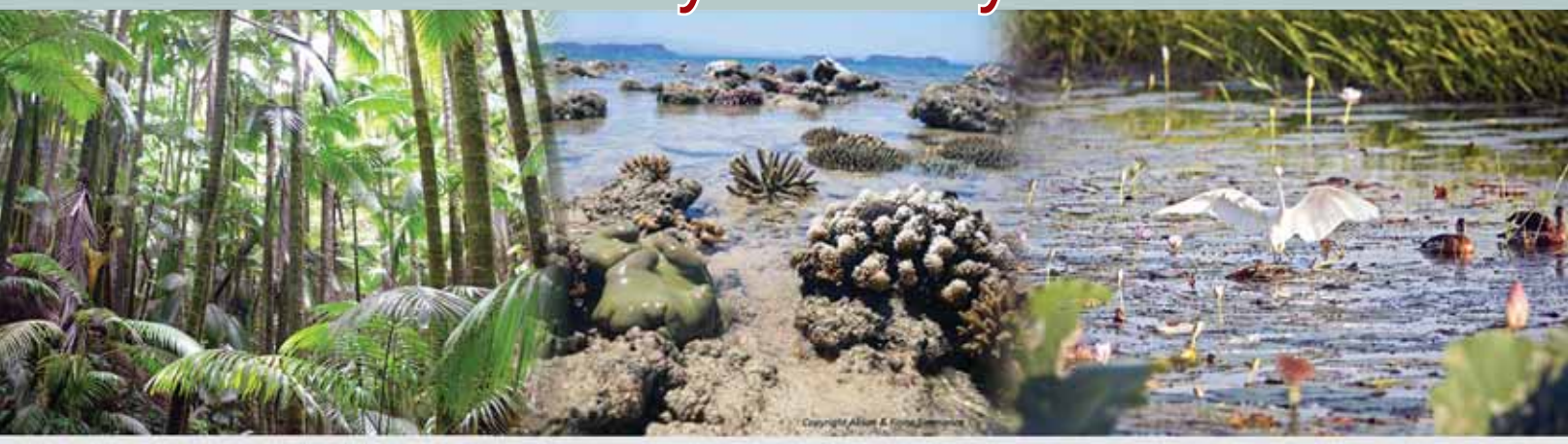
Name	Particulars
Dr. B.C. Tripathy	Has got H-index 28 as per SCOPUS database
Dr. B.C. Tripathy	Membership of the American Mathematical Society, USA
Dr. B.C. Tripathy	Vice-President of the Indian Academy of Mathematics, Indore
Dr. B.C. Tripathy	Invited to organise the 18th session of the 10th International Society for Analysis, its Application and Computation (ISAAC) Conference, held at the University of Macau, China, held during August 3-8, 2015
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Journal of Advanced Research in Pure Mathematics*” USA
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Journal of Advanced Research in Fuzzy and Uncertain Systems*” USA
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Frontier in Science*” Scientific and Academic Publishing, USA
Dr. B.C. Tripathy	Elected Editorial Board Member of the journal “*Journal of Analysis and Applications*”, KOSOVO
Dr. B.C. Tripathy	Elected Editorial Advisory Board Member of the journal “*Turkish Journal of Science and Technology”*, Firat University, TURKEY:
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Far East Journal of Mathematical Sciences*” (Pushpa Publishing House), Allahabad
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Surveys in Mathematics andMathematical Sciences*” (Pushpa Publishing House), Allahabad
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Journal of Indian Academy of Mathematics*” Indore
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical “*Computational Research*”: Horizon Research Publications Corp., USA

Name	Particulars
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical "Journal of Analysis and Number Theory" natural Science Publications, USA
Dr. B.C. Tripathy	Elected Reviewer for "Mathematical Reviews", USA
Dr. B.C. Tripathy	Elected Editorial Board member of the periodical "Journal of the Tripura Mathematical Society"
Dr. B.C. Tripathy	Chaired as session in the 2nd Bi-Annual Conference at of Jharkhand Society of Mathematical Sciences at Ranchi, held during November 21-22, 2015
Dr. B.C. Tripathy	Chairman, Local Organising Committee of the workshop on Medical Image processing, organized by IASST held during February 19-20, 2016

List of PhD Awardees:

Name of Student	Name of Supervisor	Title of the Thesis	Award giving University
Mr. Diganta Jyoti Sarma	Dr. B.C. Tripathy	Studies on b-open Sets and Bitopological Spaces	Gauhati University
Mrs. Rupanjali Goswami	Dr. B.C. Tripathy	"Studies on some Classes of Multiple Sequences in Probabilistic Normed Spaces	Gauhati University
Mrs Mitali Deka	Dr. G. Choudhury	Studies on some queueing models subject to service interruption	Gauhati University

Biodiversity and Ecosystem Research



Diversity of life forms and ecosystems of the planet earth have an intricate link with well-being of the web of all creatures. However, expansion of only one intellectual species, *Homo sapiens* on the planet has put stress on all. Lately, there has been rigorous scientific effort to enhance our understanding of biodiversity and ecosystem functions and exploration of means of scientific intervention for their restoration. This research programme is formulated with this background but in the context of North Eastern region of India.

Narayan C Talukdar
Professor

Sabitry C Bordoloi
Professor

Dipali Devi
Associate Prof. -II

Suresh Deka
Professor

Arundhuti Devi
Associate Prof. -I

Debajit Thakur
Assistant Professor-II

Mojibur R Khan
Assistant Professor-II

Soumyadeep Nandi
Ramalingaswami fellow

Nandana Bharadwaj
BioCARe-DBT,PI

Rictika Das
Women Scientist

Dr.Sailendra Goyari
N-PDF

Dr.Rupamoni Thakur
SERB NPDF

Sushmita Gupta
BioCARe-DBT,PI

Dr.Asim K Dutta
RA

Anupam Bhattacharya
RA

Gitartha Kaushik
SRF

Kaustvmani Patowary
SRF

Rupshikha Patowary
SRF

Gitumani Devi
CSIR-SRF

Mihirjyoti Pathak
SRF

Priyanka Sharma
SRF

Manashi Das
SRF

Yogesh B. Chaudhari
SRF

Madhusmita Dehingia
SRF

Jintu Dutta
SRF

Suravi Kalita
JRF

Sujata Deka
JRF

Anurupa Goswami
Inspire JRF

Monikankana Kalita
JRF

Ranjita Das
JRF

Atlanta Borah
JRF

Mohd. Shadab
JRF

Khanindra Sharma
JRF

Jilmil Baruah
JRF

Rabiya Sultana
JRF

Bhuwan Bhaskar
JRF

Tulsi Joishy
JRF

Suparna Sen
JRF

Garima Raj, JRF
Robinson C Jose, JRF
N. Grihalakshmi Devi, JRF
Mrinal Kumar das, SRF
Santana Baishya, SRF
Jafrin Farha Hussain, SRF
Mousumi Saikia,JRF
Manasse Choudhury,JRF
Dr. Supriyo Sen, DBT-RA
Priyanka Sarkar, JRF

Prof. Sabitry Choudhury Bordoloi

Exploration and documentation of fauna, Study of biology of fish and Amphibia and DNA fingerprinting study.

Research related to exploration of biodiversity in different wetlands of North east India is in progress. The study involves identification of species (Fish and Amphibia), DNA barcoding and detailed biology of selected species where no biological data is available in global database. Study related to water quality analysis of the habitat and adaptive modifications of torrential fishes are also in progress.

A new species of frog *Clinotarsus Penelope* (Grosjean et.al, 2015) was recorded from Thailand based on work done in our laboratory on *Clinotarsus alticola* collected from the river Basistha.

Recording of Ichthyofaunal diversity of Ranganadi river of Lakhimpur district revealed a total of 61 species of fishes, belonging to 6 orders and 17 families (Kaushik and Bordoloi, 2016). Detailed biology of two hill stream teleosts from this river, namely *Balitora brucei* Gray, 1830 and *Psilorhynchus balitora* (Hamilton, 1822) have been completed. Length-weight relationships which are used to determine the fatness and wellbeing of the fish was done for 9 species (Kaushik et al., 2015; Kaushik and Bordoloi, 2015). Two partial sequences of the COI gene of mitochondria for *Balitora brucei* and *Amblyceps arunchalensis* were submitted to NCBI database.

A total of 22 fishes belonging to 4 orders and 9 families were recorded from the torrential river Basistha (Guwahati). Detailed biology of a data deficient species (IUCN) *Badis assamensis* Ahl, 1937 recorded from the river was completed. Studies on Length-Weight relationships indicated that the species exhibits positive allometric growth, while studies on condition factor describe that the habitat is condusive for this species. Study on Gonadosomatic Index (GSI) revealed that the species is a single breeder and Gastro somatic Index (GaSI) revealed that the females of the species feed best during the pre-monsoon season while the males of the species feed best during the monsoon season.

Ultra surface structure of certain torrential fishes (Cyprinids) were studied that include structural specialisation in suctorial disc, adhesive apparatus in some silurids and presence of 'unculi' in the fins of some cyprinids. Taste buds (TBs) present in the barbels are responsible for various kinds of stimuli. They act as chemo-receptor, mechano-receptor or thermo-receptor and thus signal the fish regarding the changes in the environmental conditions. The study on an endangered catfish, *Amblyceps arunchalensis* (Fig.1) reveals the presence of only one type of taste bud (Type- II) (Kaushik and Bordoloi, 2015).

It was observed that torrential fishes develop a number of morphological modifications to adapt to torrential habitats. Adaptations were studied on lips, adhesive discs, barbels and paired fins. Structural adaptations in pelvic fins were observed in a torrential fish Schistura vinciguerrae (Fig.2A). Presence of tubercular structures (Fig.2B) help such fishes cling to the substratum. An important finding with SEM study was that a hill stream fish Barilius bendelisis exhibited sexual dimorphism in topography of

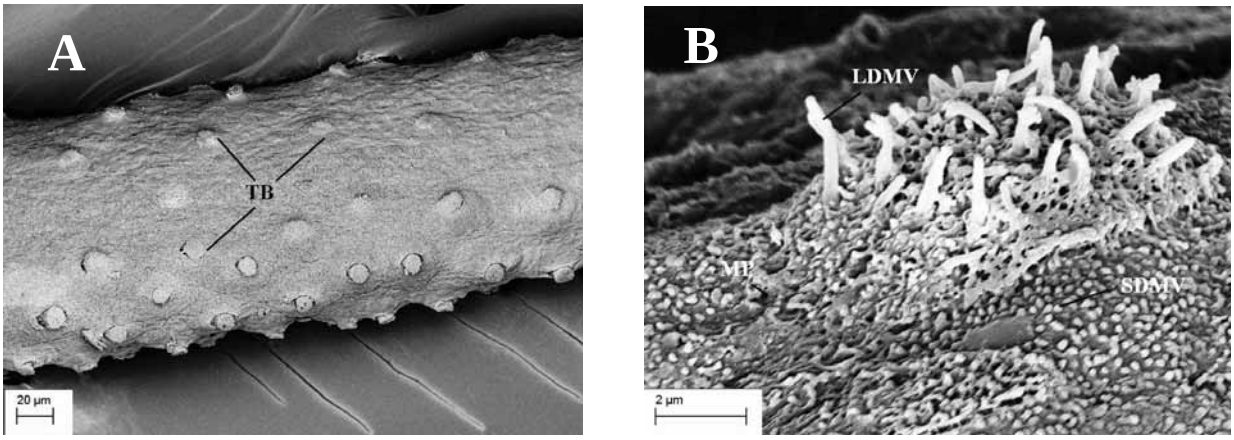


Fig. 1: Mandibular barbels of A. arunchalensis showing Tastebuds (TBs) in (A) and magnified view of the TBs showing large diameter microvilli (LDMV) and small diameter microvilli (SDMV) (B).

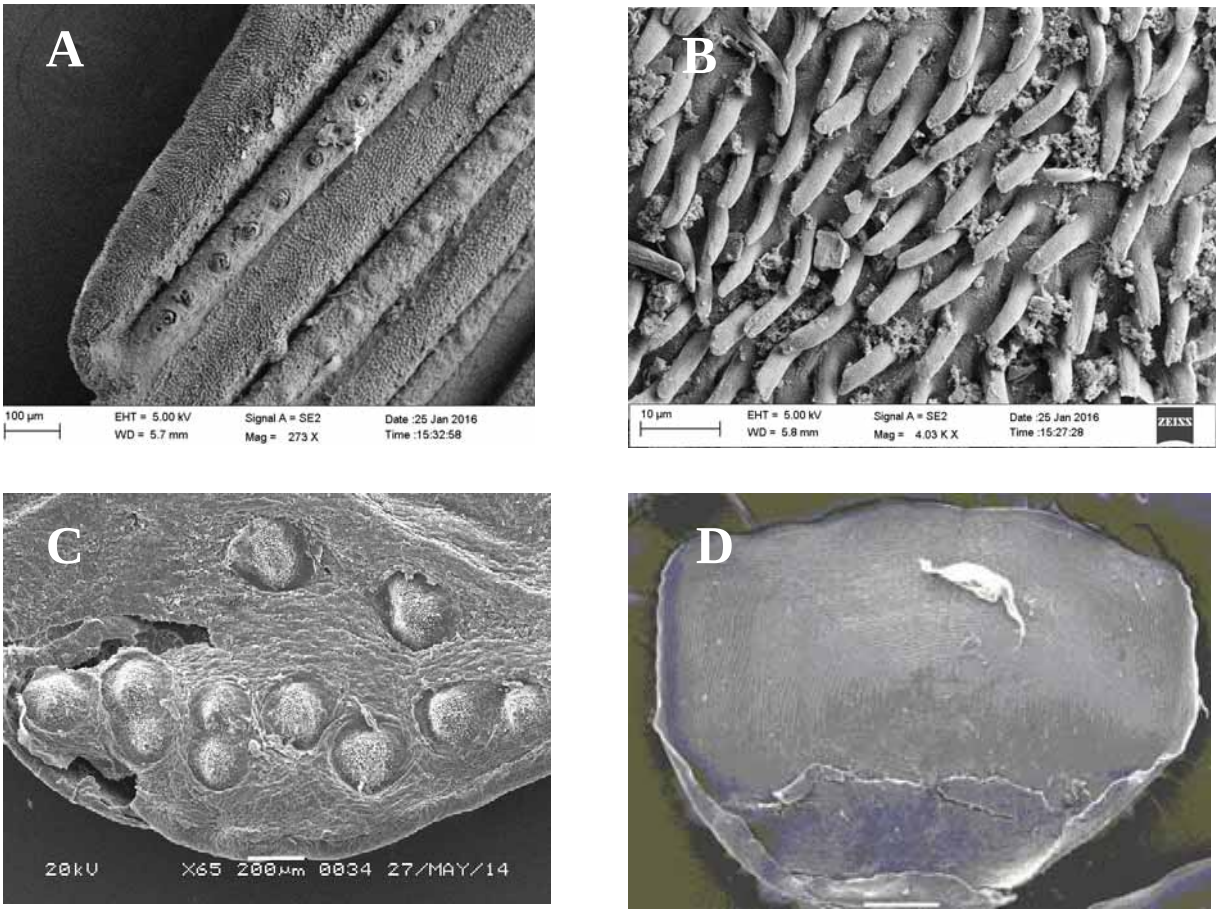


Fig. 2: Structural adaptations in a torrential fish Schistura vinciguerrae. Presence of tubercular structures (A) and magnified (4000X) view of Tubercular structures (B). Sexual dimorphism in exposed area of the scale of Barilius bendelisis showing horny tubercles called unculi (C) in males and presence of only mucous pores (D) in females.

scales in both sexes (Hussain and Bordoloi, 2016). In males, the exposed area of scales revealed the presence of horny tubercles called unculi (Fig.2C), while in females such structures were absent and instead the exposed area of the scales revealed the presence of mucous pores (Fig.2D).

A study on hydrocarbon pollution in lentic ecosystems in and around oil field areas and effect of hydrocarbon contamination on flora and fauna :

The lentic water bodies in surrounding areas of oil installations of Assam, India get contaminated over the years due to natural oozing, oil collecting stations, drilling, refining and effluent discharge. Lentic ecosystems act as a major sink for pollutants and depending on its proximity to the source of pollution the threat to aquatic flora and fauna increases. Several studies (Pettigove & Hoffman, 2005) have shown the toxic effects of TPH (total petroleum hydrocarbon) on living organisms in an aquatic ecosystem reducing their diversity and abundance. TPHs such as polycyclic aromatic hydrocarbons are known to possess mutagenic and carcinogenic properties. The present work was initiated with a view to study the extent of hydrocarbon contamination in several lentic water bodies near the oil installations and possible effect of toxicants on diversity of flora and fauna.

A total of 25 lentic water bodies were selected in and around oil fields of Digboi (Tinsukia district), Duliajan, Naharkatia (Dibrugarh district), Lakwa and Geleki (Sivasagar district) and two refineries viz. Guwahati refinery and Bongaigaon refinery of Assam. Out of theses sites, seasonal monitoring of TPH concentration in water, sediments and plant samples were done in ten selected sites only during June 2013 to May 2015.

During the study period, average ∑TPH concentration in water ranged between 80.33 to 843.0 mg l^{-1} with a median value of 269.33 mg l^{-1} (average ± SD, 337.98 ± 118.94 mg l^{-1}). In premonsoon season, average ∑TPH ranged from 87 mg l^{-1} to 301.67 mg l^{-1} (213.4±68.10), in monsoon season ranged from 530.65 mg l^{-1} to 843.0 mg l^{-1} (679.46 ±99.28), in post monsoon ranged from 80.33 to 218.33 mg l^{-1}(141.4±53.67) and in winter season ranged from 158.33 mg l^{-1} to 452.33 mg l^{-1}. Pollution status of the 25 selected sampling sites were assessed based on presence of pollution indicator species as per Central Pollution Control Board (CPCB, 1999). Out of twenty five (25) sampling sites, three (3) sites are in clean condition (class I), three (3) sites are moderately polluted (class III), 17 sampling sites are highly polluted (class IV) and three (3) sites are excessively polluted (class V).

The plants growing in and around the selected lentic water bodies showed accumulation of TPH in the shoots and roots. Ten plants belonging to Cyperaceae family have been analyzed for TPH accumulation in roots and shoots. These plants were found to be growing abundantly in the study sites. ∑TPHs concentration in different plants was in the sequence of *Cyperus scariosus* > *Cyperus rotundus* > *Cyperus cyperoides* > *Cyperus brevifolius* > *Cyperus odoratus* > *Cyperus esculentus* > *Cyperus laevigatus* > *Cyperus iria* > *Cyperus difformis* > *Cyperus helferi*. TPH content in shoot was relatively higher than in root irrespective of the plant species studied. The ∑TPH concentration in the plant shoot and root was significantly ($p < 0.05$) higher during the premonsoon season in comparison to winter and monsoon seasons in all the plant species.

Prof. Suresh Deka

Hydrocarbon degrading bacterial diversity, bioremediation, biosurfactant and plant diseases control.

Isolation of petroleum hydrocarbon degrading bacteria (PHDB) from various petroleum contaminated soil ecosystem and development of a robust bacterial consortium for bioremediation of crude oil contaminated sites of Assam is one of the areas of research of our laboratory. We reported earlier on effectiveness of an efficient bacterial consortium of *Bacillus pumilus* KS2 and *Bacillus cereus* R2 in degradation of hydrocarbon *in-vitro*. This bacterial consortium was also found to be effective in degradation of hydrocarbon from crude oil contaminated soil of oil field of Lakowa, Sibsagar. However, extent of bioremediation varied depending upon initial concentration load of hydrocarbon in the contaminated soil. At 5780 mg/kg and 1700 mg/kg initial concentrations, 74.35% and 91.25% of total petroleum hydrocarbon (TPH) was remediated respectively during six months (Fig 1.).

In the soil sample with 5780 mg/kg concentration, the various PAHs detected in the beginning were Fluorene, Phenanthrene, Anthracene, Pyrene, Fluoranthene, Benzo (a) anthracene, 1H- Indene and Perylene and after six months of treatment of this soil with the consortium, four PAHs namely; Fluorene, Anthracene, Fluoranthene and 1H- Indene could not be detected suggesting their complete degradation. Similarly, in the soil sample with 1700 mg/kg concentration, the detected PAH were Phenanthrene, Fluoranthene, Pyrene and Perylene and after six months of treatment, two PAHs namely; Phenanthrene and Fluoranthene could not be detected. It was also revealed that the TPH content of the untreated soil were found to be less than original values after six months, which indicate that some amount of hydrocarbon is degraded by the indigenous PHDB of the soil; however, results were not significant.

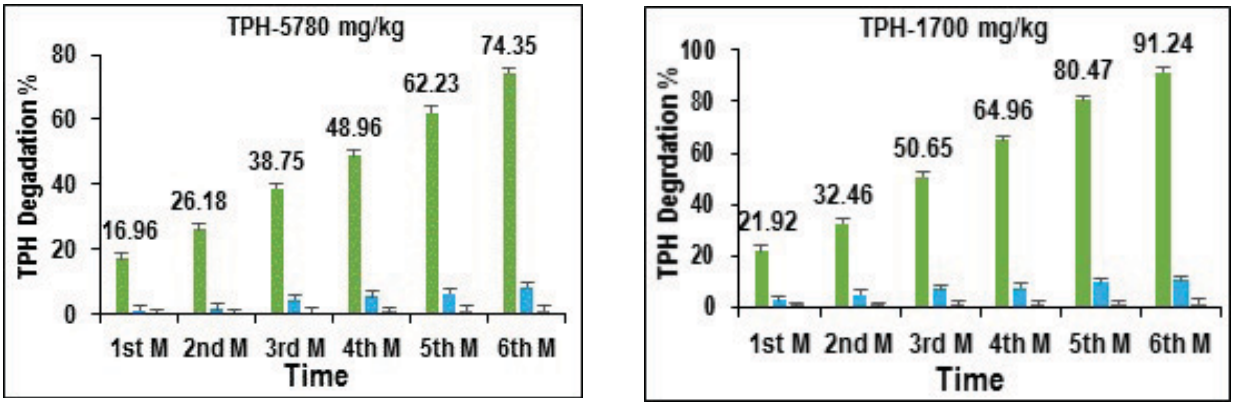


Fig. 1: Quantity of petroleum hydrocarbon (TPH) degraded (%) by the consortium in the two soil samples of varying hydrocarbon contents (5780 mg/kg and 1700 mg/kg).

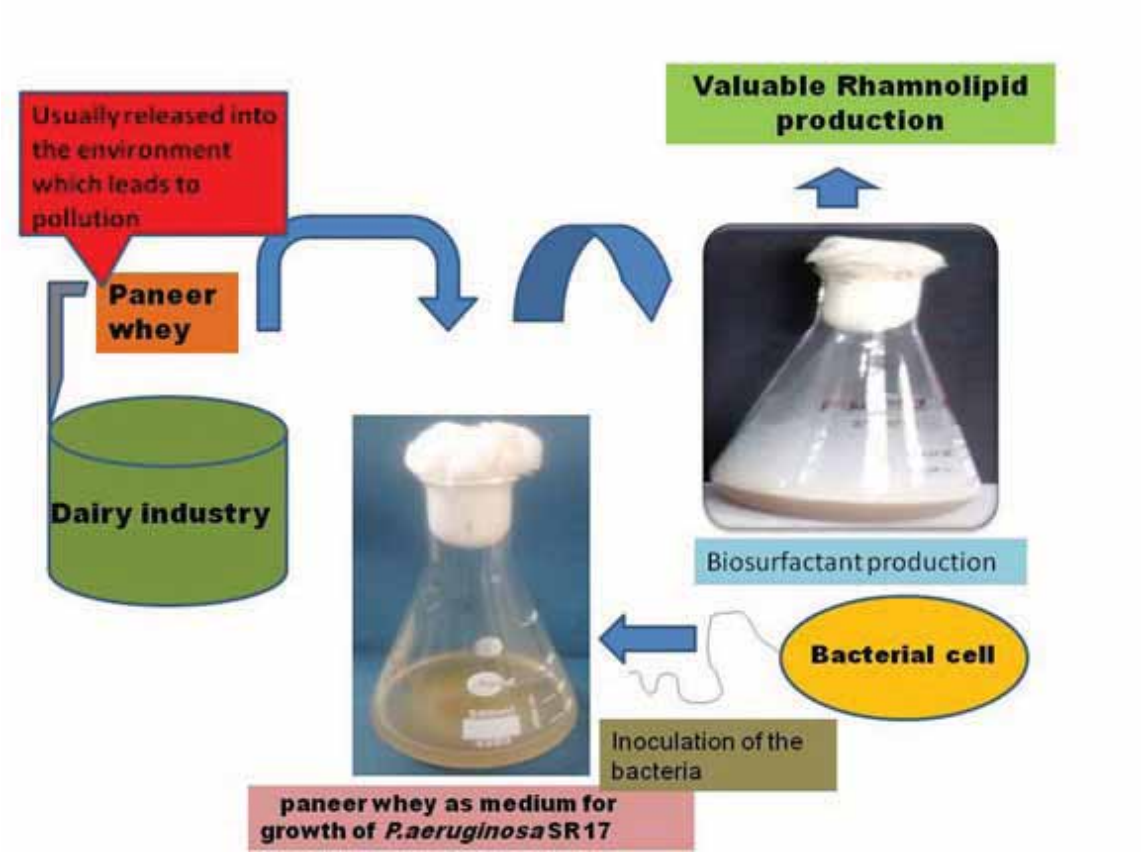


Fig. 2: Steps forward in production of Rhamnolipid in cost effective manner using paneer whey as substitute.

Production of Rhamnolipid (RL) in cost effective manner is another important area of research of this laboratory. A method has been developed where paneer whey waste was used for the production of RL. A bacterial strain SR17 identified as *Pseudomonas aeruginosa* (GenBank accession no. KR028434) of hydrocarbon contaminated soil origin was used in the investigation. This bacterium could efficiently utilize paneer whey for RL production and could reduce the surface tension of the medium from 52 mN m^{-1} to 26.5 mN m^{-1}. The yield of RL was 2.7 g l^{-1} when only paneer whey was used as a medium for production of RL. On the other hand, media formulated along with paneer whey and 2% glucose as carbon source gave a maximum yield of RL (i.e. 4.2 g/l) in shaking flasks condition. The FTIR analysis was done to determine the functional groups of the RL and the LC-MS analysis determined the RL to be a mixture of congeners of mono and di-rhamnolipid. The graphical abstract for the production of RL biosurfactant by utilizing paneer whey waste is presented in Fig 2.

We also investigated the production of RL by a bacterial strain *Pseudomonas aeruginosa* SS14 growing in mineral salt media (MSM) containing glucose, glycerol, mannitol and molasses as the sole carbon source. The biosurfactant (BS) produced in the media was extracted using ethyl acetate and purified by silica gel column chromatography. The purified BS samples were characterized using FTIR and LC-MS

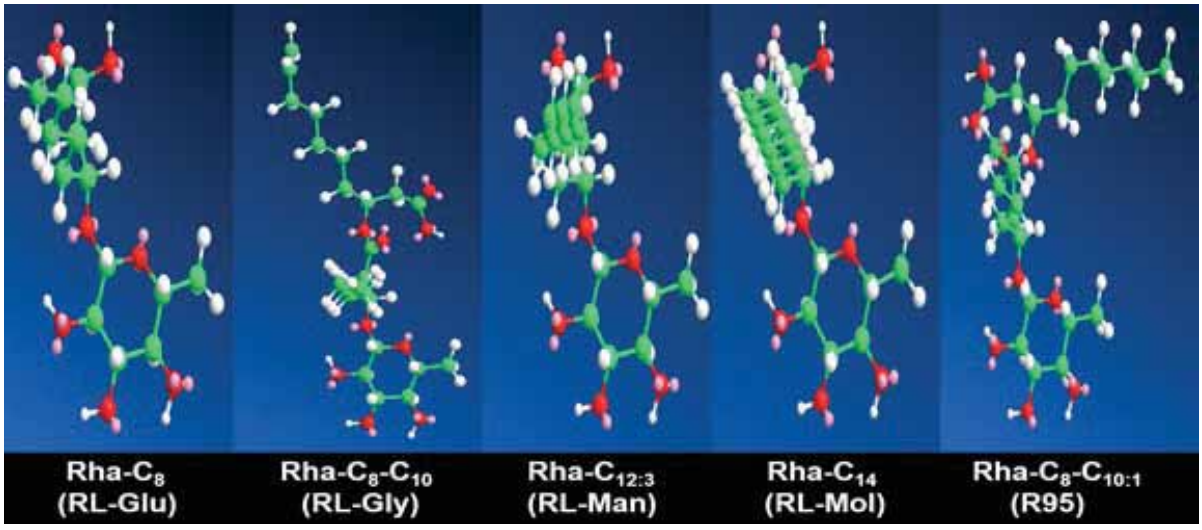


Fig. 3: The least energy conformations of the major congeners in each rhamnolipid (RL) sample and the standard R-95. The spheres in the structures represent Carbon (Green), Oxygen (Red), Hydrogen (White) and Lone pairs of electrons (Pink).

analysis and compared to a commercially available rhamnolipid (RL) R-95. The LC-MS analyses revealed that all the samples were rhamnolipid, however, the composition of each RL sample was different. The samples contained different ratios of mono and di-RLs and the major congener for each sample was found to be different (Fig. 3). Only mono RL is produced in the medium where glucose was used as carbon source, whereas, in media with other carbon sources, both mono and di RL were produced. Based on the LC-MS results, the major congeners of RL were Rha-C_8, (produced in Glucose), Rha-C_8-C_{10}, (produced in Glycerol), Rha-$C_{12:3}$ (produced in Mannitol) and Rha-C_{14} (produced in Molasses). The predominant congeners in the standard R-95 (purchased from Sigma) was found to be Rha-C_8-$C_{10:1}$.

Dr. Dipali Devi

Silkworm diversity, disease, protein chemistry and non mulberry silk as biomaterial.

The Seribiotech unit has focused on exploration of genetic diversity, studies on diseases of silkworm, silk protein chemistry and nonmulberry silk as biomaterials.

The genetic variation and phylogeny of the morphs of *Antheraea assamensis* Helfer collected from different geographical locations of North-East India were investigated based on five mitochondrial loci i.e. 12S ribosomal RNA (*12S rRNA*), 16S ribosomal RNA (*16S rRNA*), Cytochrome oxidase subunit I (*CoxI*), Cytochrome b (*Cytb*) and Control region (*CR*). All the mitochondrial loci showed a bias toward higher A and T content. The percentages of polymorphism for *12S rRNA*, *16S rRNA*, *CoxI*, *Cytb* and *CR* sequences were found to be 51.06%, 56.61%, 7.89%, 44.21% and 47.91%, respectively. In the phylogenetic trees constructed based on *12S rRNA* and *CR* sequences, the semi-domesticated and the wild morphs formed distinct clusters. However, mixing of some semi-domesticated and wild morphs was observed in the phylogenetic tree based on *16S rRNA*, *CoxI* and *Cytb* gene sequences suggesting migration or anthropogenic intervention. The information generated in this study will help in conservation and utilization in breeding programs of *Antheraea assamensis*.

Genotoxicity, alteration in nutritional physiology and histopathology of eri silkworm exposed to pesticides have already been reported. The present study demonstrates the effect of pesticides chlorpyrifos (organophophate) and cypermethrin (pyrethroid) on larval development and silk production of eri silkworm. Pesticide caused 40-50% decrease in growth at all stages of larval instars. Shell weights decreased in pesticide exposed group and silk tensile strength was reduced in the range of 9.24-61.76%. However, no changes was observed in surface morphology, thermal properties and secondary structure of fiber protein as revealed by SEM, DSC and FTIR study, respectively. Among the two pesticides, effect of cypermthrin is more deleterious than chlorpyrifos.

Silk cocoons in general are composed of two basic proteins- core fibrous fibroin and the outer glue like sericin. In addition, the cocoons specially the nonmulberry cocoons contain small amounts of waxes, pigments, and crystals of calcium oxalate. A technique has been developed to remove the impurities as well as the sericin from the muga cocoon which is required for silk processing. EDTA and two commonly available agents namely the extracts of *Musa balbisiana* (banana) and *Citrus limon* (lemon) have produced very encouraging result. Apart from removal of sericin and crystal, the method also makes the reeling process easy and produces good quality fiber compared to those produced by the conventional method.

Articular cartilage damage represents one of the most perplexing clinical problems of musculoskeletal therapeutics due to its limited self-repair and regenerative capabilities. In this study, 3D porous silk fibroin scaffolds derived from non-mulberry muga silkworm; *Antheraea assamensis* were fabricated and examined for its ability to support cartilage tissue engineering. Additionally, *Bombyx mori* and

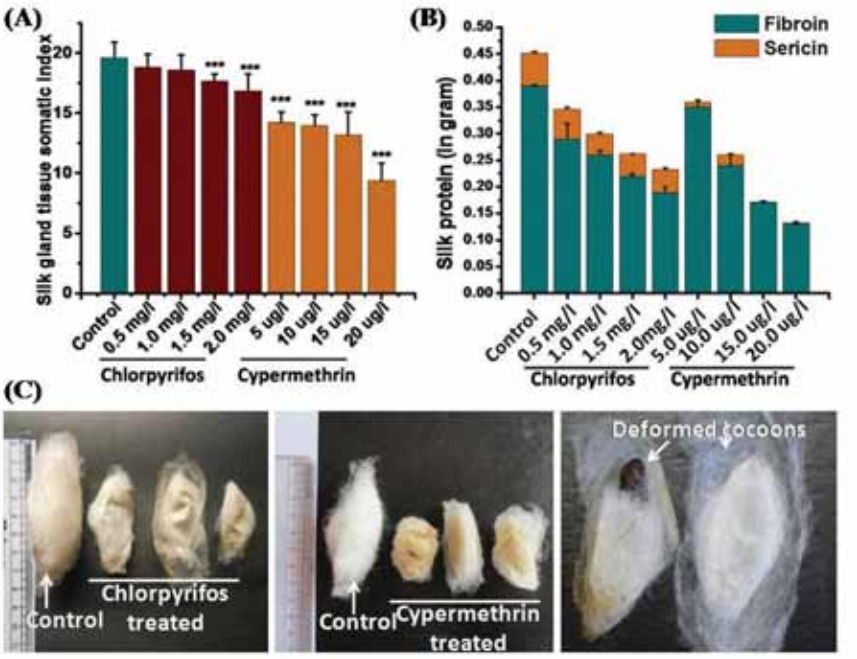


*Fig. 1: (A) Silk gland tissue somatic index (SGTSI) was compared in control, chlorpyrifos and cypermethrin exposed eri silkworm (n=20, *** p < 0.001 level of significance), (B) Fibroin and sericin content was compared in silk fiber of control, chlorpyrifos and cypermethrin exposed groups (n=20) and (C) Comparison of cocoon size, shape and formation.*

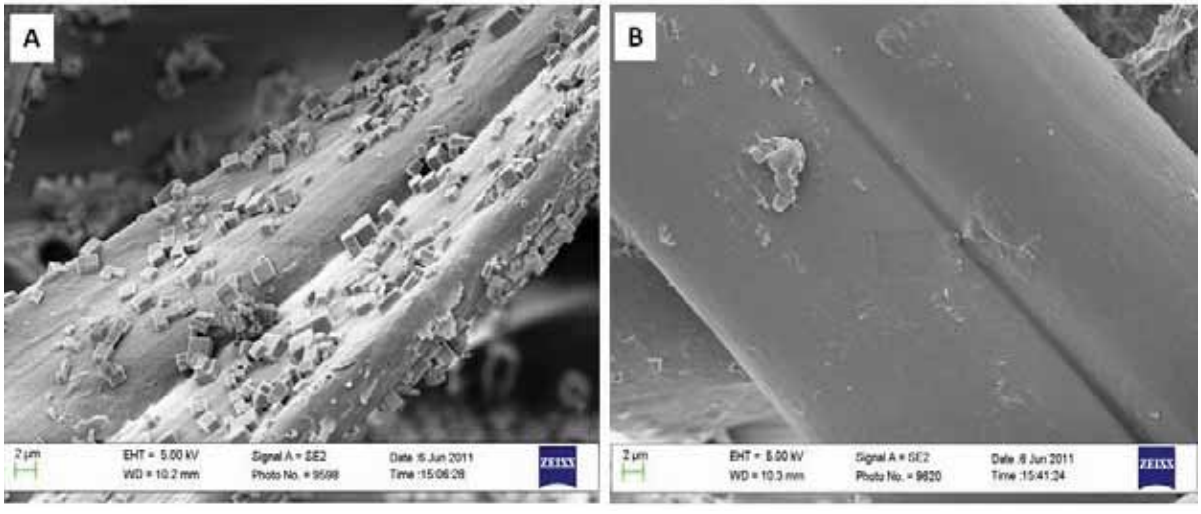


Fig. 2: Untreated muga silk fiber showing the crystals (A) Muga silk fiber treated (Deminaralized) with the extract of Banana plant (Kolakhar) (B).

Philosamia ricini silk fibroin scaffolds were utilized for comparative studies. Herein, the fabricated scaffolds were thoroughly characterized and compared for cartilaginous tissue formation within the silk fibroin scaffolds seeded with primary porcine chondrocytes and cultured *in vitro* for 2 weeks. Surface

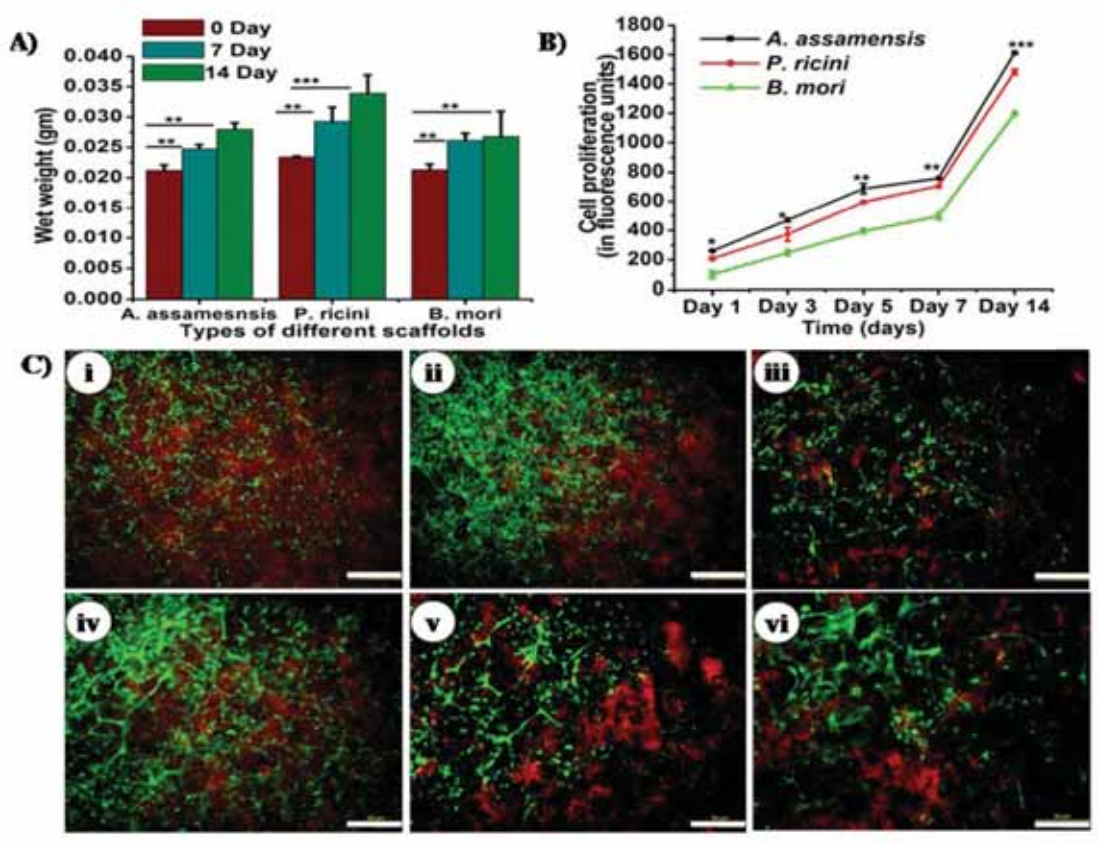


*Fig. 3: (A) Wet weight of scaffolds at day 0 (before seeding), day 7 and 14 of culture. `Data are plotted as mean ± standard deviation, n = 6. ***, ** and * show significant differences between groups at p< 0.001, p<0.01 and p<0.05, respectively (B) Chondrocytes proliferation on different silk fibroin scaffolds (C) Fluorescence micrographs showing cell growth and proliferation on 3D silk fibroin scaffolds from A. assamensis (i and iv), P. ricini (ii and v) and B. mori (iii and vi). The cells were stained with rhodamine phalloidin for actin filaments (red) and Hoechst 33342 for nuclei (green). Scale bar for upper and lower panels micrographs are 100 and 50 µm respectively.*

morphology and structural conformation studies revealed the highly interconnected porous structure (pore size-150-160 µm) with enhanced stability within its structure. The fabricated scaffolds demonstrated improved mechanical properties and were followed-up with sequential experiments to reveal improved thermal and degradation properties. Silk fibroin scaffolds of *A. assamensis* and *P. ricini* supported better chondrocytes attachment and proliferation as indicated by metabolic activities and fluorescence microscopic studies. Biochemical analysis demonstrated significantly higher production of sulphated glycosaminoglycans (sGAGs) and type II collagen in *A. assamensis* silk fibroin scaffolds followed by *P. ricini* and *B. mori* scaffolds ($p<0.001$). Furthermore, the histochemistry and immunohistochemical studies indicated enhanced accumulation of sGAGs and expression of collagen II. Moreover, the scaffolds in a subcutaneous model of rat demonstrated *in vivo* biocompatibility after 8 weeks of implantation. Taken together, these results demonstrate the positive attributes from non-mulberry silk fibroin scaffolds of *A. assamensis* and suggest its suitability as a promising scaffold for

Dr. Arundhuti Devi

Remediation and Reclamation of crude oil contaminated soil, water;
Removal of heavy metals; Air pollution; Wetland ecosystem.

Research interests include (i) remediation studies of oil spills on land and water, (ii) developing bioflocculants with the help of micro-organisms isolated from oil refinery sludge and their utilization in treatment of oil field formation water laden with inorganic salts and having high dissolved solid loads, (iii) investigating the reasons for declining yield of Muga silk cocoons in the upper Assam oil field areas.

Remediation studies with bacterium-induced production of bioflocculant :

The ongoing work has documented an efficient bioflocculant production system starting with a bacterium, isolated from activated sludge of the effluent treatment plant of an oil refinery. The bacterium thrives in crude petroleum and the bioflocculent produced by it is successfully applied in remediation of oil-field formation water. The combined scheme of bioflocculant production and substrate utilization, shown in Fig.1, can have enormous utility in remediation of petroleum hydrocarbon contaminated soil and in treatment of inorganic salt-laden formation water.

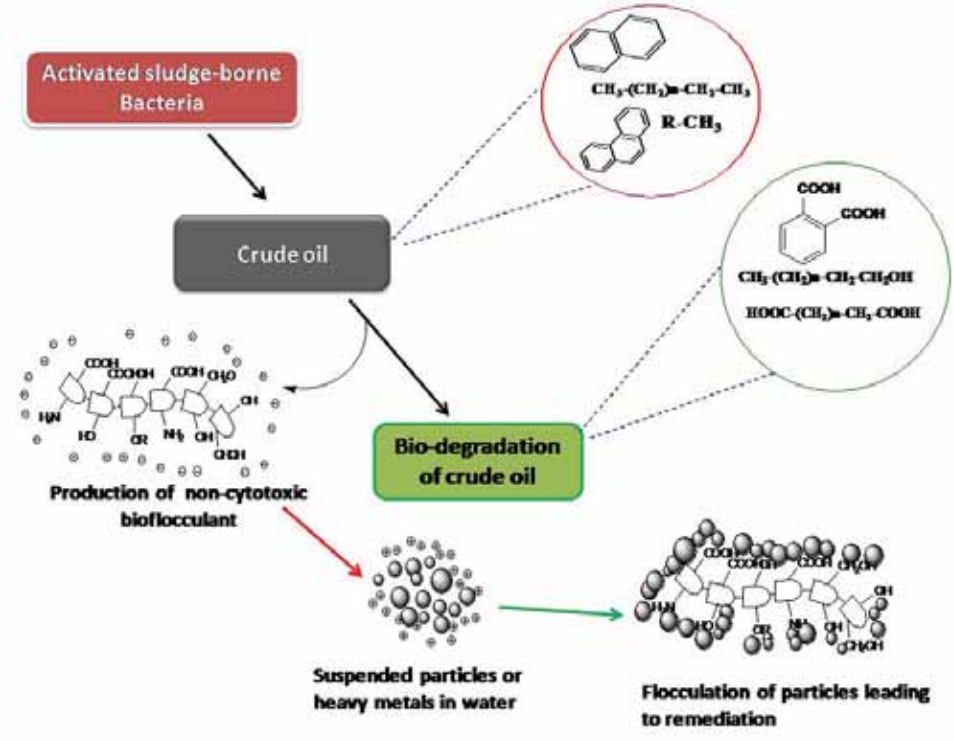


Fig. 1: Pictorial representation of bioflocculant production and its utilization in remediation studies.

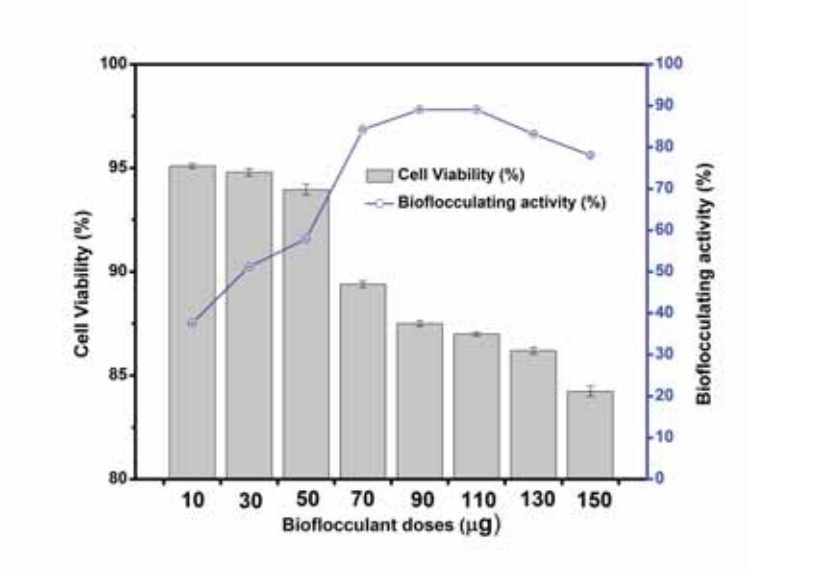


Fig. 2: Cytotoxicity study of the bioflocculant in different concentrations with respect to L292 cell line.

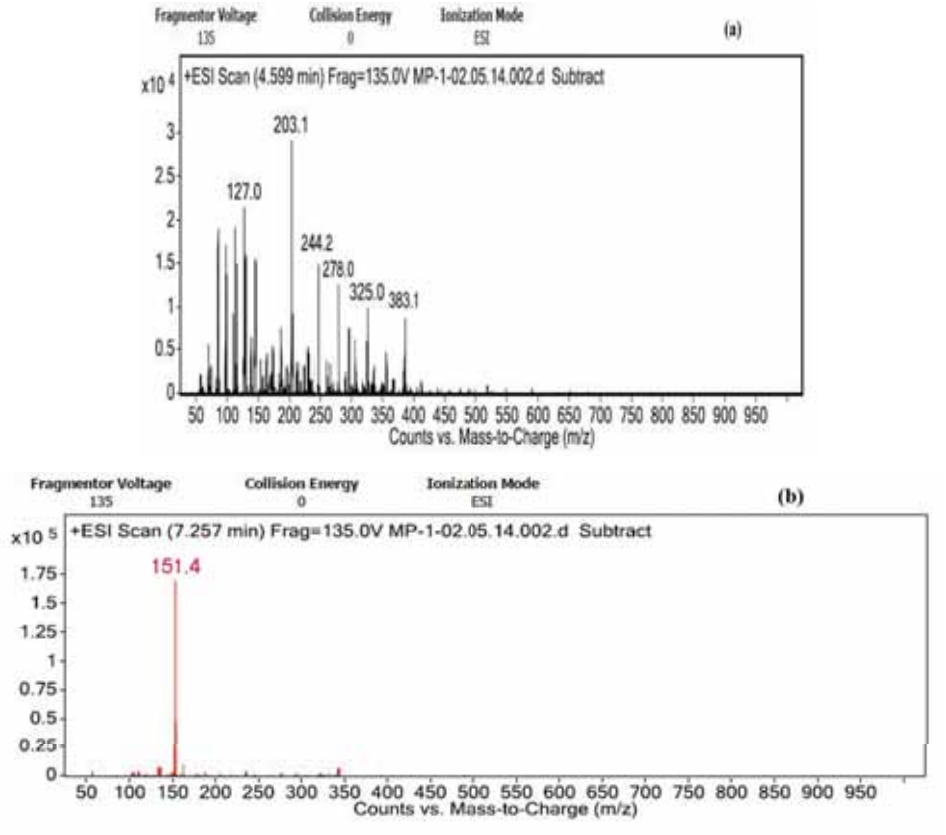


Fig. 3: Positive ion mode ESI-MS spectra recorded from the LC-MS analysis of the hydrolyzed bioflocculant sample showing (a) Na^+ adduct ions of m/z 203.1 $(Glc + Na)^+$, 383.1 $(Glc + Glc + Na)^+$, 244.2 $(HexNac + Na)^+$ and 325.0 $(Xyl + Xyl + Na)^+$ and (b) H^+ adduct ions of m/z 151.4 $(Xyl + H)^+$ respectively.

The bioflocculant obtained from the experiments has an excellent flocculating capacity of 86.2 ± 0.51% with significant removal capacity for 5 heavy metals from aqueous solution in the order of Ni^{2+} > Zn^{2+} > Cd^{2+} >Cu^{2+} > Pb^{2+} and Ni^{2+}. The bioflocculant is sufficiently non-cytotoxic to the mammalian cell line even after its application in the optimum dose necessary for highest flocculating activity. The mouse fibroblastic cell-line is found to be viable through a MTT dye conversion assay, ranging from 95.1 to 84.2% when 10 to 150 mg of the purified bioflocculant is used (Fig.2).

From a number of characterization studies, the bioflocculant has been found to be a glycoprotein-like biopolymer, with glucose, xylose and n-acetyl hexosamine as the constituents of its exopolysaccharide part (Fig.3).

Particulate pollution and its effects on Muga silk production near an oil field :

The atmospheric pollutants play an important role in determining the quality and quantity of natural silk production. In order to have a quantitative assessment of such impacts, it is necessary to know the sources and concentrations of the pollutants having direct impact on silk production. The exotic Muga silk of Assam is affected by a decline in cocoon production in places close to the upper Assam oil fields. *Antheraea assama* worm fed on *Machilus bombycina* plants grown in the area has exhibited a serious decline in cocoon production in recent years. In order to evaluate the causes, a study has been conducted on air quality near the oil field areas known for rearing the Muga silk worms. The fine particulate matter (PM2.5) has been characterized in detail and has been found to contain a number of toxic metals (Cd, Cu, Co, Cr, Ni, Pb and Zn), higher aliphatic (C22 – C35) and polyaromatic hydrocarbons (quinoline, naphthalene-6, 7-diol, phthalic acid, 9-ethyl-anthracene, 1-phenthrenecarboxylic acid, and 7-ethenyl-phenanthrene) (Fig.4).

The presence of hydrocarbons in PM2.5 is suspected from TGA and FT-IR analysis, confirmed by GC-MS analysis. The study shows that aliphatic hydrocarbons lower than C22 are not associated with

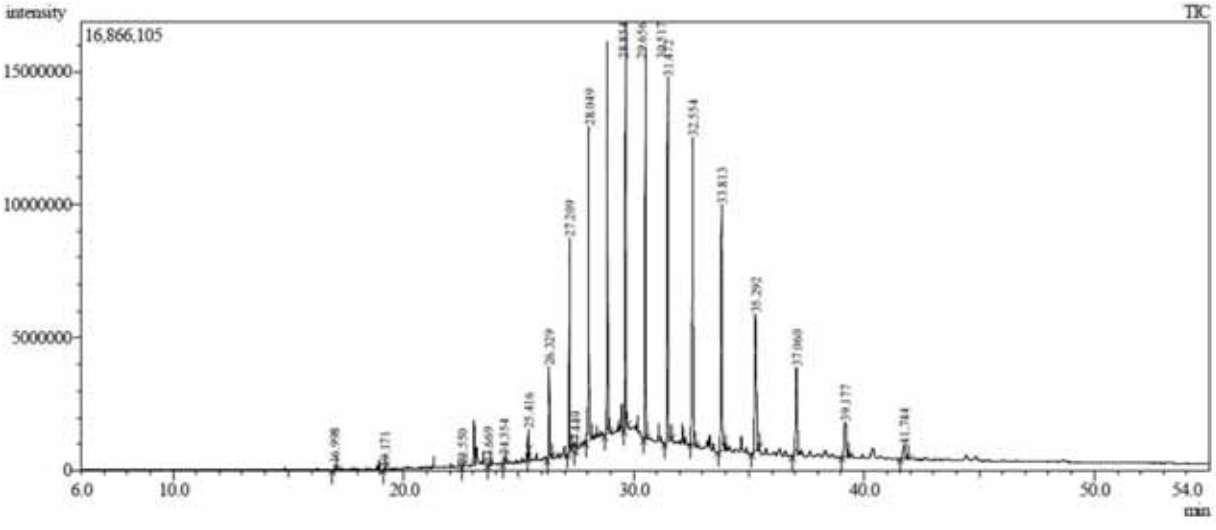


Fig. 4: GC-chromatogram for aliphatic and aromatic hydrocarbons of PM2.5

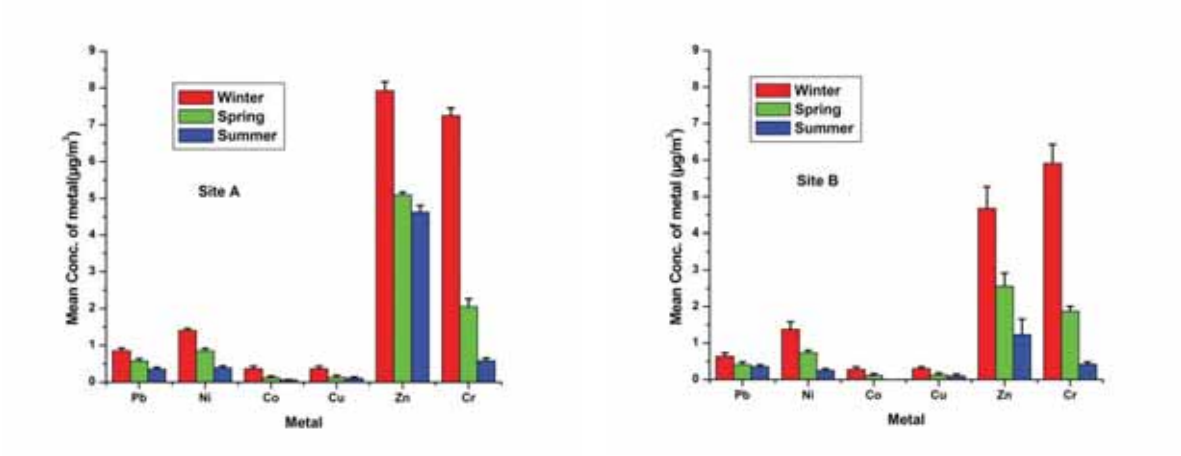


Fig. 5: Seasonal variation of mean metal concentration (µg/m^3) in PM2.5 (a) Site A (50 m from GGS) (b) Site B (200 m from GGS).

PM2.5. It has been found that the air has a high load of highest PM2.5 (exceeding the permissible limits of WHO, 25 µg/m^3) and Cd, Cr, Ni, Pb during the winter, the best season for muga cultivation. The calm meteorological conditions and high humidity during the winter have contributed to accumulation of PM2.5 in air.

It has been found that highest PM2.5 and Cd, Cr, Ni, Pb have been found during the winter, the best suited season for muga cultivation, followed by the spring and the summer. The calm meteorological conditions and high humidity during the winter have contributed to accumulation of PM2.5 in air. PM2.5 showed strong correlation with Cr, Cu, and Ni. Correlation matrix also showed that Cu, Cr, Ni, Pb, Zn have a common origin (Fig.5). It is also observed that along with the ambient air, the oil field operations also affect soil and plants in the vicinity. Since muga silk worms are sensitive to toxic chemicals, continuous presence of these chemicals in appreciable amount in the aerosol particles might have adverse effects on muga silk production in the oil field area particularly perhaps through accumulation in the host plant leaves.

Wetland ecosystem :

The Deepor beel a Ramsar Site, an Important Bird Area (IBA) as well as a Wildlife Sanctuary (at the core), located near Guwahati has shrunk in its area by about 4 square km in last twenty years. This wetland is under tremendous pressure due to anthropogenic interventions such as development activities and unsustainable land use practices. Factors like discharge of pollutants and effluents, illegal encroachment, impact of brick kilns are responsible for the degradation of the wetland's ecosystem.

Deepor beel has always attracted researchers from various fields as a port of inquisitiveness. Being a haven for migratory and local birds, it has attracted many ornithologist for carrying out a variety of studies on birds in this area. In the past, studies have been carried out on species diversity and

conservation threats to water bird and migratory birds of Deepor beel and management and conservation strategies for avian population. Detailed quantitative and qualitative information on lower (e.g. rotifers and palynomorphs) and higher organisms (e.g. herpitofauna and fish fauna) of Deepor beel are also available. Other study includes spatial, temporal and depth profiles of trace metals in the water and the impact of railways and channel changes on this wetland ecosystem through GIS test.

This study is directed towards determination of variation, if any, in the physico-chemical parameters of water and sediment of the Deepor beel on temporal and spatial dimension. During 2015, 40 sites were selected on the basis of i) vegetated and non-vegetated area ii) distance from the bank of the beel iii) polluting sources and distance of 50-200m for collection of samples.

During the winter season of 2015-16, water and sediments samples were collected from 20 sites in a similar way. The following observation have been made:

1) pH of water in the month of May-June was in between 6.0-7.0 but in February, the pH was found to increase (7-9) i.e. basicity was more. The bicarbonate ions could contribute more to the total alkalinity.
2) Fluoride content in water was found in sufficient amount in both the sampling periods but the concentration elevated in the February month.
3) Turbidity and conductivity were also higher in the month of February.
4) Common metals detected in water were Pb, Ni, Cr, Co, Zn and Fe.

Dr. Narayan C. Talukdar

Programme Head

Microbial diversity and interaction in agroecosystems.

Study on endophytic bacteria diversity inside seeds of diverse crops, their proliferation and movement to shoots and roots upon germination coupled with efforts to generate an endophyte-free plant might provide insight into direct role of endophytic bacteria on plant growth and development. Such study might also provide tools for generating knowledge on their interaction and manipulation to enhance plant performance.

Rice, green gram, tomato and tobacco seeds were found to contain varying population and diversity of endophytic bacteria. Cfu of bacteria in seeds of rice, green gram, tomato and tobacco seed varied from 9.68×10^8 to 1.1×10^9, 0 to 7×10^2 (green gram *var.* pratap and SG1), 8.9×10^6 (tomato *var.* pusa) to 4.3×10^7 (tomato *var.* S22) and 8×10^7 (tobacco *var.* podali) to 1.06×10^8 (tobacco var.torsa) per g seed, respectively. Green gram seeds' endophytic bacteria population varied conspicuously with some seeds

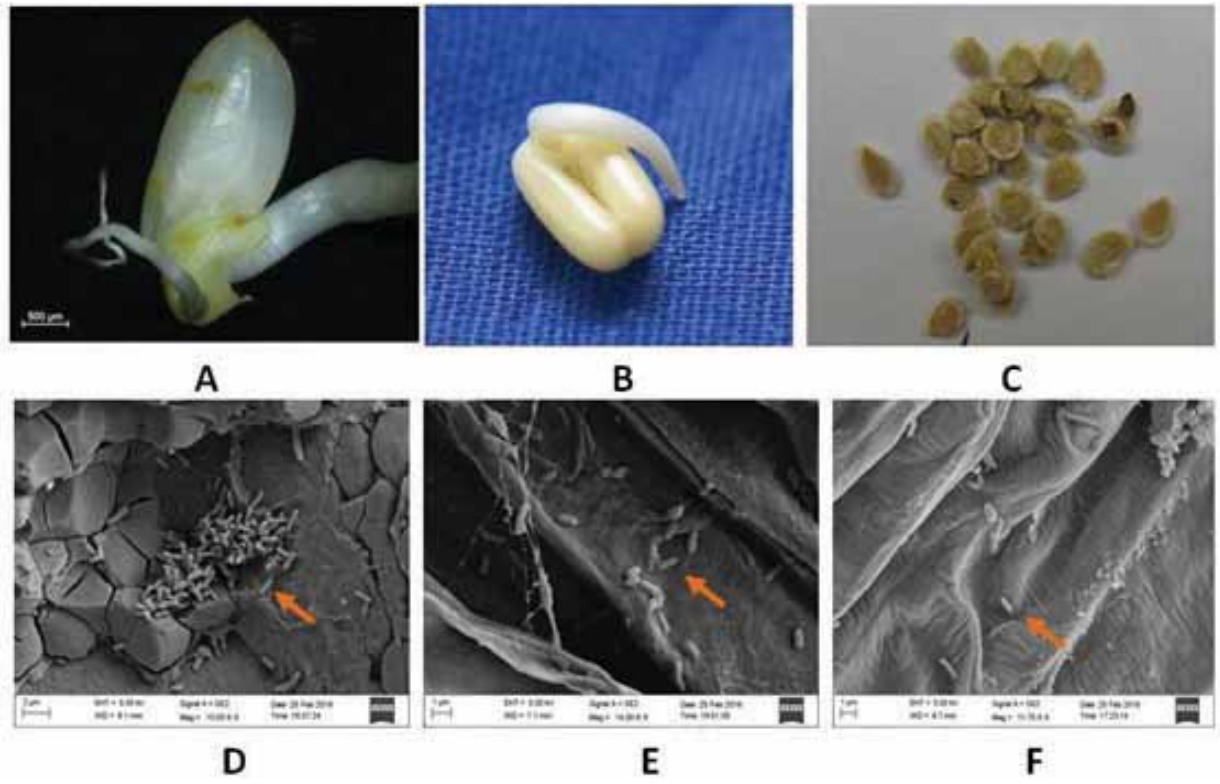


Fig. 1: Surface sterilized (A) 5 days old germinated rice seed (B) Green Gram var. Pratap (C) Tomato var.Pusa seed of germinated seeds (D) SEM image of Seed interior of rice (E) Plumule and (F) Radicle interior of germinated seeds; Arrows used for determination of population of endophytic bacteria by culture technique and detection of cells (arrow) by SEM.

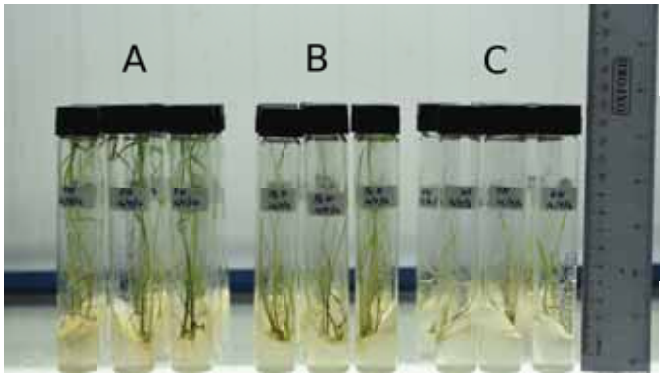


Fig. 2: 15 days old plantlets grown in Hoagland media supplemented with three doses of nitrogen, (A) 697.5 ppm/ml, (B) 348.75 ppm/ml and (C) 0 ppm/ml respectively.

within which no endophytic bacteria detected by cultural method (Fig.1).

Tomato and tobacco seeds contain morphologically different types of bacteria. In tomato *var* pusa, S22 and tobacco *var* torsa and podali, we found 8, 6, 3 and 2 types of bacteria respectively. Surface sterilized rice seeds endophytic bacteria migrated to roots and shoots of plants produced in axenic cultures containing 0, 348.75 and 697.5 ppm/ml nitrogen (Fig.2).

Depending upon N dose, endophytic population and GC-MS-MS based metabolic profile in the root and shoot was also found to vary. New experiments are being carried out to determine whether external nutrient supplements have any regulatory role on endophytic population which, in turn, may effect plant metabolic profile.

The Plant-fungi interaction: Proteomic insights on the Biotrophic interaction of *Ustilago esculenta* leading to the smut gall formation in *Zizania latifolia*

Zizania latifolia - *Ustilago esculenta* and *Saccharum spontaneum* - *Sporisorium scitamineum* interactions interfere with the inflorescence formation and modify the topmost internode filled with fungal spores, which are consumed as delicacy item (Fig.3). Life cycles of these fungi in these two interacting systems have been deciphered. For long, infection by *Sporisorium scitamineum* was known to cause extensive yield loss in sugarcane and was assumed that its wild relative *Saccharum spontaneum* which escapes infection might contain resistant gene against the smut fungus for utilization

Fig. 3 : Zizania latifolia plants after removal of the leaves seen with the swollen uppermost internode due to infection by Ustilago esculenta. (A) Uninfected Z. latifolia plant in wild which bear flower (arrow). (B) Note drastic changes in morphology of plants due to the smut infection.

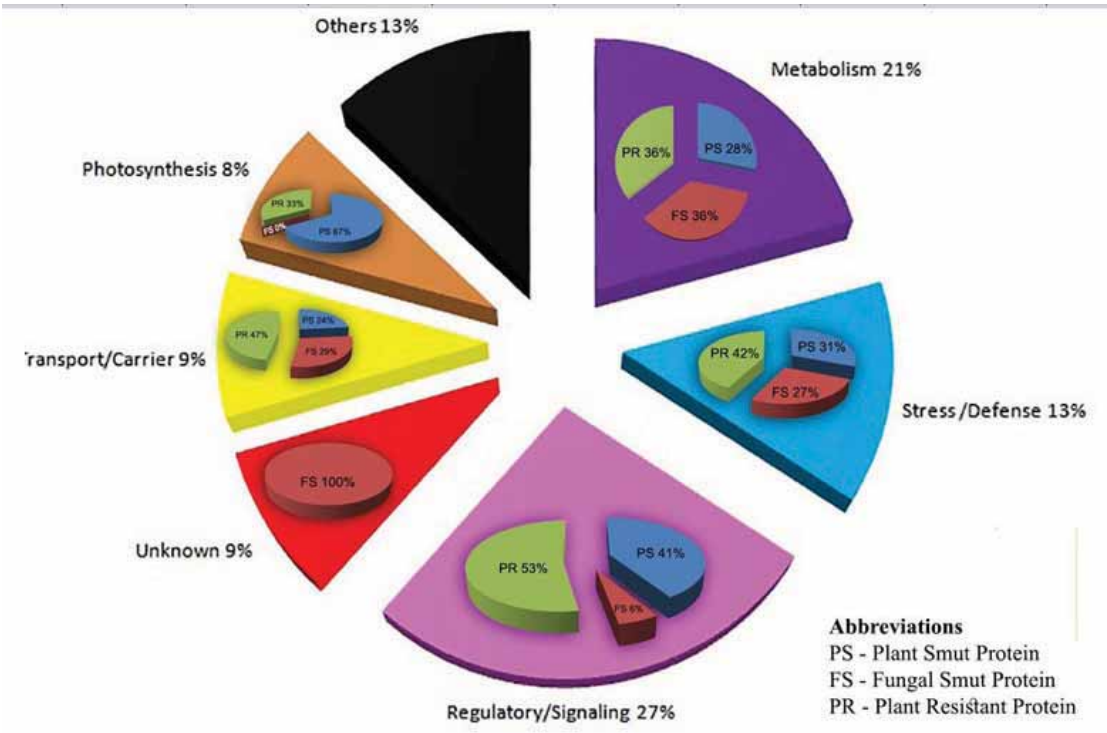


Fig. 4 : The pie diagram representing the total homologous non-redundant protein accessions with various function at different stages of smut interaction.

in plant breeding programme. Our research has shown that *S. spontaneum* also gets infected by the fungus *S. scitamineum*. It was interesting to observe that uninfected plants (resistant) completed their life cycle by producing inflorescence (Fig 3). We analysed the protein profiles of the uninfected (flowering) and infected plants using 2D GE, SDS-PAGE and LC-MS-MS analysis.

The number and abundance of spots and bands varied among the two-dimensional gel electrophoresis and SDS-PAGE gels at the various stages of plant growth and fungal infection. Proteins found to be differentially regulated after smut formation in the infected plants were compared to the uninfected plants. The DENOVO sequencing was also done for their identification due to the under-representation of *Z. latifolia* and *U. esculenta* proteins in major databases. The proteins related to metabolism, defence, photosynthesis, signalling, cell wall biogenesis, hydrolase and uncharacterized proteins were up-regulated or induced after the smut formation in the interacting systems (Fig.4). The differential regulation of proteins shed light on why inflorescence might have been replaced by bulbous smut gall and why some plants escape smut infection and this study may serve as a framework for future smut infection mechanism study.

Endophytic and rhizospheric bacteria and arbuscularmycorrhizal fungi interaction with crops in jhumagrosystem :

Analysis of culture dependant and culture independent diversity indicated differential effect of plant rhizosphere niches on bacterial abundance (Fig.5). In general, strongly adhered rhizosphere soils of

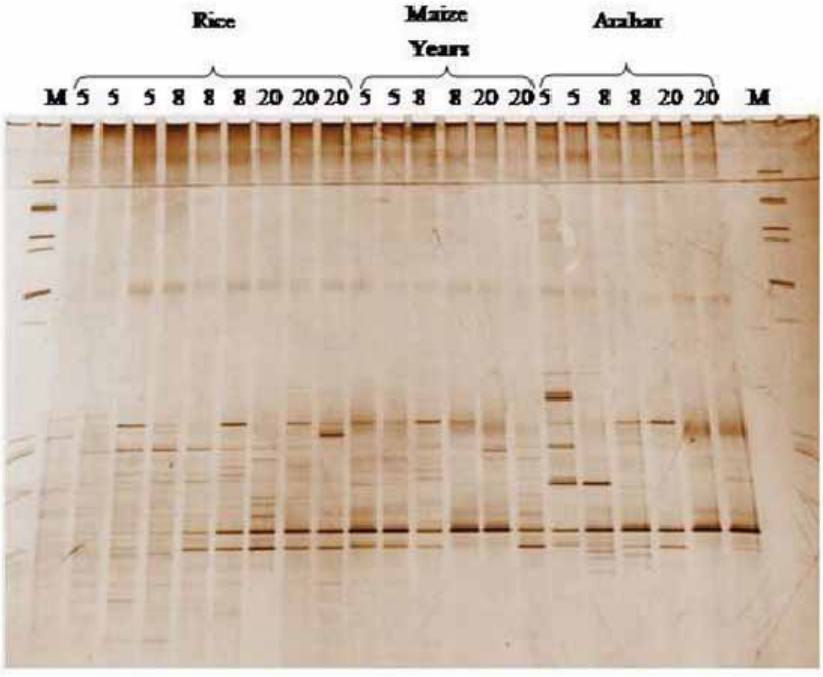


Fig. 5: 16S rDNA PCR-DGGE profile of strongly adhered rhizoshperic soils (SARS) of three crops collected from Jhum fields of Tacchip village, Mizoram. Note the DNA band location with respect to age of jhum fallen fields and three types of crop grown in these fields.

crops grown in shorter *jhum* fellow field tend to harbour higher population of bacteria compared to those in longer *jhum* fellow field. PCR-DGGE analysis indicated that rhizosphere bacterial diversity in strongly adhered soils of the same crop differs conspicuously depending upon age of *jhum* fallow cycle. This is an indication of *jhum* fallow cycle effect on bacterial community diversity.

During analysis of AMF, the important component of *jhum* agroecosystem, we found occurrence of at least 3 types of AMF spores (species) in Nagaland *jhum* field and eight types in Mizoram *jhum* field. However, sequence of 18S rDNA-PCR amplicons of DNA from surface sterilized roots suggested occurrence of at least six species of AMF in the roots of different types of crops of Nagaland *jhum* field.

Dr. Debajit Thakur

Plant-Microbe interactions, Diversity of Bioactive Metabolite/s Producing Actinobacteria.

This research work mainly includes studies on function of indigenous beneficial rhizobacteria and endophytes associated with commercial crop like Tea (*Camellia sinensis*) and their application for tea growth promotion and fungal disease suppression. Another research focus is to explore extracellular antimicrobial metabolite/s production and antibiotic biosynthesis gene in Actinobacteria prevalent in protected forest ecosystems of Assam using culture dependent and metagenomic approaches.

Tea plant is one of the oldest organized practices in India with massive plantation in Assam and most of the tea grown fields are highly fertilized with enormous quantities of chemical fertilizers for enhancing crop production. Despite its efficiency, the long-term applications of such fertilizers have proved to be perilous to soil health as well as the human and also reduced the crops quality. Therefore, our study was designed to evaluate the potential of tea root associated bacteria from six commercial tea estates of Assam, India for tea plant growth promotion to not only reduce the use of chemical fertilizer but also for the overall benefit of plant and soil health.

A total of 217 tea root associated bacteria were isolated and subjected to preliminary *in vitro* plant growth promotion (PGP) screening for indole acetic acid (IAA) production, phosphate solubilization, siderophore production and ammonia production. Out of 217 isolates, 50 isolates showed all the PGP traits *in-vitro*, 212 isolates exhibited at least one PGP trait and the data is depicted by the Venn diagram representation (Fig.1).

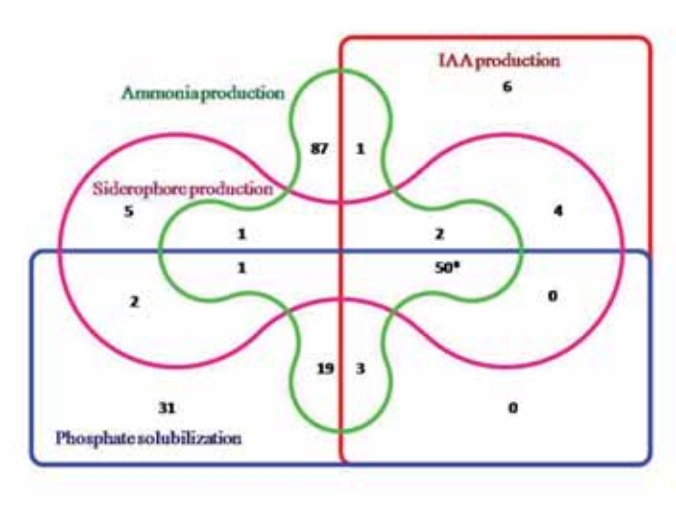


*Fig. 1: Venn diagram representation of rhizobacterial isolates showing positive results for different PGP traits (*50 isolates showing the positive results for all the PGP traits).*

These 50 potential isolates were further analyzed for quantitative estimation of the PGP traits along with the aminocyclopropane-1-carboxylate (ACC) deaminase, protease and cellulose production. After several rounds of screening, four rhizobacteria were selected based on their maximum ability to produce in vitro PGP traits and their partial 16S rRNA gene sequence analysis revealed that they belong to *Enterobacter lignolyticus* strain TG1, *Burkholderia* sp. stain TT6, *Bacillus pseudomycoides* strain SN29 and *Psedumonas aeruginosa* strain KH45. To evaluate the efficacy of these four rhizobacteria as plant growth

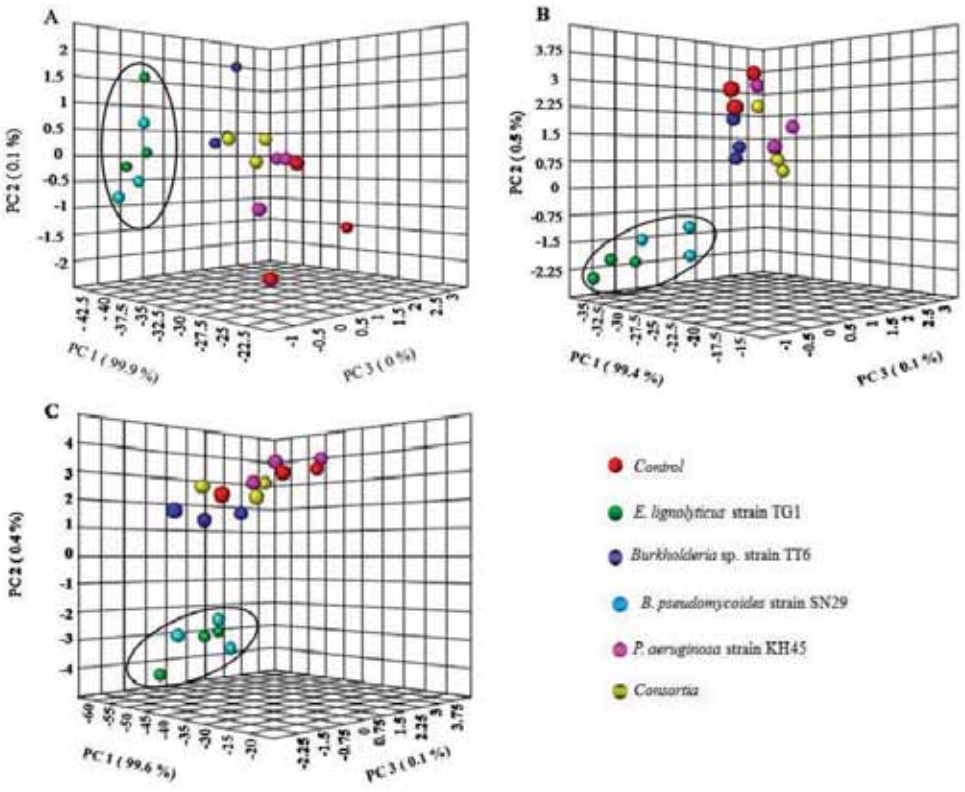


Fig. 2: Clustering relationship of inoculated strains TG1, TT6, SN29, KH45 and their consortia with uninoculated control plants based on the PCA analysis of greenhouse tea plant growth promoting experiment for (A) TV1 clone, (B) TV19 clone and (C) TV20 clone.

promoters, three different commercially important tea clones TV1, TV19 and TV20 plants were inoculated with these rhizobacteria in greenhouse condition and compared to the uninoculated control plants using several plant growth products. The PCA analysis of the five different treatments for greenhouse plant growth promotion showed that the two groups of treatments TG1 and SN29 clustered together and other three groups of treatments TT6, KH45 and "consortia" appeared with the control in all the three TV1, TV19 and TV20 clones (Fig. 2 A-C).

Though, all the rhizobacterial treatments showed an increase in plant growth compared to control, the multivariate PCA analysis confirmed more growth promotion by TG1 and SN29 strains than the other treatments in all three clones. To validate this result, the fold change analysis was performed and it revealed that the tea clone TV19 plants inoculated with the *E. lignolyticus* strain TG1 showed maximum root biomass production with an increase in 4.3 fold, shoot biomass with increase in 3.1 fold, root length by 2.2 fold and shoot length by 1.6 fold. Moreover, two way ANOVA analysis also revealed that rhizobacterial treatment in different tea clones showed the significant increase ($p<0.05$) in growth promotion compared to the control.

Hence, these indigenous rhizosphere associated soil microorganisms with wide array of PGP activity could be beneficial for tea plantation of Northeast India. However, further experiments are needed to determine the effectiveness of these rhizobacterial isolates under different field conditions and also to understand the nature of their interaction with other soil native microflora and the host plant.

In our continued search for novel microbial metabolites having agricultural and pharmaceutical potential, a large number of Actinobacterial strains were isolated and screened for extracellular antimicrobial activity from the protected forest ecological niches of Assam. This has resulted in isolation of a mesophilic actinomycete strain designated as PB-52 from the soil samples of Pobitora Wildlife Sanctuary, Assam, India (26˚12´ to 26˚16´N and 91˚58´ to 92˚05´E). Based on phenotypic and molecular characteristics, the strain was identified as *Nocardia* sp. which shares 99.7% sequence similarity with *Nocardia niigatensis* IFM 0330 (NR_112195). The strain is a Gram-positive filamentous bacterium with rugose spore surface which exhibited a wide range of antimicrobial activity against Gram-positive bacteria including methicillin-resistant *Staphylococcus aureus* (MRSA), Gram-negative bacteria and yeasts. Based on polyketide synthases (PKS) and nonribosomal peptide synthetases (NRPS) gene-targeted PCR amplification, the occurrence of both of these biosynthetic pathways was detected which might be involved in the production of antimicrobial compounds in PB-52 (Fig. 3).

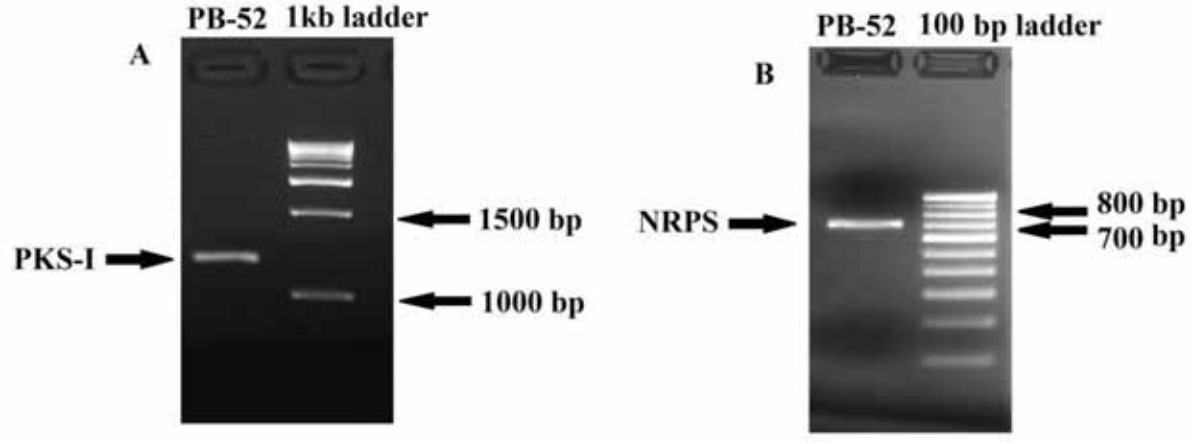


Fig. 3: Agarose gel electrophoresis of PCR amplified products of Nocardia sp. PB-52. (A) Selective amplification of PKS-I using K1F/M6R specific primers; (B) Selective amplification of NRPS using A3F/A7R specific primers.

Ethyl acetate extract of the fermented broth culture of PB-52 was prepared and tested its ability to inhibit growth of several pathogenic microorganisms. Ethyl acetate extract of PB-52 (EA-PB-52) showed lowest minimum inhibitory concentration (MIC) against *Staphylococcus aureus* MTCC 96 (0.975 µg/mL) whereas highest was recorded against *Klebsiella pneumoniae* ATCC 13883 (62.5 µg/mL). Scanning electron microscopy (SEM) revealed that treatment of the test microorganisms with EA-PB-52 destroyed the targeted cells with prominent loss of cell shape and integrity (Fig. 4).

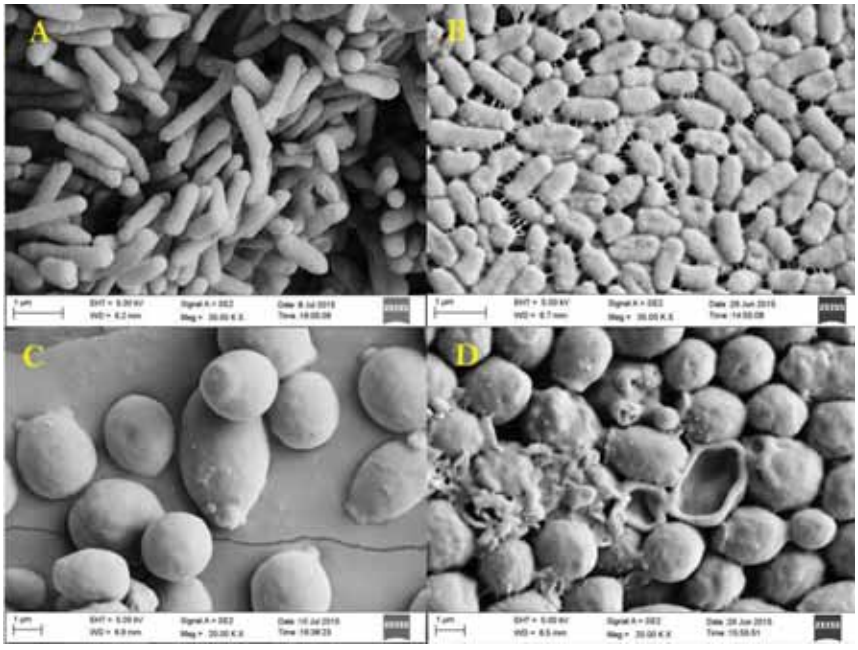


Fig. 4: Scanning electron micrograph showing the effect of 1×MIC EA-PB-52 against P. aeruginosa MTCC 741 (A) without treatment, (B) treatment with EA-PB-52; and against C. albicans MTCC 227 (C) without treatment, (D) treatment with EA-PB-52.

In order to determine the constituents responsible for its antimicrobial activity, EA-PB-52 was subjected to chemical analysis using gas chromatography-mass spectrometry (GC-MS). GC-MS analysis showed the presence of twelve different chemical constituents in the extract, some of which are reported to possess diverse biological activity. 3,5-bis(1,1-dimethylethyl)-phenol and 2,4-di-t-butyl-6-nitrophenol were the two phenolic compounds detected in EA-PB-52. Phenolic compounds are commonly known as potent antimicrobial agents as well as antioxidant agents. Antimicrobial activity of 2,4-di-t-butyl-6-nitrophenol is already documented but 3,5-bis(1,1-dimethyethyl)-phenol is not reported as an antimicrobial agent. As 3,5-bis(1,1-dimethyethyl)-phenol occupied 34.43% of the total constituents present in EA-PB-52, it might be involved in antimicrobial action. From our results, it is evident that *Nocardia* sp. PB-52 strain could be a promising candidate for the development of potential antimicrobial drug active against a wide range of microbial pathogens including drug resistant microorganisms such as MRSA.

Dr. Mojibur R. Khan

Human gut microbes, Metagenomic approach for novel cellulases,
Agarwood oil biotechnology.

The gastro intestinal tract of humans is inhabited by trillions of bacteria of diverse nature. The inoculum is acquired maternally during birth and subsequent colonization of the gut depends upon diet, age, diseases etc. Knowledge on the dynamic nature of the gut microbiota and its relation to physiology may lead to targeted modulation for better health. Our previous study reported for the first time the gut bacterial profile (GBP) of Mongloid and Proto-Australoid tribes of India. It was observed that diet plays a major role in the GBP and thus the health of an individual. Based on previous lead, our current research is directed at understanding the role of traditional dietary habits such as dairy products of Nepali population and traditional rice beer of the tribes of Assam on GBP and health (Fig.1).

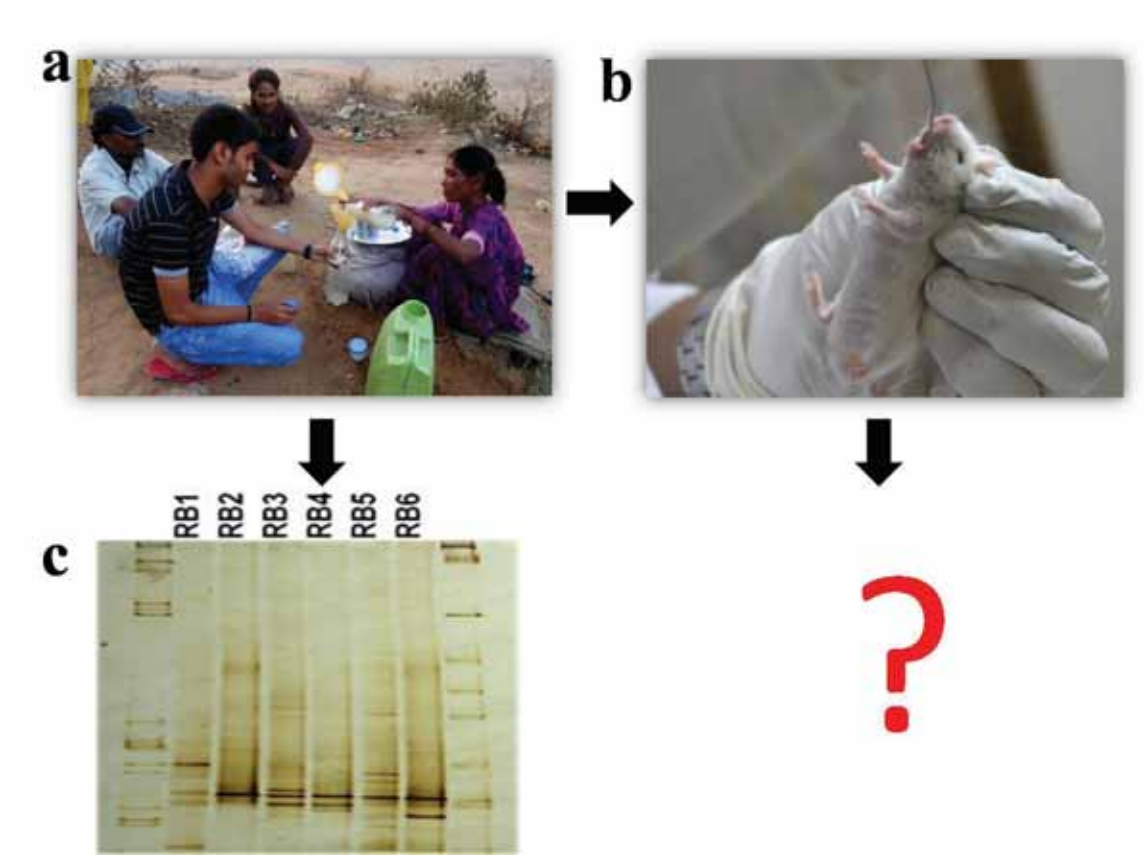


Fig. 1: Effect of traditional rice beer on gut bacterial diversity. Traditional rice beer (a) is being evaluated on animal model (b) and the bacterial diversity in the gut is being compared with that of rice beer (c).

Our group has also undertaken research on novel cellulase encoding genes from metagenomic DNA of North-East of India for bioethanol production. Four novel genes encoding cellulases of glycosyl hydrolase family 9, 65, 88 and 95 were cloned. One of them was overexpressed and the purified protein had higher carboxymethyl cellulase activity compared to commercial cellulases and reference cellulolytic strain (MTCC23) (Fig. 2a & b). Molecular docking analysis with carboxymethyl cellulose as substrate (Pubchem CID- 23706213) indicated its interaction of the amino acids SER162, ALA228, SER229, VAL230 and GLY289 with the substrate by hydrogen bonding (Fig. 2c). Research is also underway to characterise more novel genes in these metagenomic libraries to construct multifunctional cellulases for industrial application.

Research has also been undertaken to understand the mystery around formation of fragrant agarwood as a result of fungal infection. In our previous research a range of fungal isolates were obtained from various infected agarwood tissues collected from various plantations of north-east of India. Fungi isolated from fragrant resin impregnated agarwood of Assam have been screened for their ability to induce production of fragrant compounds in agarwood callus i*n vitro*. A promising *Fusarium* has been used to study the fungus-agarwood interaction using tools of metabolomics and statistical systems biology. Chemometric signatures of aromatic compound formation over three experimental platforms of fungus-agarwood interaction, viz. *in vitro* callus, juvenile plant and resinous agarwood chips were analysed. Formation of aroma compounds, their precursors, activation of metabolic pathways responsible for plant defense, secondary metabolism, terpene biosynthesis, etc. were tracked to understand the role of interaction in aroma production (Fig. 3).

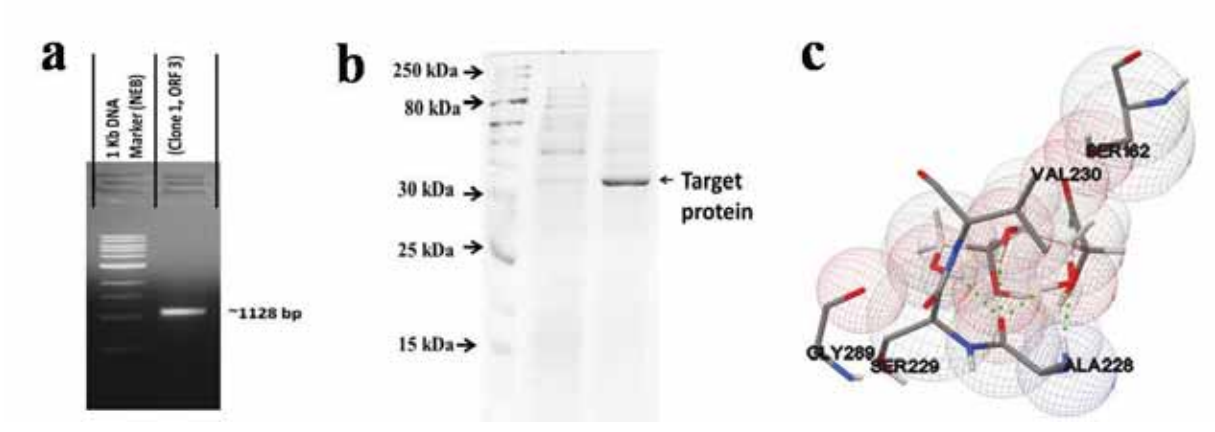
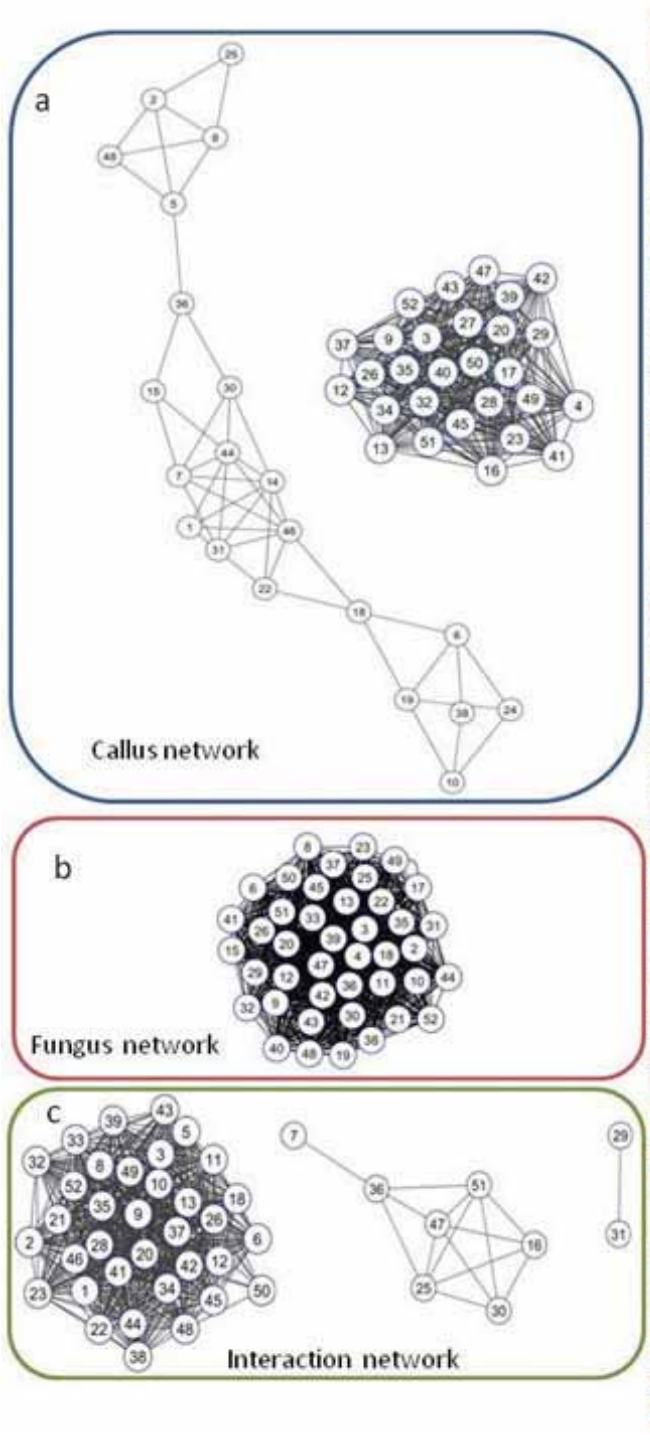


Fig. 2: Characterisation of a novel cellulase isolated from metagenomic DNA. The putative open reading frame (ORF) (a) was overexpressed and purified (b). Molecular docking analysis indicates it interaction with the substrate cellulose (c).



1	[1,1'-Biphenyl]-2,3'-diol, 3,4',5,6'-tetrakis(1,1-dimethylethyl)-
2	1,1,3,6-tetramethyl-2-(3,6,10,13,14-pentamethyl-3-ethyl-pentadecyl)cyclohexane
3	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester
4	1,3-Propanediol, 2-butyl-2-ethyl-
5	11-Methyldodecanol
6	1-Decanol, 2-hexyl-
7	1-Hexanol, 2-ethyl-
8	1-Nonanol, 4,8-dimethyl-
9	1-Octanol, 2-butyl-
10	2,5-Dimethylhexane-2,5-dihydroperoxide
11	2,5-Hexanediol, 2,5-dimethyl-
12	2-Heptanone, 4,6-dimethyl-
13	2-Isopropyl-5-methyl-1-heptanol
14	2-methylhexacosane
15	Benzaldehyde, 4-methyl-
16	Benzene, 1,3-bis(1,1-dimethylethyl)-
17	Bis(2-ethylhexyl) phthalate
18	Cyclopropane, 1,2-dimethyl-3-pentyl-, (1.alpha.,2.alpha.,3.alpha.)-
19	Cycloundecane, 1,1,2-trimethyl-
20	Decane
21	Dodecane
22	Dodecane, 2,6,10-trimethyl-
23	Dodecane, 2,6,11-trimethyl-
24	Dodecane, 4,6-dimethyl-
25	Dodecane, 4-methyl-
26	Eicosane
27	Ethanone, 2,2-dimethoxy-1,2-diphenyl-
28	Heneicosane
29	Heptadecane
30	Heptane, 3,3,5-trimethyl-
31	Hexacontane
32	Hexadecane
33	Hexanedioic acid, bis(2-ethylhexyl) ester
34	Hexatriacontyl trifluoroacetate
35	Hydroperoxide, 1-ethylbutyl
36	Isodecyl methacrylate
37	Isopropyl myristate
38	Nonane, 4-methyl-
39	Octane, 3,5-dimethyl-
40	Octatriacontyl pentafluoropropionate
41	Oxalic acid, bis(6-ethyloct-3-yl) ester
42	Pentadecane, 2,6,10-trimethyl-
43	Pentadecane, 3-methyl-
44	Pentanoic acid, 2,2,4-trimethyl-3-carboxyisopropyl, isobutyl ester
45	Pentatriacontane
46	Squalene
47	Tetracosane
48	Tetradecane
49	Tetradecane, 4,11-dimethyl-
50	Tetrapentacontane
51	Tetrapentacontane, 1,54-dibromo-
52	Undecane, 4,6-dimethyl-

Fig. 3: Fungus (Fusarium) and agarwood interaction. Chemometric analysis was performed on interaction (co-culture followed by fermentation) of agarwood callus with Fusarium sp. strain H15. Correlation networks of 52 compounds shared by fungus (a), callus (b) and interaction (c) with different topologies were observed.

Dr. Soumyadeep Nandi

Computational Biology.

Our group focuses on development and implementation of computational algorithms to analyze the enormous amount of biological data produced in recent days. Example of such data are, Genomic and Proteomic sequences, Next Generation Sequencing data, viz, ChIP-seq, ChIP-chip, transcriptome etc. Generation of such large scale data brings in the challenge to manage and analyze. Therefore, studies directed towards development or improvement of the efficient computational methods to manage and investigate these data has become highly essential.

The project that is currently in operation, studies the correlation of determinants of gene regulators. The generation of a wide range of highly ordered and reproducible cell types from a single-cell embryo has remained the most intriguing phenomenon. Cells in the multicellular organisms develop to a distinct cellular lineage, albeit they all carry an identical genome. This differentiation of cells during different time point in development is primarily done by orchestrated gene expression. Studies have revealed that, the maintenance and the specification of the differentiated cells identity are controlled by major determinants namely the transcription factors, DNA methylation, post-translational modifications of the histone proteins, polycomb mediated gene repression, etc. These epigenetic regulators control the transcriptional program of each cell by regulating the chromatin structure and all these regulators work in an orchestrated fashion. One of the objective of the study is to characterize the interplay among these regulators by exploiting massive amount of experimental data and using different computational algorithms to investigate the interactions of transcription factors in the model organism Drosophila. The interactions are analyzed for different time point of development. To achieve a wholistic understanding of the mechanism of interaction, different databases, such as, protein expression, protein-protein interaction, genome wide mapping of different transcription factors (ChIP-seq and ChIP-chip), binding site profiles of different DNA binding proteins from Jaspar database and developmental time specific histone modifications data are integrated. Essentially, the binding pattern of different transcription factors across Drosophila genome are investigated. These factors, often bind to the genome in a non-random combination to influence genes and are termed as Cis-Regulatory Module (CRM), and the regions where they bind in such a manner are called Regulatory Elements. In this study, how the CRMs interact with the regulatory elements is investigated and the genes being regulated by these modules are determined and are classified with respect to their functions. In the past, combinations of non-muscle specific factors with muscle specific transcription factor, MyoD, were studied in Human skeletal muscles. The study identified novel combinations of non-muscle specific factors with the muscle specific factor, like, MyoD or myogenin during myogenesis were discovered. The study also identified the preferred binding site of the factor MyoD with respect to the other transcription factors.

Extending the study in Drosophila, the CRMs are determined and the genes influenced by these

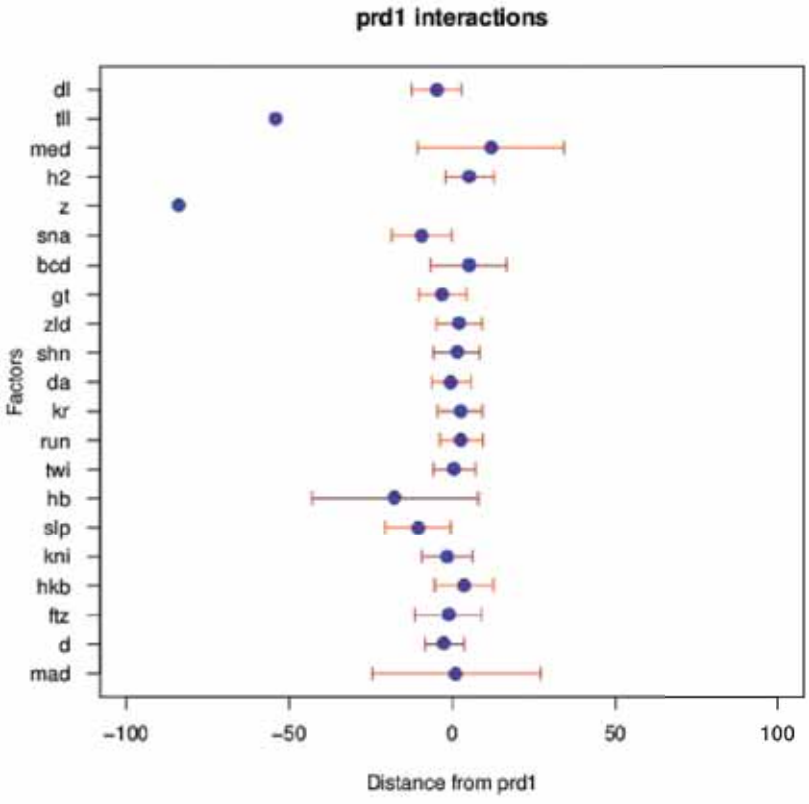


Fig. 1: ***Clustering Factors interacting with paired-like 1:*** *Distribution of the transcription factors from Drosophila with respect to the prd1. The blue dot represents the mean distance of the factor to prd1 and red bar shows the range of distribution of the factors. In the plot the prd1 binding site is centered at 0.*

combinations are further studied. Defining the CRMs of the transcription factors are the most challenging task. In this study, to establish the CRMs, first the pair-wise interactions of all the transcription factors from Jasper and experimental data were identified. For example, Figure 1 shows the binding distribution of different developmental factor with respect to prd1 (paired-like 1). Blue dot and red bar represents the mean distance and the spread of the factors in terms of confidence intervals, respectively. It is evident that many factors bind to the genome in almost an overlapping manner with the prd1. This shows the high interaction of the factors with prd1. Similarly, other such interactions are investigated and the CRMs are determined.

Extramural Projects

Completed Projects

Title of the Project	Funding Agency; Total fund;Duration; PI/Coordinator	Achievement
Endophyte diversity in wild versus cultivated rice across the environmental gradients in North East India	DBT, Govt. of India; Rs 23.00 lakhs; 2013-2016; **Dr. Narayan C. Talukdar**	A total of 817 bacterial isolates obtained from 4 microsites of rhizospheres of 8 hill rice, two deep water rice and one HYV 16s rDNA based phylogenetic diversity of 3 types of rice developed. Within a small area of similar rainfall and humidity, growth of 3 rice types in varying water depth results in a diverse set of endophytic community
Biotechnology led Organic farming in the North Easten region: Technology Assessment, Refinement and Demonstration for high value crops	DBT, Govt. of India; Rs 77.6 lakhs; 2010-2015; **Dr. Narayan C. Talukdar**	Through extensive demonstrations in 14 KVKs scattered across NER region, this project standardized biofertilizer and biopesticide doses for fair high value horticultural crops and promoted organic certification of the products as well as established laboratory infrastructure in 14 KVKs for production of these bioinputs beyond the project period.
Isolation, characterization and identification of pigments of food industrial value from filamentous fungi	DBT, Govt. of India; Rs 6.85 lakhs; 2011-2015; **Dr. Narayan C. Talukdar**	*Talaromyces purpurogenus* strain NFML-X under optimized conditions (15 days 30ºC incubator) yielded 2.39 g/L red pigment. This red pigment was devoid of rubratoxins and therefore identified as a potential colorant agents for further testing.
Treatment of oil field formation water with *in situ* generated bioflocculant	DBT, Govt. of India; Rs 41.20 lakhs;2012-2015; **Dr. Arundhuti Devi (IASST)** **&** **Dr. S. Subudhi (TERI)**	Three bacteria with significant bioflocculant production ability namely, *Acromobacter* sp., *Pseudomonas* sp. and *Pseudochrobacter* sp. were isolated from activated sludge samples of oil refineries of Assam Further, these bacteria are capable of significant biosorption of multiple heavy metals including the toxic metals (Zn, Cd, Pb, Ni, Hg, Cu). The bioflocculants were characterized as a glycoprotein complex. The bioflocculant showed negligible cytotoxicity on testing with the L292 cell line indicating the tremendous possibility of its use in bioremediation.
Study on intestinal microbiota of ethnically diverse tribal population of India: enhancing our understanding on effect of host genotype, diet and ecology.	DBT, Govt. of India; Rs 80.45 lakhs For IASST Rs 45.15 lakhs; 2011-2015; **Dr. Mojibur R. Khan (IASST),** **Dr. Narayan C. Talukdar (IBSD)** **&** **Dr. Rupjyoti Talukdar (AIG)**	This study aimed to understand the effect of ethnicity and geography on gut bacterial profile (GBP) of Mongoloid and Proto-Australoid tribes of India. Fecal bacterial diversity was studied in fifteen tribal populations representing four geographic regions (Assam, Telangana, Manipur and Sikkim) by DGGE followed by NGS analysis on Illumina MiSeq platform. Geography and diet had significant effect on GBP of the Indian tribes and was dominated by *Prevotella*. A comparison with the worldwide data revealed that GBP of the Indian population was similar to the Mongolian population (Mongolia). The bacterial genera *Faecalibacterium*, *Eubacterium*, *Clostridium*, *Blautia*, *Ruminococcus* and *Roseburia* were found to be core genera in the representative populations of the world.

Title of the Project	Funding Agency; Total fund;Duration; PI/Coordinator	Achievement
Agarwood production from *Aquilaria malaccensis*- Studies from a biotechnological perspective on an ancient and important plant based industry of Northeast India.	DBT, Govt. of India; Rs 18.5 lakhs; 2012-2015; **Dr. Mojibur R. Khan** Mentor (DBT –RA Dr. Supriyo Sen)	Fragrant agarwood oil produced in the plant *Aquilaria malaccensis* found in the north-east of India is well known for its quality. An *in vitro* method has been developed for production of fragrant agarwood compounds by treating agarwood callus with a fungus. Indian patent has been filed for this technique (Patent application number:1277/KOL/2014). Therefore this technique has potential for commercialization.
A study on hydrocarbon pollution in lentic ecosystems in and around oil field areas and effect of hydrocarbon contamination on flora and fauna	North Eastern Council, Government of India; Rs 26.35 lakhs; 2013-2015; **Prof. Sabitry C. Bordoloi**	A total of 25 lentic water bodies were selected in and around oil fields of Digboi (Tinsukia district), Duliajan, Naharkatia (Dibrugarh district), Lakwa and Geleki (Sivasagar district) and two refinery sites near Guwahati and Bongaigaon refinery of Assam. High concentration of TPH was found in water, sediments and plants growing in and around the water bodies. The TPH concentration in the plant shoot and root was significantly ($p < 0.05$) higher during the premonsoon season in comparison to winter and monsoon seasons in all the plant species. Pollution status of the 25 selected sampling sites were assessed based on presence of pollution indicator species as per Central Pollution Control Board (CPCB, 1999). Out of twenty five (25) sampling sites, three (3) sites were in clean condition (class I), three (3) sites were moderately polluted (class III), 17 sampling sites were highly polluted (class IV) and three (3) sites were excessively polluted (class V).
Exploration of microbial diversity (culturable) associated with Tea Rhizosphere Soil of Assam and Darjeeling (WB), and utilization for the production of plant growth promoting substances and bio-control of prominent fungal diseases and pests in tea.	DBT, Govt. of India; Rs 38.82 lakhs; 2012-2015; **Dr. Debajit Thakur (PI)** **Dr. Mojibur R. Khan (Co-PI)**	In this research a new tea foliar fungal disease namely, "Nigrospora Leaf Blight" on Tea caused by *Nigrospora sphaerica* was reported first time in India. This research data will be useful in easy detection of the disease symptoms of "Nigrospora leaf blight" in field condition and also its control. Also, a total of 217 tea root associated rhizobacteria were isolated from tea estates situated in Assam and 150 rhizobacteria from Darjeeling tea estates. Our study indicates the potential of these indigenous PGPR isolates for use as microbial inoculation or biofertilizer for growth promotion and fungal diseases (particularly red rust and black rot) and pest control (particularly Mealybug) of tea crops.

Ongoing Projects

Title of the Project	Funding Agency; Total fund; Duration; PI/Coordinator	Goal
Co-ordinated project –Impact assessment of *Jhuming* on native plants and soil microbiota and restoration of sustainable *Jhum* agro-ecosystem in North-East India	DBT, Govt. of India; Rs 542.14 lakhs (IASST component Rs 57.62 lakhs); 2012-2016 **Dr. Narayan C. Talukdar**	*Jhum* agro-ecosystem prevails in about 65% land area of North East India which is constituted by hills and mountains and it is regarded as an ecologically unsustainable system. This project is exploring below ground microbial diversity, specifically arbuscular mycorrhizal and rhizospheric bacteria of crop grown in *jhum* cycle of different duration and their role in *jhum* agro-ecosystem stability. This project also aims at extensive screening of the microorganisms for developing low cost bio-inputs for sustaining crop productivity under the harsh environment of short *jhum* cycle.
Studies on structure of enzymes and their interaction with nanostructure materials for bioelectronics devices and other applications.	DBT, Govt. of India; Rs 16.70 lakhs;(For IASST) Total fund Rs 4.5 Crores; 2012-2016 **Dr. Dipali Devi**	This research aims to gain a clear understanding on the electronic structure of redox enzymes and its distinctions from other proteins, it is proposed to investigate the structures of additional three different types of non-redox proteins, namely, protease (a globular soluble protein), lipase (interfacial active hydrophobic protein) and silk protein (a structural insoluble protein) for comparison. This structural information on the non-redox enzyme will also be useful to study the structure –function relationship of these proteins.
Infrastructure Development of Bioinformatics facility at IASST	DBT, Govt. of India; Rs 37.8 lakhs 2012-2017 **Dr. Dipali Devi (Coordinator)**	The Department of Biotechnology (DBT), Government of India, funded to establish the Bioinformatics Infrastructure Facility at IASST in the year of 2011-2012. The functions of the centre include acquisition, creation and development of programmes and databases by organizing workshops and seminars in the field of bioinformatics. The facility had procured one high-end workstation, desktop, server etc. and softwares like FlexX, LeadIT, R, Gromacs, Modeller, AutoDock, Bioedit, Hex, Mega and other online resources. These are extensively used by researchers, scientists of IASST. Centre is regularly organizing seminars, workshops and training programmes to spread latest knowledge on Bioinformatics among the students, teachers, and scientists of the entire north east as a whole. Recently the centre has launched its own website (www.bifiasst.ac.in).
Empowerment of ST people through rearing of *Eri* silkworm *Samia ricini* Donovan in two districts of Assam	In-house project of IASST for ST/SC people; Rs 5.49 lakhs; 2015-2016 **Dr. Dipali Devi**	This research aims to study sustainable utilization of indigenous *eri* silkworm bioresources for livelihood generation through scientific intervention .The goal will be achieved applying the following approaches ➢ To improve the rearing performance and host plant cultivation of *eri* silkworm. ➢ To train the farmers to operate 'Charkha' for *eri* silk spinning ➢ To utilize the byproduct (*Eri* larva, pupa etc.) for human consumption and as ornamental fish food.

Title of the Project	Funding Agency; Total fund; Duration; PI/Coordinator	Goal
Exploration of microbial resources from North-East India- generation of metagenomic DNA bank, construction of metagenomic libraries and screening for gene of interest	DBT, Govt. of India; Rs 70 lakhs (Ramalingaswami fellowship); 2011-2016; **Dr. Mojibur R. Khan**	This research aims to generate a metagenomic DNA bank for construction of metagenomic libraries from various environmental samples of north-east of India. Such libraries will be used to isolate genes of the enzymes important for cellulosic bioethanol production industry.
Institutional Biotech Hubs	DBT, Govt. of India; Rs 44 lakhs; 2011-2016; **Dr. Mojibur R. Khan**	The Institutional Biotech Hubs is funded by DBT to set up facility to impart training on basic techniques of microbiology and molecular biology to the researchers of IASST and neighboring institutions. This facility is also being used to expose school students to modern tools and techniques of biotechnology.
Effect of traditional dietary habits on human gut microbes: dairy products of Nepali population and traditional rice beer of tribes of Assam on gut bacterial profile	DBT, Govt. of India; Rs 133 lakhs; 2016-2019; **Dr. Mojibur R. Khan**	In our previous research, it was observed that the tribes of Sikkim namely, Nepali, Lepcha and Bhutia who consume more dairy products, contain more *Lactobacillus* and *Bifidobacteria* and less pathogenic bacteria in their guts compared to the tribes of Assam and Manipur. Tribes of Assam consume traditional rice beer prepared from fermented rice using inoculum derived from herbs. The effect of rice beer on the gut bacterial profile is not known. This research aims to study the effect of dairy products and traditional rice beer on human gut bacterial profile and health.
Antifungal properties of biosurfactants produced by the native bacterial strains and their application to control certain fungal diseases of field crops of Assam	DBT, Govt. of India; Rs 44.89 lakhs; 2012-2015; **Dr. Suresh Deka (PI)** **Dr. Mojibur R Khan (Co-PI)**	This research aims to understand the antifungal properties of biosurfactant that will be evaluated for developing biopesticides for controlling certain fungal diseases of agricultural crops
Biosurfactant enhanced bioremediation of PAHs contaminated soil of oil field situated at upper Assam	DBT, Govt. of India; Rs 24.846 lakhs; 2013-2016; **Dr. Suresh Deka (PI)** **Dr. A. Devi (Co-PI)**	The expected outcome of the proposed study is to develop a practically viable and scientifically acceptable process to be used in the polluted sites contaminated with Poly Aromatic Hydrocarbon (PAHs) for restoration of soil health.

Title of the Project	Funding Agency; Total fund; Duration; PI/Coordinator	Goal
Correlation study of different determinant of gene regulators	DBT, Govt. of India; Rs 83 lakhs;2015-2020; **Dr. Soumyadeep Nandi**	The project aims to understand the interactions among different determinants of gene regulators like, transcription factors, PolyComb complexes, DNA methylation etc. during the process of development and differentiation.
North - East origin silk based co-culture 3-D model for cartilage tissue repair	DBT (BioCARe), Govt. of India; 31.93 Lakhs; 2013-2017 **Dr. Nandana Bhardwaj**	Recent advances in biological sciences have generated great interest in use of cell-based therapies including stem cells for tissue defects. This project outcomes will support the efforts to elucidate the mechanism of regenerating the osteochondral interface on tissue-engineered grafts. From the proposed work, we expect development/mimicking of native like cartilage/ osteochondral tissue grafts/interface towards repair and regeneration..

Publications

In Cited Journals

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
R.C. Jose, B. Louis, S. Goyari, S.D. Waikhom, P.ap J. Handique, N.C. Talukdar	Biotrophic interaction of *Sporisorium scitamineum* on new host *Saccharum spontaneum*	Micron	81/8-15	February/2016
S. Goyari, S.H. Devi, L. Bengyella, M. Khan, C.K. Sharma, M.C. Kalita, N.C. Talukdar	Unveiling the optimal parameters for cellulolytic characteristics of *Talaromyces verruculosus* SGMNPf3 and its secretory enzymes	Journal of Applied Microbiology	119/88-98	May/2015
Y.B. Chaudhari, N.C. Talukdar, N.C. Adhikary, M.C. Kalita, M.R. Khan	Rice straw based evaluation of lignolytic and cellulolytic capabilities of novel strains of saprophytic fungi from Indo-Burma biodiversity hotspot	Energy and Fuels	29/784-792	January/2015
S. Sanjukta, A.K. Rai, A. Muhammed, K. Jeyaram, N.C. Talukdar	Enhancement of antioxidant properties of two soybean varieties of Sikkim Himalayan region by Proteolytic *Bacillus subtilis* fermentation	Journal of Functional Foods	14/650-658	April/2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
B. Louis, S.D. Waikhom, R.C. Jose, S. Goyari, N.C. Talukdar, P. Roy	*Cochliobolus lunatus* colonizes potato by adopting different invasion strategies on cultivars: new insights on temperature dependent-virulence	Microbial Pathogenesis	87/30-39	October/2015
R. Nath, D. Devi	Protein profile of Native population of *Antheraea assamensis* Helfer (Muga Silkworm) of Assam, India	Journal of Entomology and Zoology Studies	3(4)/157-159	July/2015
M. Choudhury, B. Talukdar, K.C Baruah, N.N Dass, D. Devi	Impact of BSA and casein on chemical modification of Muga silk fiber	The Journal of Textile Institute	107(3)/ 346-354	April 2015
M. Choudhury, D. Devi	Impact of high temperature and high pressure on sericin scouring of Muga silk cocoon	Indian Journal of Fiber and Textile Research	41/93-96	March 2016
M. Choudhury, B. Talukdar, D. Devi	Surface smoothening and characterization of silk fibers of *Antheraea assamensis* Helfer (muga) using some natural agents	The Journal of Textile Institute	DOI: 10.1080/ 00405000. 2015. 1108688	November 2015
S. Laishram, D.S. Moirangthem, J.C. Borah, B.C. Pal, P. Suman, S.K. Gupta, M.C. Kalita, N.C. Talukdar	Chrysin rich Scutellaria discolor Colebr. induces cervical cancer cell death via the induction of cell cycle arrest and caspase dependent apoptosis	Life Sciences	143/105-113	December/ 2015
A. Kumar, H. Chetia, S. Sharma, D. Kabiraj, N.C. Talukdar, U. Bora	Curcumin Resources Databases	DATABASE-The journal of Biological databases and curation.	doi: 10.1093/ database/ bav070	June/2015
Y. Sheikh, B.C. Maibam, D. Biswas, S. Laisharm, L. Deb, N.C. Talukdar, J.C. Borah	Anti-diabetic potential of selected ethno-medicinal plants of north east India	Journal of Ethnopha-rmacology	171/37-41	August/2015
R. Nath, D. Devi	Protein profile of Native population of *Antheraea assamensis* Helfer (Muga Silkworm) of Assam, India	Journal of Entomology and Zoology Studies	3(4)/157-159	July/2015

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
G. Devi, A. Devi, K.G. Bhattacharyya	Hydrocarbons and heavy metals in fine particulates in oil field air: possible impacts on production of natural silk	Environmental Science and Pollution Research	23(4)/ 3310-3321	February/2016
M. Pathak, A. Devi, K. G. Bhattacharyya, H. K. Sarma, S. Subudhi, B. Lal	Production of a non-cytotoxic bioflocculant by a bacterium utilizing a petroleum hydrocarbon source and its application in heavy metal removal	RSC Advances	5/66037-46	July/2015
S. Subudhi, V. Bisht, N. Batta, M. Pathak, A. Devi, B. Lal	Purification and characterization of exopolysaccharide bioflocculant produced by heavy metal resistant *Achromobacter xylosoxidans*	Carbohydrate Polymers	137/441-451	October/2015
P. Tamuly, G. Devi, A. Devi	Dissipation pattern of trace metals from soil to leaves in tea gardens of Assam, India	Journal of Environmental Research and Development	10(3)/ 451-462	March/2016
M. Dehingia, K.Thangjamdevi, N. C. Talukdar, R Talukdar, N. Reddy, S.S. Mande, M. Deka, M. R. Khan	Gut bacterial diversity of the tribes of India and comparison with the worldwide data	Scientific Reports	doi: 10.1038/ srep18563	December/ 2015
G. Kaushik, S. Bordoloi	Length–weight and length–length relationships of four species of genus *Pethia* and genus *Puntius* from wetlands of Lakhimpur district, Assam, India	Journal of Applied Ichthyology	31/1150-1152	June/2015
G. Kaushik, S. Bordoloi	Adaptive modifications in lip and barbel of an endangered catfish *Amblyceps arunchalensis* Nath & Dey, 1989	Current Science	109(9)/ 1554-1556	November / 2015
G. Kaushik, S. Bordoloi	Ichthyofauna of Ranganadi River in Lakhimpur, Assam, India	Checklist, Biotaxa	12(2)/1-6	April/2016
J.F. Hussain, S. Bordoloi	Breeding tubercles in scales of male *Barilius bendelisis* (Hamilton, 1807) identified as sexual dimorphic character	Current Science	110 (6)/ 985-986	March/2016

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
J.F. Hussain, M.K. Das, G. Kaushik and S. Bordoloi	Length-weight relationships of five fish species collected from Basistha River, a torrential river in Assam, India	Journal of Applied Ichthyology, Wiley	32 (1)/137-138	February/2016
S. Grosjean, S. Bordoloi, Y. Chuaynkern, P. Chakravarty & A. Ohler	When young are more conspicuous than adults: a new ranid species (Anura: Ranidae) revealed by its tadpole	Zootaxa	4058(4)/ 471-498	December/ 2015
J. Dutta, P. J. Handique, D. Thakur	Assessment of culturable tea rhizobacteria isolated from tea estates of Assam, India for growth promotion in commercial tea cultivars	Frontiers in Microbiology	6/1252	November/ 2015
P. Sharma, M. C. Kalita, D. Thakur	Broad spectrum antimicrobial activity of forest-derived soil actinomycete, *Nocardia* sp. PB-52	Frontiers in Microbiology	7/347	March/2016
D. Goswami, S. N. Borah, J. Lahkar, P. J. Handique, S. Deka	Antifungal properties of rhamnolipid produced by *Pseudomonas aeruginosa* DS9 against *Colletotrichum falcatum*	Journal of Basic Microbiology	55(11)/ 1265-21274	July/ 2015
K. Patowary, M. C. Kalita, S. Deka	Degradation of polycyclic aromatic hydrocarbons (PAHs) employing biosurfactant producing *Pseudomonas aeruginosa* KS3	Indian Journal of Biotechnology	14(2)/208-215	April/2015
P. Baruah, S. Deka, P. P. Baruah	Phytoremediation of crude oil-contaminated soil employing *Crotalaria pallida* Aiton	Environmental Science and Pollution Research	DOI 10.1007/ s11356-016-6227-y	February/2016
S. N. Borah, S. Deka, H. K. Sarma	First report of *Fusarium verticillioides* causing Stalk Rot of Maize in Assam, India	Plant Disease	DOI: 10.1094/ PDIS-01-16-0074-PDN	February /2016

Conference Proceedings:

Author (s)	Title	Conference name	Volume & Issue no./ page no.	Month/ Year of publication
J.F. Hussain, S. Bordoloi	A Study on Arsenic Concentration in soil of waste dumping sites in Titabar, Jorhat District, Assam, India	Proceedings of the UGC Sponsored National Seminar on Bio prospecting of Gene Pool: Trends and Prospects in North East India	ISBN no.: 978-81-922965-2-4, PP: 80-85.	2015
S. Baishya, M. K. Das, S. Bordoloi .	A Study on Physico-chemical analysis of water in lentic water bodies near Bongaigaon refinery in Assam, India	Proceedings of the UGC Sponsored National Seminar on Bio prospecting of Gene Pool: Trends and Prospects in North East India	ISBN no.: 978-81-922965-2-4, pp: 139-146.	2015

Book Chapters:

Author (s)	Other details
S. Sen, P. Gogoi, M.R. Khan (2015)	Specialty plant products - need for synergism between resource and research. Innovative Research in Biological Sciences (Eds. Das, S. and Barkalita, L.M.), Global Publishing House, New Delhi. ISBN 978-93-81563-41-0.
S. Bordoloi, B. Basumatary (2015)	Phytoremediation:Management of Environmental Contaminants, Volume -1 Ansari, A.A., Gill, S.S., Gill, R., Lanza, G.R., Newman, L. (Eds.) Springer publication ISBN 978-3-319-10394-5.
D. Thakur (2015)	Therapeutic effects of Tea [*Camellia sinensis* (L) O. Kuntze] constituents on human health. In: Recent Advances in Natural Products. (edited by Sujogya Panda). Studium Press, LLC, Houston, U.S.A. 2015, pp. 151-178. ISBN: 1-62699-060-3.

Contribution to World Database:

Author (s)	Title	Database	Year
N.C. Talukdar, H.S. Devi	Earthworms from four niches of North East India, Mitochondrial COI based	NCBI Genbank KT716821 to KT716821	2015
N.C. Talukdar, H.S. Devi	Aerobic bacteria isolated from gut of earthworms of four niches of North East India, 16S rDNA based	NCBI Genbank KX138434 to KX138449	2015
N.C. Talukdar, H.S. Devi	Facultative anaerobic bacteria isolated from gut of earthworms of four niches of North East India, 16S rDNA	NCBI Genbank KX242115 to KX242133	2016
N.C. Talukdar, H.S. Devi	Actinobacteria isolated from gut of earthworms of four niches of North East India, 16S rDNA	NCBI Genbank KX242134 to KX242158, KU242158	2016

Author (s)	Title	Database	Year
N.C. Talukdar, H.S. Devi	Fungi isolated from gut of earthworms of four niches of North East India, ITS1-5.8S-ITS2	NCBI Genbank KX138411 to KX138433	2016
N.C. Talukdar, S. Goyari	Fungi isolated form undisturbed forests soil of Indo-Burma Biodiversity hotspot, ITS1-5.8S-ITS2	NCBI Genbank KC937053 to KC937055	2015
N.C. Talukdar, S. Goyari	A high cellulase producing fungus (*Talaromyces verruculosus* SGMNPf3) of Indo-Burma Biodiversity hotspot LC-MS data of proteins: Cellobiohydrolase 1, Endoglucanase, beta- glucosidase, Endo-1,4-beta-xylanase LC-MS data	Dryad Digital Repository Doi:105061/dryad.64715	2015
S. Sen, M. R. Khan	*Fusarium* isolates, NH34 (NCBI Acc. No. KT001452) and J3 (NCBI Acc. No.KT001451) submitted to NCBI in May 2015	http://www.ncbi.nlm.nih.gov/nuccore/KT001452 http://www.ncbi.nlm.nih.gov/nuccore/KT001451	2016
Y. Chaudhari, M.R. Khan	Uncultured prokaryote clone C_1O_3 putative carboxymethyl cellulase gene, complete cds (NCBI Acc. No. KT962251.1)	NCBI (http://www.ncbi.nlm.nih.gov/nuccore/KT962251.1)	2016
M. Dehingia, K.T. Devi, N. C. Talukdar, M. R. Khan	Gut bacterial diversity of the tribes of India and comparison with the worldwide data	Database of gut bacterial composition of 15 tribal population of India submitted in the **MGRAST** online server. http://metagenomics.anl.gov	2016
P. Sharma, D. Thakur	Antimicrobial metabolite/s producing Actinobacteria isolated from Pobitora Wildlife Sanctuary of Assam, India, 16S rDNA	NCBI Genbank KU892679, KU901712 to KU901726	2016
P. Sharma , D. Thakur	Antimicrobial metabolite/s producing Actinobacteria isolated from Pobitora Wildlife Sanctuary of Assam, India, PKS-I	NCBI Genbank KU721843	2016
P. Sharma , D. Thakur	Antimicrobial metabolite/s producing Actinobacteria isolated from Pobitora Wildlife Sanctuary of Assam, India, NRPS	NCBI Genbank KU721842	2016
J. Dutta, D. Thakur	Assessment of Culturable Tea Rhizobacteria Isolated from Tea Estates of Assam, India for Growth Promotion in Commercial Tea Cultivars, 16S rDNA	NCBI Genbank KJ767521-24	2015
J. Dutta, D. Thakur	Tea root associated actinobacteria as biocontrol agents of tea phytopathogens and as growth promoters, 16S rDNA	NCBI Genbank KT892736-38	2015
J. Dutta, D. Thakur	Evaluation of multifarious plant growth promoting traits, antagonistic potential and phylogenetic affiliation of rhizobacteria associated with commercial Tea plants grown in Darjeeling, India, 16S rDNA	NCBI Genbank KX373959-KX373991	2016

Author (s)	Title	Database	Year
R. Das, D. Thakur	Silver nanoparticles synthesized by the cell free extract of Actinomycetes strain P34 isolated from Pobitora wildlife sanctuary, 16S rDNA	NCBI Genbank KR610333	2015
R. Das, D. Thakur	Extracellular antimicrobial metabolite/s producing strain isolated from Nameri National Park, Assam, India, 16S rDNA	NCBI Genbank KU940237 to KU940250 , KX171763 to KX171770 and KX255002 to KX255003	2016
R. Das, D. Thakur	Extracellular antimicrobial metabolite/s producing strain isolated from Nameri National Park, Assam, India, PKS II and NRPS	NCBI Genbank KX592592 to KX592594, KX575651, KX761862 and KX575648.	2016
R. Patowary, S. Deka	Utilization of Paneer Whey Waste for Cost-Effective Production of Rhamnolipid Biosurfactant.	NCBI Genbank KR028434	2016
K. Patowary, S. Deka	Developmant of an efficient bacterial consortium for the potential remediation of hydrocarbons from contaminated sites.	NCBI Genbank KR052033	2016

Presentation in Conferences/Seminars

Invited Talks

Faculty	Title	Programme Name	Date & Venue
Dr. N.C. Talukdar	Protection of plant variety and farmers' right (PPVFR), chief guest lecture	Annual function of North East Farmers' organized by PPVFR, Guwahati	March 25, 2016 at AAU, Kahikuchi, Guwahati
Dr. N.C. Talukdar	Knowledge of rich herbal medicine of North East region holds key to new drug discovery. chief guest lecture	National Seminar organized by North East Chapter of Chemical Society of India	March 21, 2016 at NEIST, Jorhat
Dr. N.C. Talukdar	Microbial database for North East India	Workshop on Bioinformatics organized by Deptt. of Biotechnology of Boroland University	March 17, 2016 at Deptt. of Biotechnology, Boroland University
Dr. N.C. Talukdar	Plant microbe interaction can result in higher plant productivity and delicacy food, plenary lecture	National Seminar on "Current trend in plant science research" organized by the Department of Botany, Tripura University.	March 15, 2016 at Department of Botany, Tripura University

Faculty	Title	Programme Name	Date & Venue
Dr. N.C. Talukdar	Inter-institutional synergy and collaboration with multidisciplinary approach for technology innovation, key note speech	Organized by Central Muga *Eri* Research and Training Institute	February 25, 2016 at Guwahati
Dr. N.C. Talukdar	Molecular biology and biotechnology research in North East India, key note speaker	National Seminar organized by Pub Kamrup College	August 19, 2015 at Pub Kamrup College, Guwahati
Dr. N.C. Talukdar	The brain storming session on Issues and challenges in shifting cultivation and its relevance in the present context.	Seminar organized at National Agricultural Science Complex	August 17, 2015 at NASC complex New Delhi
Dr. N.C. Talukdar	Traditional Knowledge based drug discovery- North East Region of India context, invited lecture	National Conference on IPR in Bio Science for scientists of North East Indian states, organized at USTM, Meghalaya and sponsored by ICMR, New Delhi	July 21-22, 2015 at USTM, Meghalaya
Dr. N.C. Talukdar	Below Ground Microbial biodiversity relation to above-ground plant community structure and utility of microbial inoculum in crop productivity, soil health, endophytic and rhizospheric bacterial diversity, plenary lecture	International Conference on Biotechnological advances in Enviromental health and biodiversity conservation & 39th Annual Meeting of Environemental Mutagen Society of India	May 21-23, 2015 at Manipur University, Imphal
Dr. Dipali Devi	Non-mulberry Silk as Biomaterial	International Conference on Material Science and Technology (ICMTech)	March 2, 2016 at University of Delhi, India
Prof. S. C. Bordoloi Theme talk	Degradation of habitat: Threat to the indigenous fish species in the wetlands of Assam and Nagaland	National Conference on Aquaculture in the North East Region: Realities, Potential and Challenges	August 25-26, 2015 at St. Anthonys' College, Shillong
Prof. Suresh Deka	Engineering Challenge in algal energy	Seminar programme for faculty and students of UG & PG, Department of Applied Biology	May 9, 2015 at University of Science & Technology, Meghalaya.
Prof. Suresh Deka	Bioremediation of petroleum hydrocarbon from contaminated sites	National Conference on Challenges in Environmental Research	June 4-6, 2015 Center for the Environment IIT Guwahati

Contributory

Author(s)	Title	Conference Name	Oral/ Poster	Date & Venue
S.S. Singh, C. Khanikar, N.C. Talukdar, G.K. Saini, J.C. Bora	Production of Mycotoxin free water soluble red pigment by a novel strain of *Talaromyces purpurogenus* NFML-X	9th World Congress on Polyphenols Applications	Oral	June 3-5, 2015 at St. Julian's, Malta
M. Das, R.K. Sarma, N.C. Talukdar	Diversity of rhizobacteria and arbuscular mycorrhizae in the crop fields of three *Jhum* cycles in Nagaland and Mizoram	56th Annual Conference of Association of Microbiologists of India & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University, New Delhi.
G. Raj, N.C. Talukdar	Diversity of endophytic bacteria in seeds of *Oryza sativa* of three distinct Agro-ecosystem of North East India	56th Annual Conference of Association of Microbiologists of India & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University, New Delhi.
G. Devi, A. Devi	Distribution of VOC in the atmosphere and hydrocarbons, metals in soil and plant leaves of silk cultivated area near oil exploration region of Assam	2nd International Conference on Environment and Ecology	Oral	March 7-9, 2016 at Bharathiar University, Coimbatore
M. Pathak, H.K. Sarma, A. Devi	Characterization of a non-cytotoxic glycoprotein like bioflocculant and its application in heavy metal removal	2nd International Conference on Environment and Ecology	Oral	March 7-9, 2016 at Bharathiar University, Coimbatore
P. Tamuly, A. Devi	Heavy metal assessment of Assam tea	2nd International Conference on Environment and Ecology	Oral	March 7-9, 2016 at Bharathiar University, Coimbatore
S. Sen, M. Dehingia, N. C. Talukdar, M. R. Khan	Metabolite profiling and statistical systems biology - a new approach to understand the formation of fragrant resins in agarwood	International Conference on Flavor and Fragrance Biotechnology (Bioflavor 2015)	Oral	September 9-11, 2015 at Frankfurt, Germany
M. Dehingia, N. C. Talukdar, M. R. Khan	Gut microbiota variation due to ethnicity, diet and geography	19th ADNAT Convention: International Symposium on Microbiome in Health and Disease (MICROHD2016)	Poster	February 23-25, 2016 at ICAR- NIANP, Bangalore

Author(s)	Title	Conference Name	Oral/ Poster	Date & Venue
B. Bhaskar, M.R. Khan	An insight into the effect of some indigenous fermented food on the gut microbial profile of the tribal populations of North-east India	19th ADNAT Convention: International Symposium on Microbiome in Health and Disease (MICROHD2016)	Poster	February 23-25, 2016 at ICAR- NIANP, Bangalore
G. Kaushik, S. Bordoloi	Analysis of length-weight relationships, condition factor and Bayesian approach for prediction of health and shape of fish populations collected from Lakhimpur district, Assam, India	International Conference of Aquaculture, Indonesia, 2015	Oral	October 29-31, 2015 at Jakarta, Indonesia
J. F. Hussain, S. Bordoloi	Change in Fish assemblage pattern of a Hill Stream over a decade	National Conference on Aquaculture in the North East Region: Realities, Potential and Challenges	Oral	August 25-26, 2015 at St. Anthonys' College, Shillong
J.F.Hussain, S. Bordoloi	A Study on Arsenic concentration in Soil of Waste dumping sites in Titabar, Jorhat district, Assam, India	National Seminar on 'Bioprospecting of Gene Pool'	Oral	June 26-27, 2015 at DK College, Mirza, Assam
J. Dutta, P. Jyoti, H., D. Thakur	Tea rhizobacteria as a potential biofertilizer and biocontrol agent for sustainable agriculture in North-east India	4th Asian PGPR Conference	Oral	May 3-6, 2015 at Hanoi, Vietnam
J. Dutta, D. Thakur	Investigation of biocontrol and plant growth promoting potential of culturable actinobacteria associated with tea rhizosphere soil	56th Annual Conference of AMI (AMI-2015) & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University, New Delhi
R. Das, D. Thakur	Exploration of pesticide tolerant actinobacteria from Tea rhizosphere for growth promotion and disease control	56th Annual Conference of AMI (AMI-2015) & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University, New Delhi
P. Sharma, D. Thakur	Genetic diversity and antimicrobial biosynthetic potential of actinobacteria from Pobitora Wildlife Sanctuary of Assam, India	56th Annual Conference of AMI (AMI-2015) & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University

Author(s)	Title	Conference Name	Oral/ Poster	Date & Venue
A. Borah, D. Thakur	Exploration of endophytic actinobacteria associated with different Camellia species and screening for their in vitro growth promotion activity and Bio control of tea fungal pathogens	56th Annual Conference of AMI (AMI-2015) & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University
R. Majumdar, H. K. Sarma, D. Thakur	Assessment of the acquisition of drug resistant UTI pathogens infecting women in Guwahati city Assam and *in-vitro* evaluation of microbial secondary metabolites against drug resistant UTI pathogens	56th Annual Conference of AMI (AMI-2015) & International Symposium on "Emerging Discoveries in Microbiology"	Poster	December 7-10, 2015 at Jawaharlal Nehru University, New Delhi
V. Das, R. Sikha, S. Deka	Antifungal activity of biosurfactant against three plant pathogenic fungi of capsicum Chinense Jacq	National seminar on Bioprospecting of gene pool: trends and prospects in North East India.	Oral	June 6-7, 2015 at D.K. College Mirza , Kamrup, Assam
R. Patowary, S. Deka	Utilization of whey for cost effective production of biosurfactant produced by Pseudomonas aeruginosa strain SR17	National seminar on Bioprospecting of gene pool: trends and prospects in North East India.	Oral	June 6-7, 2015 at D.K. College Mirza , Kamrup, Assam
K. Patowary, S. Deka	Recovery of petroleum hydrocarbons from refinery sludge by biosurfactant producing *Bacillus pumilus* KS2	6th European Bioremediation Conference	Poster	June 29-July 2, 2015 at Chania, Crete, Greece
K. Patowary, S. Deka	Characterization of biosurfactant during crude oil biodegradation employing *Pseudomonas* sp. PG1	6th European Bioremediation Conference	Poster	June 29-July 2, 2015 at Chania, Crete, Greece
S. Deka, K. Patowary, M. C. Kalita	Degradation of Poly Aromatic Hydrocarbon (PAH) by biosurfactant producing bacterial strains	6th World Congress on Biotechnology	Oral	October 5-7, 2015 at New Delhi
R. Patowary, M. C. Kalita, S. Deka	uptake of PAHs by rice *(Oryza sativa*) grown near Lakowa oil fields of upper Assam	International Conference on New Horizons in Biotechnology	Poster	November 22-25, 2015 at Trivandrum, Kerala
K. Patowary, M. C. Kalita, S. Deka	Crude Petroleum Oil Degradation Efficiency of *Bacillus Cereus* R2 Strain Isolated From Crude Oil Contaminated Rice Field	The 2nd Conference on Environmental Chemistry (CEC2015)	Oral	December 18-20, 2015 at Guilin, China

Conferences/Workshops/Meetings Attended

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Dr. N.C. Talukdar	Inaugural meeting of the Bioinformatics infrastructure facility of DBT at Department of Biotechnology, Bodoland University as Chief guest	March 17, 2016 at Department of Biotechnology, Bodoland University, Kokrajhar, Assam
Dr. N.C. Talukdar	Microbial role in yield management of scented rice of NER" presented and defended the project before the task force of DBT	March 1, 2016 at Department of Biotechnology, New Delhi
Dr. N.C. Talukdar	Chief guest of Inaugural function of National Seminar on Problem and Prospect of Muga and *Eri* silk sectors	February 25, 2016 at Guwahati
Dr. N.C. Talukdar	Chief guest in the inaugural function of amazing NANO, one week national workshop on nanotechnology, organized jointly by Don Bosco University, Guwahati and Tezpur University	February 1, 2016 at Don Bosco University, Guwahati
Dr. N.C. Talukdar	Chief guest at the closing ceremony of Science and Engineering exhibition during Jan 29-30 for school, general and engineering college student	January 30, 2016 at Regional Science Centre, Guwahati, Assam
Dr. N.C. Talukdar	Inaugural function of 6th session of Assam Science society at Goalpara college and also two-hours interactions with about 150 hihger secondary and college science students on sustainable development 6th session of Assam Science society, Organized by Goalpara Chapter of ASS and the Goalpara College	January 23, 2016 at Goalpara College, Assam
Dr. N.C. Talukdar	Chief guest- National Model Training programme on Integrated pig farming for sustainable and economic return , National Model Training programme, organized by ICAR- NRC Pig at Rani for eight days	January 5, 2016 at ICAR-NRC Pig, Rani
Dr. N.C. Talukdar	As chief guest of the one day symposium on Biomedical Engineering -2015 At The Centre for Environment, IITG under Biotech Hub	December 23, 2015 at Indian Institute of Technology, Guwahati
Dr. N.C. Talukdar	First Research Council Meeting of CCSU- attended as member	December 23, 2015at Cotton College State University, Assam
Dr. N.C. Talukdar	Guest of Honour, National Seminar on "Sustainable Conservation for Bioresources of North East India , National Seminar on "Sustainable Conservation for Bioresources of North East India	November 6, 2015 at Arya Vidyapith College, Guwahati sponsored by DST, New Delhi
Dr. N.C. Talukdar	Interaction with 230 students of class VIII to IX, 23rd State Level Children Science Congress at Jawahar Navodaya Vidyalaya, Titabor	October 30, 2015 at Jawahar Navodaya Vidyalaya, Titabor

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Dr. N.C. Talukdar	Meeting of ABC DST, presentation on IASST research programmes, achievements and contribution to national missions, All 37 DST institutes and 7 IIT Director participated	July 6-7, 2015 at DST Conclave, New Delhi
Dr. N.C. Talukdar	Chaired and conducted all the theme presentations and prepared the minutes, Brainstorming workshop on "scented rice of North East India"- DBT workshop held in IASST, Guwahati	June 26, 2015 at IASST, Guwahati
Dr. N.C. Talukdar	Chaired a session on "Promoting Innovations" in which five presentations were made, Innovative Research and Entrepreneurial opportunities in Biotechnology- Organized by Guwahati Biotech Park and sponsored by Department of Scientific and Industrial Research, Ministry of Science and Technology, GOI	June 12, 2015 at Guwahati Biotech Park
Dr. N.C. Talukdar	NER BPMC Project evaluation meeting, Ecorestoration of *jhum* agro ecosystem	May 26, 2015 at DBT, New Delhi
Dr. N.C. Talukdar	NER BPMC Project evaluation meeting, Biotech led organic farming	May 26, 2015 at DBT, New Delhi
Dr. Dipali Devi	International conference on MCB75:From Molecules to Organisms	December 11-14, 2015 at Indian Institute of Science, Bangalore
Dr. Dipali Devi	Workshop on "Patinformatics for Bioinformatics" organized by Department of Biotechnology, Kuman University, Nainital.	March 5, 2016 at Kumaun University, Nainital.
Dr. Soumyadeep Nandi	Computational Biology Back to Future	December 26-27, 2015 at Jawaharlal Nehru University
Dr. Soumyadeep Nandi	Basics of Bioinformatics	March 17, 2016 at Bodoland University, Kokrajhar, Assam
Ms Moni Kankana Kalita	National Seminar on "Science and Technology for sustainable development" (61st Annual Technical session of Assam Science Society)	January 23, 2016 at Goalpara College, Goalpara, Assam
Mr. Kishor Haloi	National Seminar on "Science and Technology for sustainable development" (61st Annual Technical session of Assam Science Society)	January 23, 2016 at Goalpara College, Goalpara, Assam
Ms Moni Kankana Kalita	Workshop on Proteomics- 2016	January 20-21, 2016 at IASST, Guwahati, Assam
Mr. Kishor Haloi	Workshop on Proteomics- 2016	January 20-21, 2016 at IASST, Guwahati, Assam

Lectures Delivered at other Institutes

Faculty	Topic	Date & Venue
Dr. Dipali Devi	Role of Biotechnology in Society	March 22, 2016 at Puthimari Higher Seconadary School, Soneswar, Rangia, Assam.
Dr. Dipali Devi	Silkworm and silk: searching for safe and better avenues.	September 7, 2015 at Rajiv Gandhi University, Itanagar, Arunachal Pradesh
Dr. M. R. Khan	Micro-macro organism interactions	April 23, 2015 at Goalpara College
Dr. Debajit Thakur	Application of microbes in agriculture and industry	March 14, 2015 at School of Biological Sciences, University of Science and Technology, Meghalaya
Dr. Soumyadeep Nandi	An overview of Bioinformatics	March 17, 2016 at Bodoland University, Kokrajhar, Assam

Other activities

Visits to National/International Institutes/Laboratories

Faculty/Research Scholar	National/international institutes/laboratories	Date
Dr. Dipali Devi	Chaired a session in International Conference on Material Science and Technology (ICMTech) , University of Delhi, India	March 2, 2016
Dr. Dipali Devi	Chaired a session in technical session of UGC sponsored National Seminar on Future of Muga and Pat Industry at S.B.M.S College, Sualkuchi, Assam	April 29, 2015
Dr. Dipali Devi	Chaired two technical sessions in National Seminar on “Science and Technology for sustainable development” (61st Annual Technical session of Assam Science Society), Goalpara College, Goalpara	January 23, 2016
Dr. Dipali Devi	Attended the Alumni Meet of Molecular and Cell biology lab., Indian Institute of Science organized as a part of Platinum jubilee celebration of the Department(MCB-75)	December 14, 2015
Dr. Dipali Devi	Visited the Department of Zoology, Rajiv Gandhi University,Itanagar,Arunachal Pradesh as visiting scientist	September 1-10, 2015
Dr. Dipali Devi	Visited the Department of Zoology. Gauhati University as external examiner	June 13-15, 2015
Prof. S. C. Bordoloi	British Museum of Natural History (BMNH), UK.	January 4-9, 2016
Dr. Soumyadeep Nandi	Jawaharlal Nehru University	November 27, 2015 at JNU

Patents

Inventor(s)	Title	File no. for enrollment	Provisional/ final patent grant no.	Issue no. of patent office
S. Deka, S. N. Borah	Method for preventing stalk and ear rot disease of maize	546/KOL/2015	Published	23/2015 Dated 05/06/2015
S. Deka, R. Patowary	Method for production of rhamnolipid	201631004581	Published	10/2016 Dated 04/03/2015

M.Sc. / B. Tech Projects/Training Courses Offered at IASST

Name(s) of trainee	Programme and supervisor	Title of work	Duration
Mr. Arbaz bin Sabir	M.Sc. under Dr. Arundhuti Devi	Particulate matter (PM10 and PM2.5) in ambient air inside IASST campus and the associated metals	2 months
Ms Rizuwana sultana	M.Sc. under Dr. Arundhuti Devi	Assessment of drinking water quality in some government schools of Guwahati	2 months
Ms. Sushmita Singh	M.Tech. under Dr. Mojibur Khan	Study of microbial diversity of traditional rice beer	9 months
Miss. Aashiyana Aszmin Hussain	M. Sc. under Dr. Mojibur Khan	Isolation and characterization of cellulose degrading microbes from forest soils of Assam	5 months
Mr. Debajit Deka	B.Sc. Biotechnology under Dr. Debajit Thakur	*In-vitro* screening of Actinomycetes strains for the production of extracellular antimicrobial metabolites	2 months
Ms. Arifa Rahman	M. Sc. under Prof. Suresh Deka	Evaluation of production of biosurfactant by bacterial strain DB6 using different carbon sources	1 month
Mr. Naresh Kr. Mahato	B. Sc. under Prof. Suresh Deka	Evaluation of biosurfactant production in mineral salt media containing different carbon source	1 month
Miss. Arushi Ashok Gupta	M.Sc. under Prof. Suresh Deka	Isolation of hydrocarbon degrader biosurfactant producing bacteria from water and soil sediments of Deepor Beel- A Ramsar site of Assam	2 months

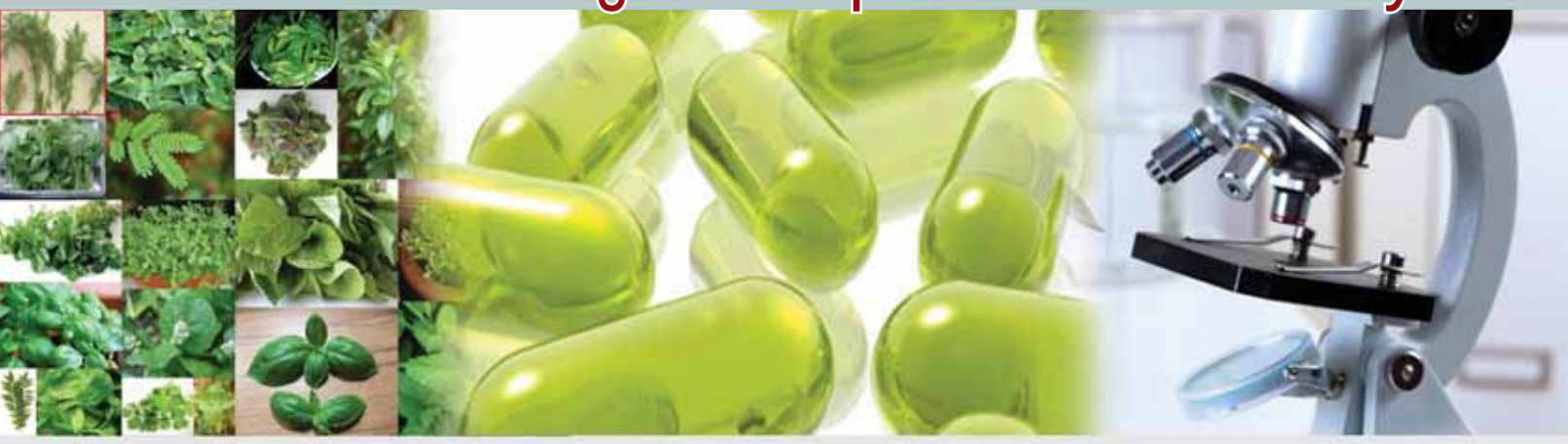
Awards/Recognitions/Achievements

Name	Particulars
Dr. N. C. Talukdar	Scientific advisory committee member of Institute of Bioresources and Sustainable Development; Scientific advisory committee member of Toklai Tea Research Institute; Scientific advisory committee member of Chemical Ecology of the North East India programme; Member of the SYR young scientist award committee; Parry Agro Industries Limited, Coimbatore; Governor's nominee for selection committee meeting for academic and administrative posts of Cotton College State University (CCSU); Chairman of Selection Committee meeting, UGC – BSR Fellowship at Dept. of Chemistry Gauhati University; Member, Animal Ethics Committee of CCSU and Manipur University; External examiner of Ph.D. thesis on microbial miodiversity in NBU and MU.
Dr. M. R. Khan	Member of selection committee of DBT's Biotech Industrial Training Programme
Ms Madhusmita Dehingia	2nd best poster award at 19th ADNAT Convention: International Symposium on Microbiome in Health and Disease (MICROHD2016)

List of PhD awardees:

Name of Student	Name of Supervisor	Title of the Thesis	Award giving University
Dr. Elizabeth Thokchom	Dr. N.C. Talukdar	Rhizobacterial Community and Plant Growth Promotion of Citrus reticulate Blanco	Gauhati University
Dr. Sailendra Goyari	Dr. N.C. Talukdar	Characterization of cellulose degrading microorganisms and its cellulase enzymes from undisturbed forests soil located at different temperature regimes of North East India.	Gauhati University
Dr. Dinesh Moirangthem	Dr. N.C. Talukdar	Phytochemical and pharmacological studies of bioactive principles from *Cephalotaxus griffithii* Hook. f. and *Oroxylum indicum* (L.) Benth. ex Kurz	Gauhati University
Ms Mamata B. Sarma	Dr. Dipali Devi	Effect of enzymes and some natural degumming agents on muga silk fabrics produced by *Antheraea assamensis* Helfer	Gauhati University
Dr. Mrinal Kumar Das	Prof. Sabitry Choudhury Bordoloi	Ichthyofaunal diversity of Majuli island and biology of two Cobitid species	Gauhati University
Mrs. Plabita Baruah	Prof. Suresh Deka	Phytoremediation of hydrocarbon contaminated soil with some efficient plant species	Gauhati University

Traditional Knowledge Based Drug Development and Delivery



India is well known for its rich traditional medicinal systems-Ayurveda, Siddha, and Unani. Ancient Vedic literature mentioned about this different medical systems. The concept of Ayurveda appeared and developed between 2500 and 500 BC in India. Traditional medicines are widely used by about 60% of the world's population. This medication is used not only in rural areas for the primary health care but also in developed countries where modern medicines dominate. In India, vast repository of medicinal plants are used in traditional medical treatments. The traditional medicines are mostly derived from herbs, minerals and organic matter in which medicinal plants are predominant. Seventy percent of rural population of India depends on the traditional Ayurvedic system of medicine. Most healers/practitioners of the traditional systems of medicine prepare formulations by their own recipes and dispense to the patients. North Eastern part of India is located under the Indo-Burma biodiversity hotspot which is one of the world 35 biodiversity hot spots. This is very rich in medicinal plants, different flora and fauna. In IASST active research is carridet out to explore this traditional medicinal plants used by different healers for the treatment of different diseases. It is expected that proper scientific validation of this treasure will lead to discover and develop remedy for diabetic complications, metabolic disorder and cancer.

Jibon Kotoky
Professor

Rajlakshmi Devi
Associate Prof.-I

Rosy Mondal
DST INSPIRE faculty

Sourav Kundu
Ramanujan fellow

Sanjeeb Kalita
SRF

Raghuram Kandimalla
SRF

Rahul Sarma
SRF

R. Elancheran
SRF

Himadri Kalita
SRF

Momita Das
JRF

Sima Kumari
JRF

Ankita Hazarika
JRF

Bhaswati Choudhury, SRF

Prof. Jibon Kotoky

Metabolic disorders, Cancer, Superficial wound infections,
Biomaterials, Medicinal plants, Nanotherapeutics.

Drug discovery lab (DDL) has been working on the development of drugs from natural, synthetic and semi-synthetic sources for treating diseases such as metabolic disorders, superficial wound infections, breast cancer, prostate cancer. DDL also involves in the development of advanced biomaterials from natural fibers as a part of health care products. Nano/ plasma technologies and green chemistry approaches have been adopted to overcome the hurdles in the product development process.

Bioactive guided fractions of *Annona reticulata* L. bark**: Protection against liver toxicity and chronic inflammation through inhibiting oxidative stress and proinflammatory cytokines:**

Herbal medicine is drawing worldwide attention due to its ability to cure diseases with less or no side effects. India is known for its rich heritage of Ayurvedic medicine from ages. North Eastern part of India is also bestowed with rich traditional herbal medicines. *Annona reticulata* L. (Annonaceae) is one

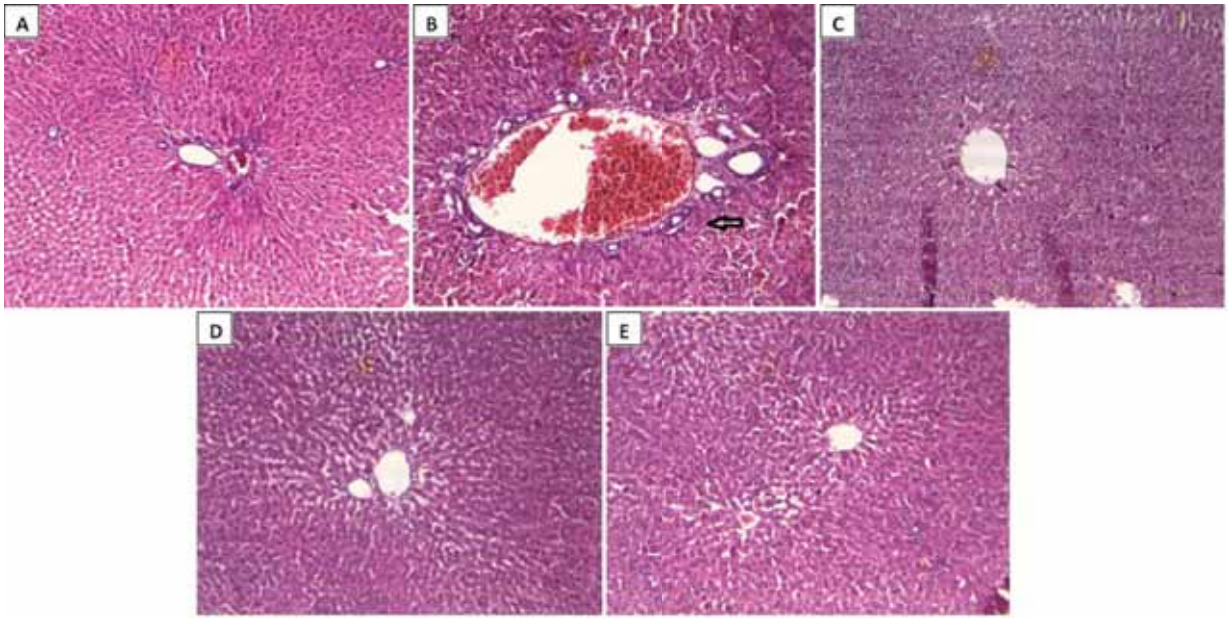


Fig. 1: Effect of drug treatment on liver cells of CCl4 intoxicated rats. A) Liver of control rat with no CCl4 treatment showing normal hepatocytes with no inflammatory cell infiltrate; x10. B) Liver of rat treated with CCl4 showing formation of bridging necrosis with chronic inflammatory cells; x10. C) Liver of rat treated with CCl4 and 100 mg/kg silymarin showing normal hepatocytes with no inflammation and necrosis; x 10. D) Liver of rat treated with CCl4 and 400 mg/kg of ARBME showing mild periportal inflammation and no necrosis; x 10. E) Liver of rat treated with CCl4 and 100 mg/kg ARBWF showing absence of inflammatory cells or necrosis; x10. ARBME: A. reticulata bark methanol extract; ARBWF: A. reticulata bark water fraction.

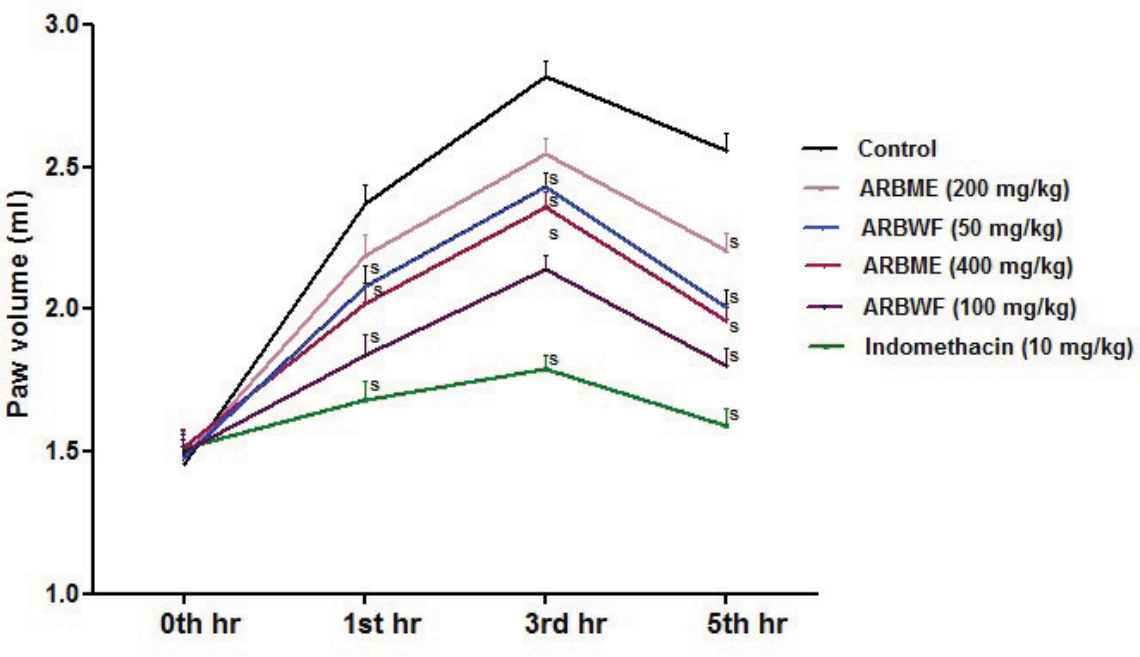


Fig. 2: Effect of A. reticulata bark fractions on carrageenan induced paw edema over 5 h period. All the results were expressed in mean ± S.D (n=6). S $p < 0.05$ in comparison of drug treated animals with saline treated animals. ARBME: A. reticulata bark methanol extract; ARBWF: A. reticulata bark water fraction.

such plant used for the treatment of inflammatory diseases, liver ailments and diabetes by traditional healers. The present study was aimed to scientifically validate this folk knowledge through evaluating bioactive guided fractions of *A. reticulata* (AR) bark against hepatotoxicity and inflammation using *in vitro* and *in vivo* models. Among all fractions, AR bark, methanol extract and its water fraction were found to possess strong anti-oxidant ability and protection against CCl_4 induced toxicity in HepG2 cell lines and rats. Both the fractions also exhibited dose dependent anti-inflammatory response against carrageenan induced inflammation in rats. Water fraction showed potent response in the entire tests compared to that of methanol extract, which suggests that polar components of the AR bark methanol extract is responsible for these activities. AR extract bark also showed liver protection and anti-inflammatory response through inhibiting the oxidative stress and inflammatory cytokines.

Fiber from ramie plant (*Boehmerianivea*): A novel suture biomaterial:

The quest for developing an ideal suture material prompted our interest to develop a novel suture with superior attributes compared to those available in the market. Sutures of natural origin such as silk, cotton and linen fibers are presently available in market as non-absorbable suture biomaterials. In this study, we have developed a novel, cost-effective, biocompatible suture biomaterial from ramie plant, *Boehmeria nivea* fiber. Field emission scanning electron microscopy (FE-SEM), energy-dispersive X-ray spectroscopy (EDX), attenuated total reflection fourier transform infrared spectroscopy (ATR-

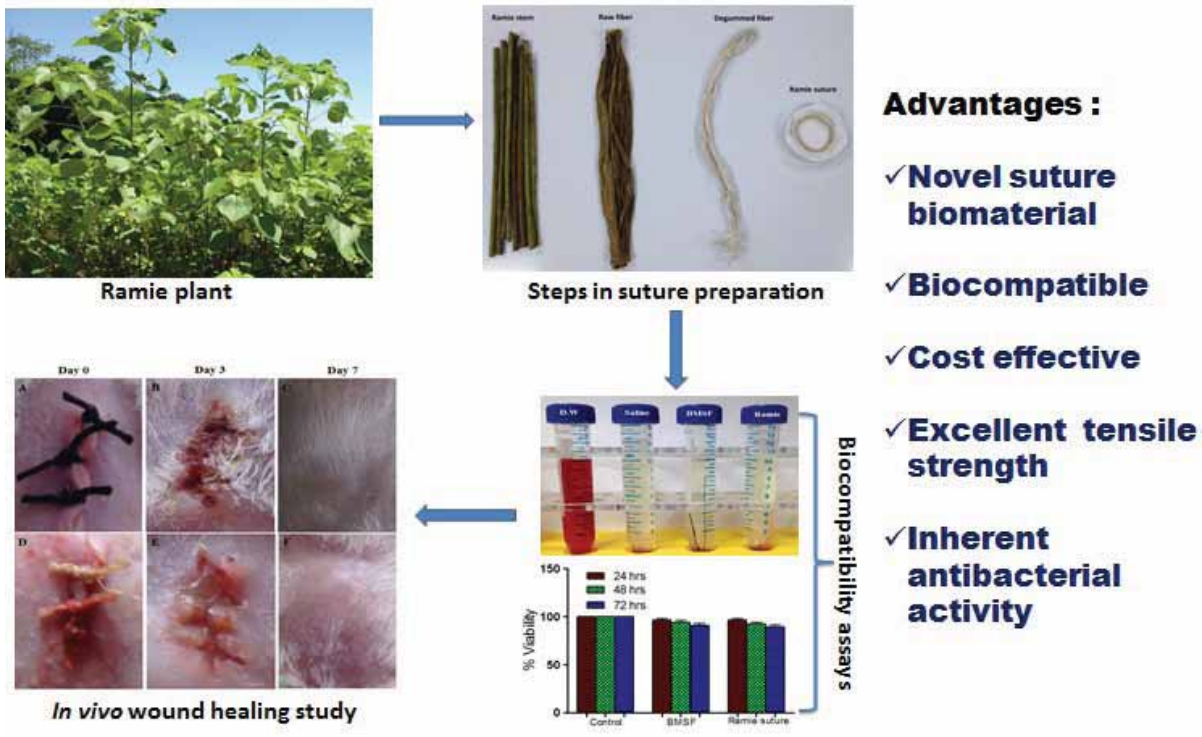


Fig. 3: Graphical representation of ramie suture development and biological evaluation.

FTIR) and thermo gravimetric analysis (TGA) results showed the physicochemical properties of raw and degummed ramie fiber, where the former one showed desirable characteristics for suture preparation. The braided multifilament ramie suture prepared from degummed fiber exhibited excellent tensile strength. The suture found to be biocompatible towards human erythrocytes and nontoxic to mammalian cells. The fabricated ramie suture exhibited significant antibacterial activity against *E. coli*, *B. subtilis* and *S. aureus*; which can be attributed to the inherent bacteriostatic ability of ramie plant fiber. *In vivo* wound closure efficacy was evaluated in adult male wister rats by suturing the superficial wound incisions. Within seven days of surgery the wound got completely healed leaving no rash and scar. Role of the ramie suture in complete wound healing was supported by the reduced levels of serum inflammatory mediators. Histopathology studies confirmed the wound healing ability of ramie suture, as rapid synthesis of collagen, connective tissue and other skin adnexal structures were observed within seven days of surgery. Tensile properties, biocompatibility and wound closure efficacy of the ramie suture were comparable with these BMSF sutures available in market. Outcome of this study can drive tremendous possibility for the utilization of ramie plant fiber for various biomedical applications.

Design and development of novel thiazolidinediones as anti-prostate cancer agents:

Androgen receptor (AR) is an attractive target for the treatment of prostate cancer. Structural modification and molecular docking-based virtual screening approaches were imposed to identify the novel 1,3-thiazolidine-2,4-diones (TZDs) by using Schrödinger (Maestro 9.5). To investigate the *in vitro* antioxidant and anti-prostate cancer activities, the best fit molecules (3-12 & 23-31) were

synthesized (Fig. 4) and characterized using spectroscopic techniques. Further, the structure of the intermediate (18) was confirmed by single crystal XRD analysis (Fig. 5). Of these compounds, 29, 30 and 31 showed comparatively significant antioxidant activity and better antiproliferative activity

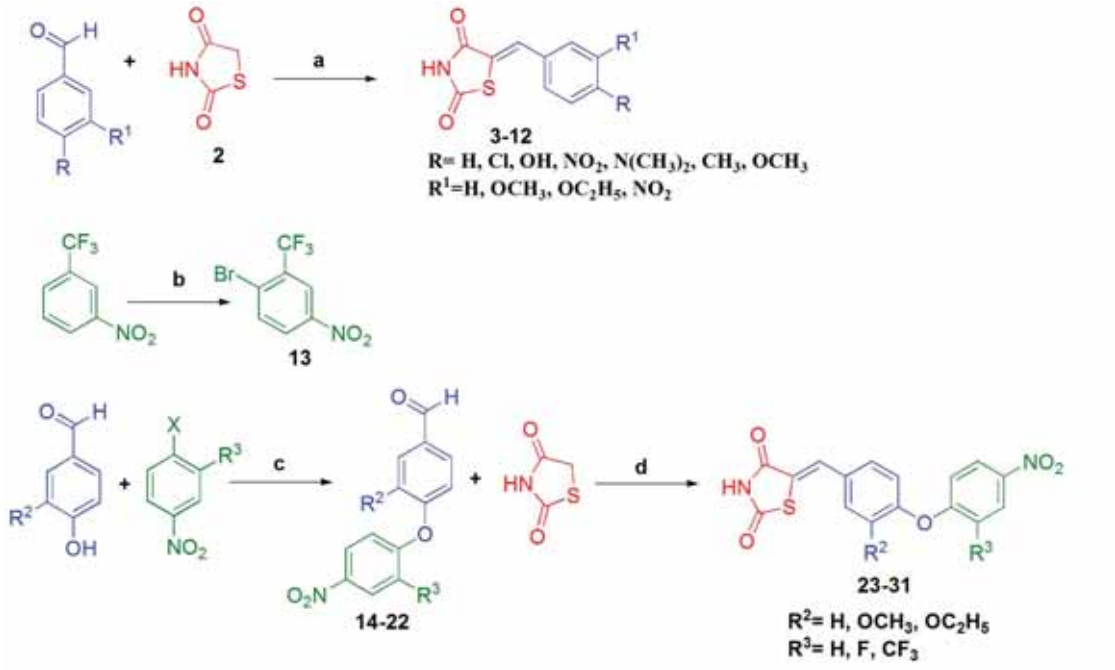


Fig. 4: Scheme 1: Synthesis of the compounds, 3-31. Reagents and conditions: (a) CH_3COONa, AcOH, 110 º C, 8-12 hrs (b) NBS, DMF, RT, 2hrs (c) K_2CO_3, DMF, 110 º C (d) CH_3COONa, AcOH, 110 º C, 8-12 hrs.

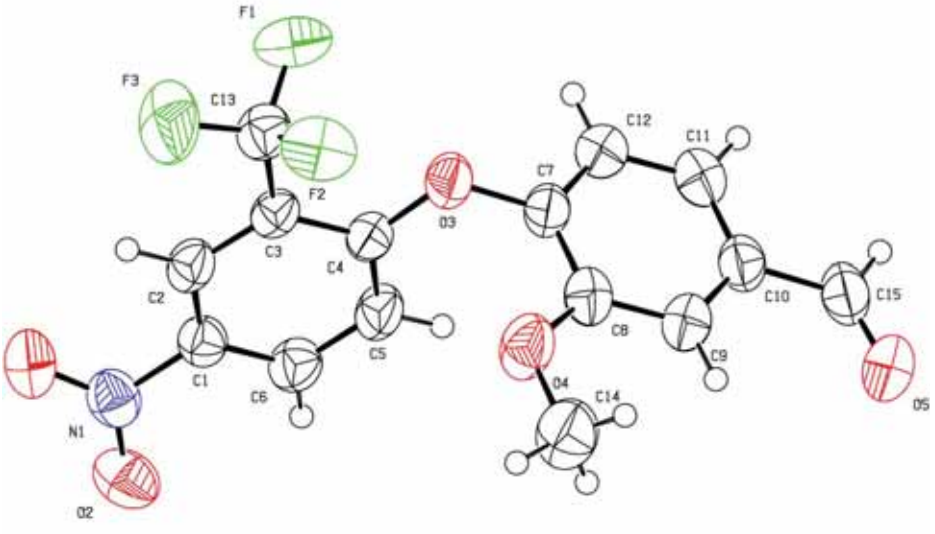


Fig. 5: An ORTEP representation of the compound 18.

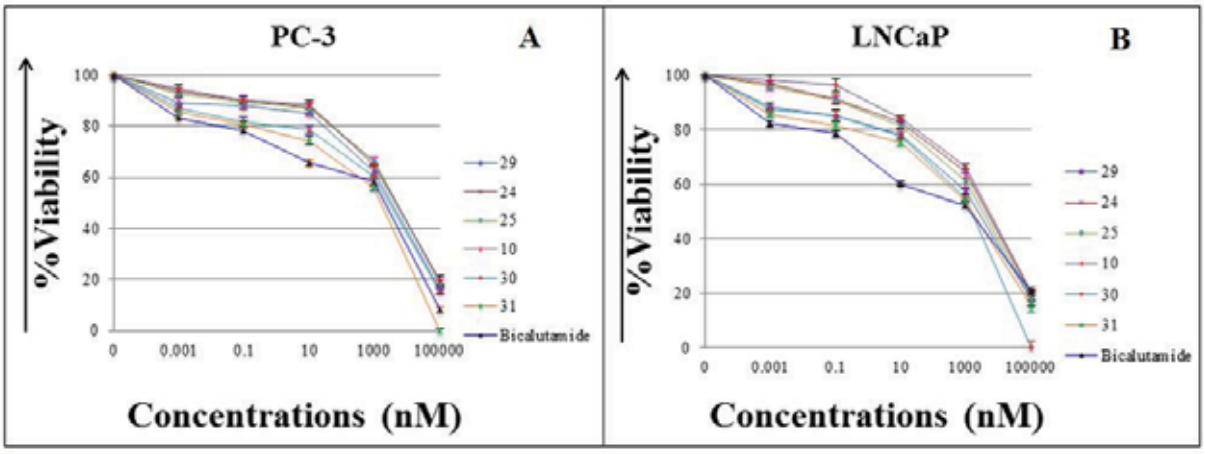


Fig. 6: The anticancer activities of the NCEs (10, 24, 25, 29, 30 & 31) were determined along with the reference standard (Bicalutamide) against A) Dose–response curves on PC-3 cells, B) Dose–response curves on LNCaP cells.

against PC-3 and LNCaP cell lines (Fig. 6). Also, a very low cytotoxicity was observed in the non-cancerous cell (3T3). ADME/T properties were predicted for the compounds (3-12 & 23-31). In addition, DFT calculations clearly confirmed the stable conformer of the compound, 31. These findings may provide some basic information for the development of anti-prostate cancer agents.

Dr. Rajlakshmi Devi

Programme Head

Medicinal Plant, Lipidemia, Antioxident, Oxidative stress, Metabolic disorder.

Musa balbisiana Colla (MB) is an endemic species of Northeast (NE) region of India, used by different communities for curing different diseases. MB is used by folk people to prevent bacterial attack on freshly cut injuries and promote faster healing for normalizing digestive disorder of stomach. Previously, we showed that root extract (RE) of MB attenuates diabetes in STZ induced diabetic rats (Kalita et al., 2016). Present study was designed to study whether RE can reduce structural abnormalities of few organs and tissues affected during metabolic syndrome.

High-carbohydrate high-fat (HCHF) diet caused structural abnormalities in liver, kidney and pancreas such as deposition of lipid droplets (LDs) in liver, fibrosis in the pancreas and abnormalities in the glomerulus of the kidney of experimental rats at 12th week after feeding. On administration of RE of MB we observed onset of regenerative features at the ultra-structure level in liver, kidney and pancreas (Fig. 1).

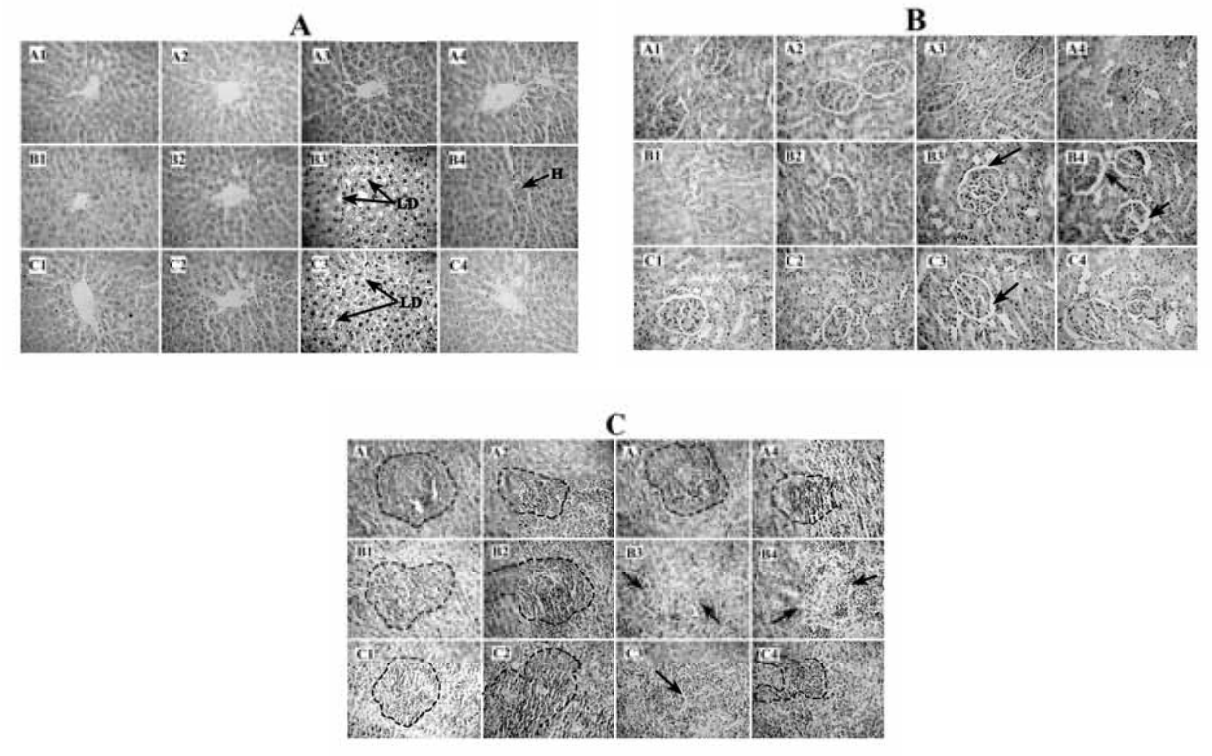


Fig. 1: Structural changes in high-carbohydrate high-fat diet (HCHF) fed group (group B) and reversal of these structures in root extract treated group (group C) along with basal diet fed group (group A) at 4th, 8th, 12th and 16th week. A - liver, B - kidney, C - pancreas.

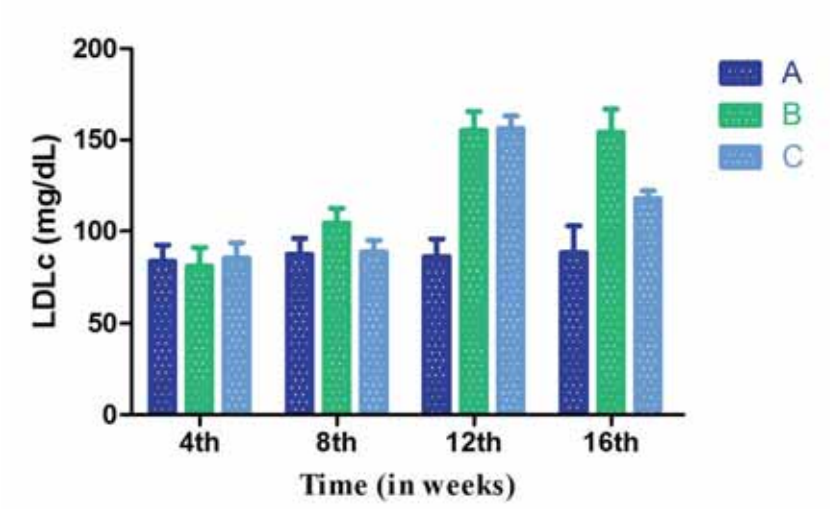


Fig. 2: Effect of herbal formulation (HF) on serum Low Density Lipoprotein cholesterol (LDLc) of rats, induced with hyper-lipidemia by feeding high-carbohydrate high-fat (HCHF) diet. Group A, fed on basal diet; Group B, fed on HCHF diet; Group C, fed on HCHF diet + HF. Values are mean ± S.E.M. n= 6.

The Tangsa tribe of Northeast India is known to consume a *Clerodendrum colebrookianum* based herbal decoction as home remedy for hypertension. These tribal people claim that there is a lower incidence of hypertension in their community owing to the consumption of this decoction. Also, hypertension and hyper-lipidemia are among the most prominent symptoms of the metabolic syndrome, occurrence of which has been rising at an alarming rate due the modern lifestyle and food habits. Herbal formulations are considered to posses synergistic effects due to the presence of multiple components and this concept may be implemented to treat the multiple disorder condition of metabolic syndrome. Due to this, formulations are considered to be on a higher demand when compared to use of individual herbs. This serves as a key to the implementation of the above folklore practice as a potential herbal remedy for the multi-targeted disorder of metabolic syndrome. Hence, in this study, effect of this folklore based herbal formulation was evaluated in high-carbohydrate high-fat diet induced metabolic syndrome in rats. The present study clearly showed the protective effects of the HF by lowering the serum low-density lipoprotein cholesterol (LDLc) which is the detrimental lipid for heart (Fig. 2).

Medicinal plants, such as *Hydrocotyle sibthorpioides* (HS) (Family, Araliaceae), *Amaranthus viridis* (AV) (Family, Amaranthaceae) and *Centella asiatica* (CA) (Family, Apiaceae) is native to India and other parts of Asia and have been utilized in folk medicine such as dysentery, jaundice, cancer, ulcer, wound healing, asthma and diabetes in different countries. Based on the report from folklore medicine, we investigated the antioxidant potentiality of HS, CA and AV and the results were very encouraging (Fig. 3). As evidenced by LC-MS/MS, the catechin, epicatechin and quercetin were the major components detected in higher amounts in HS extract. The antioxidant activity of these compounds are

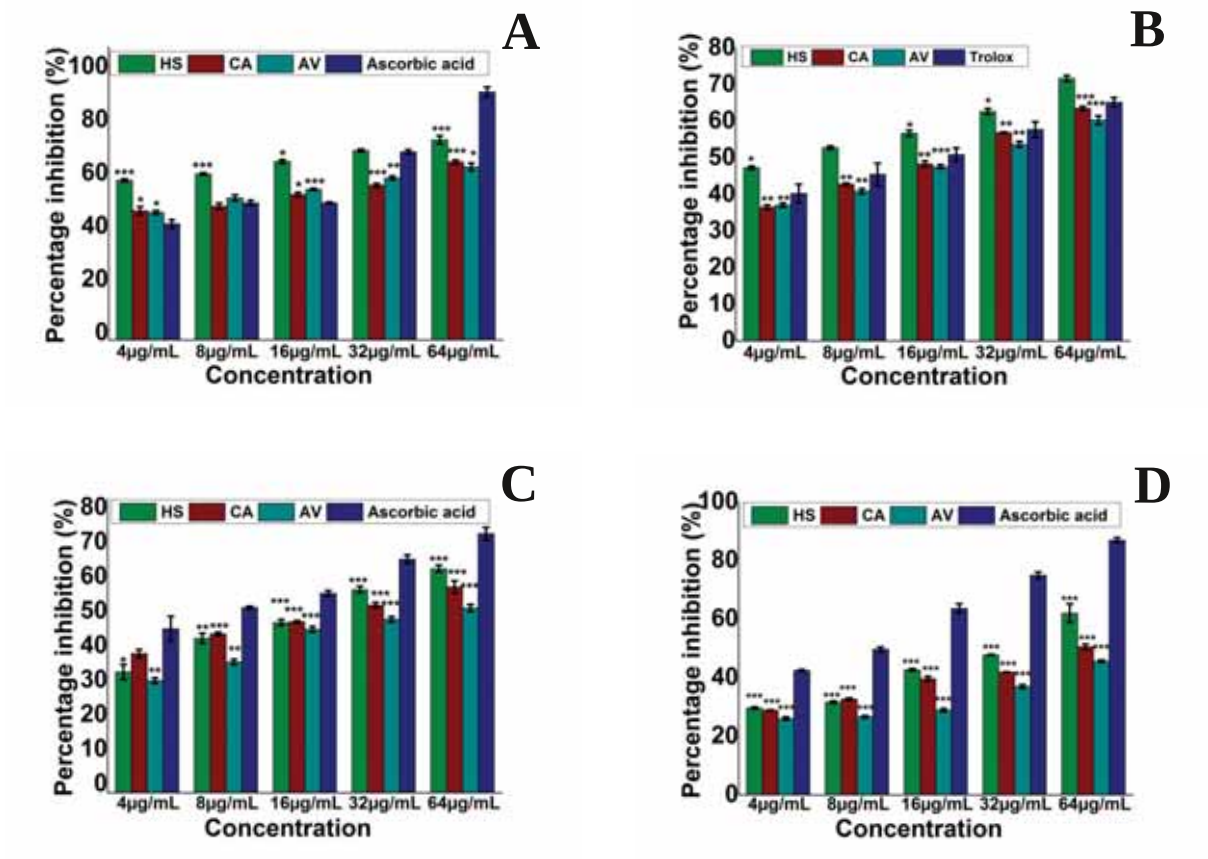


*Fig. 3: Antioxidant activity of the HS, CA and AV extracts at different concentration (4 - 64 µg/mL). A) DPPH free radical scavenging activity; B) reducing capability; C) Nitric oxide scavenging activity; D) Lipid peroxidation assay. Each point represents the mean ± SD (n=3). ***, ** and * shows statistical significant differences at $p<0.001$, $p<0.01$ and $p<0.05$.*

well established. Thus, these herbs need to be evaluated for different applications in pharmaceutical and food sector.

Dr. Rosy Mondal

Cancer genomics, Oncovirus, Biomarker development, medical biotechnology.

The current areas of research are on mitochondrial cancer genomics and circulating cell-free nucleic acid in head and neck squamous cell carcinoma (HNSCC). The information about role, patterns and timing of mitochondrial mutations in HNSCC may serve to potentially facilitate clinical applications in assessing cancer risk, and distinguishing new primary cancer from recurrent cancer. The cell-free DNA (cfDNA) is a promising, noninvasive tumor 'liquid biopsy' which might prove to be a suitable target for the development of diagnosis, prognosis, and follow-up cancer testing.

The term head and neck cancer refers to a group of biologically similar cancers originating from the upper aero digestive tract, including the lip, oral cavity (mouth), nasal cavity, paranasal sinuses, pharynx, larynx. Most head and neck cancers originate from the mucosal lining (epithelium) of these regions. In India, over one third of all cancers occurs in the head and neck compared to less than 10% in the Western world. In Northeastern Indian states, viz. Assam and Meghalaya accounts for the highest prevalence of tobacco related oral cancer, which is about 33%. Smokeless tobacco products and betel quid with or without tobacco are the major risk factors for oral cavity cancer in Taiwan, India, and other neighboring countries. Smoking, alcohol use, smokeless tobacco products, and HPV (Human papilloma virus) infections are the major risk factors for oral cavity cancer, with smoking and alcohol having synergistic effects.

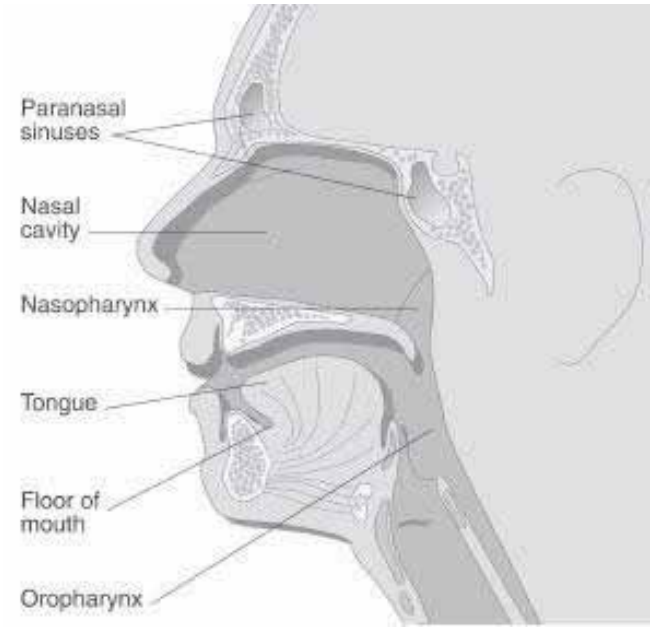


Fig. 1: Illustrates the location of different regions of head and neck cancer.

Mitochondrial dysfunction is a hallmark of cancer cells. Tobacco consumption in various forms is one of the major risk factors for the development of oral squamous cell carcinoma which makes the mitochondrial DNA (mtDNA) susceptible to damage by reactive oxygen species (ROS). In human epithelial cells, tobacco products increase the production of ROS and induce free radical reactions that may be responsible for single strand breaks in DNA especially in the mitochondria where they preferentially accumulate. MtDNA is present in multiple copies in each mitochondrion. Damage is thought to occur more frequently to mtDNA than to nuclear DNA, through the production of ROS

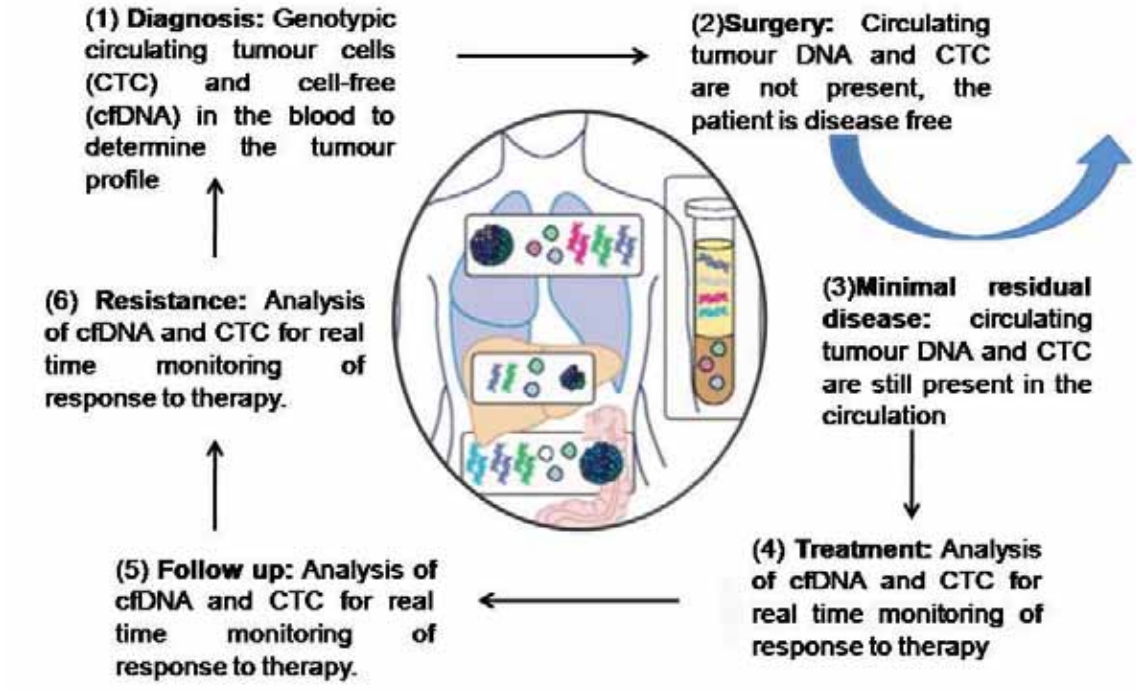


Fig. 2: Schematic representations of cell free DNA as diagnosis, prognosis, and follow-up cancer testing in plasma/serum of cancer patients.

during oxidative phosphorylation, as mtDNA lacks protective histones. Cigarette smoking can cause an increase in ROS such as H_2O_2 and O^-. In addition, many tobacco smoking related metabolic products contain DNA binding agents that can accumulate preferentially in the mitochondria and lead to DNA damage.

Cell-free DNA (cfDNA) is a promising, noninvasive tumor 'liquid biopsy' with quantitative and qualitative significance. The presence of small amounts of cell free tumor DNA (cfDNA) circulating in the plasma or serum of cancer patients was first demonstrated by Mandel and Metais in 1948 which provides another possibility of examining tumour derived genetic material into the circulation and detect haematogenic spread of tumour cell DNA. Circulating cftDNA levels are raised in cancer patients and exhibited genetic and epigenetic changes found in the underlying tumor. In fact, circulating tumor-derived nucleic acids in cancer patients may harbor tumor-specific genetic alterations and, in this way, could become an interesting target for the noninvasive examination of tumor DNA and ultimately might prove to be a suitable target for the development of diagnosis, prognosis, and follow-up cancer testing in plasma/serum of cancer patients and determine the feasibility of a deep sequencing-based [exome] approach to cancer detection.

This application is highly innovative in both concept and approach. While detection of specific, known mutations associated with tumors has been demonstrated in ccftDNA, the idea to deep-sequence large

portions of multiple genes eliminates the need for a prior knowledge of tumor mutations. We believe that this is a novel concept in cancer detection. Enabling this concept are our unique exome sequencing data in tobacco related cancer and the innovative technology that permits targeted re-sequencing libraries to be generated from small amounts of fragmented ccftDNA.

Dr. Sourav Kundu

Endocrinology, Toxicology, Molecular biology, Epigenetics.

Endometriosis, an enigmatic gynecologic disorder and has been described as a hormonal/genetic or an autoimmune disease by several scientific groups. Recent studies have started linking this disease with environmental toxins exposure but the underlying mechanism of its etiopathogenesis is still unclear. Epigenetics came into limelight in recent time which is a powerful tool for endometriosis diagnosis and prognosis and have a better explanatory power than traditional genetics. Our study is focused on the occurrence of epigenetic modification during endometriosis induced by toxicants.

Increased use of plastics (a source of bisphenol a, BPA) has led to several diseases in humans including reproductive disorders. Till date, there is no toxicity report found for BPA induced endometriosis in mouse and we have undertaken the following study to detect lethal dose (LD50), effective dose (ED50) and therapeutic index (TI) of BPA to induce endometriosis in mouse

a. Animals: 8 week old adult female cycling mouse (body weight: 25-30 gm) were used for this study. Animals were housed in standard condition supporting the Institutional animal ethics committee.
b. Chemical: All chemicals including BPA were procured from Sigma Aldrich Corporation, Bangalore, India. BPA was dissolved in absolute ethanol and the injection volume for any concentration of BPA was kept constant (100 µl).
c. Experimental groups: Animals were divided in to four groups:

Grp-I, Control (n=5)	Grp-II (n=7)	Grp-III (n=5)	Grp-IV (n=4)
Received only 100 µl of ethanol (100%)	BPA treatment via intraperitoneal (IP) route	BPA treatment via intravenous route (IV)	BPA treatment via oral gavage

d. Determination of LD50: There are several methods for detection of these parameters and we followed Dixon's up and down method (Dixon, W.J., 1965) for LD50 detection.

LD50 detection via IP: median lethal dose for BPA was found to be 158.5 mg/ kg bw. BPA was injected intraperitoneally in mice of Gr-I and survival rate was observed up to 48 hrs. The highest dose caused death to the animal after 24 hr. The result is summarized in Table 1.

LD50 detection via IV: Median lethal dose for BPA was found to be 12.6 mg/ kg bw. BPA was injected intraperitoneally in mice of Gr-II and survival rate was observed up to 2 hrs. The highest dose caused death to the animal after 30 mins. The result is summarized in Table 2.

LD50 detection via oral gavage: Table 3 depicts the median lethal dose for BPA when administered orally after mixing with sesame oil. The LD50 was found to be 2.08 mg/ kg bw.

Table 1: *Effect of BPA (IP) on Gr-I mice and the survival score for 48 hrs*

Real dose of BPA (mg/ kg bw)	Log dose of BPA	Score ('O'= survival ; 'X'= death)
50	1.6989	O
100	2.000	O
150	2.1760	O X O
200	2.3010	X X

Final score is OOOXXOX and k = -0.144 (using Dixon's table for LD50 calculation). Now, LD0=Xf+kd where, Xf = max. dose given and d is the difference between logs of max. dose and min. dose.

Therefore, LD50 = 2.301+ [(-0.144) x 0.603= 2.214~ 2.2; Antilog (2.2) = 158.48 mg/ kg bw.

Table 2: *Effect of BPA (IV) on Gr-II mice and the survival score for 2 hrs*

Real dose of BPA (mg/ kg bw)	Log dose of BPA	Score ('O'= survival ; 'X'= death)
2	0.3010	O
5	0.6989	O
10	1.0000	O
15	1.1760	X X

Final score is OOOXX and k = 0.026 (using Dixon's table for LD50 calculation).

Therefore, LD50 = 1.176+ [(0.026) x 0.875= 1.198~ 1.1; Antilog (1.1) = 12.58 mg/ kg bw.

Table 3: *Effect of orally administered BPA and the survival score for 48*

Real dose of BPA (mg/ kg bw)	Log dose of BPA	Score ('O'= survival ; 'X'= death)
0.5	-0.301	O
1.0	0.000	O
2.5	0.397	O
5.0	0.698	X

Final score is OOOX and k = -0.378 (using Dixon's table for LD50 calculation).

Therefore, LD50 = 0.698+[(-0.378) x 0.999= 0.32; Antilog (0.32) = 2.08 mg/ kg bw.

No mortality was observed in the control group having vehicle dose of ethanol.

Pharmacodynamics:

This study was performed to specify an effective dose for BPA to induce endometriosis. Using Dixon's up and down method, acute toxicity of BPA was estimated using very few numbers of animal which is evident from our results. We show that the LD50 of BPA is 158.48 mg/ kg bw when injected intraperitoneally and 12.58 mg/ kg bw when injected via intravenous route. The mean lethal dose for

BPA was 2.08 mg/ kg bw when the animal was fed with sesame oil containing BPA. Further study is under progress to confirm the optimum dose of BPA to induce endometriosis in vitro.

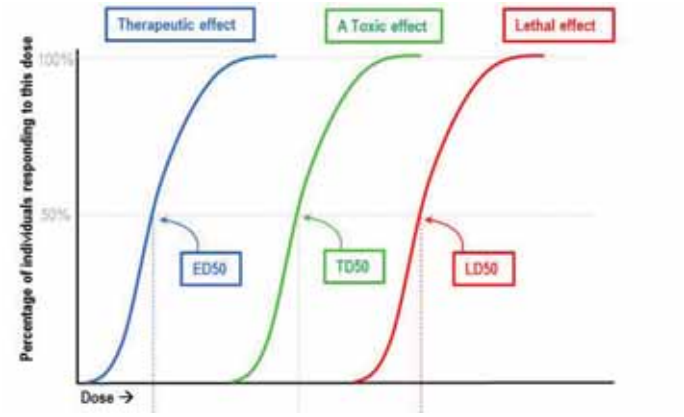


Fig. 1: An overview of median doses: ED50, TD50and LD50. X axis represents the dose and Y axis represents the %age of individuals responding to this particular dose.
(Ref: Deranged physiology, a free online resource for intensive care medicine, section: 2.1.7, critical care pharmacology)

Extramural Projects

Completed Projects

Title of the Project	Funding Agency; Total fund; Duration; PI/Coordinator	Achievement
Pharmacological evaluation of some indigenous variety of citrus fruits of Northeastern region of India – a biomolecular approach	ICMR, New Delhi; Rs 14 lakhs; 2012-2015; **Dr. Rajlakshmi Devi**	In this study, the antioxidant activity of dried pulp of *Garcinia pedunculata* (GP) and *Garcinia Morella* (GM) fruits were evaluated by *in vitro* tests viz. DPPH, H_2O_2, reducing power, lipid peroxidation etc. and IC_{50} value was calculated. GP and GM extracts showed the lower IC_{50} value in comparison to that of standard drug ascorbic acid. Moreover, the cold water extracts of GP and GM exhibits better free radical scavenging, reducing power and antifungal activity than hot water extract. As the local tribes of NE region, often use the cold water infusion of dried pulp of GP and GM against different diseases, so there is significant effect of cold water extraction methods and also an indicative of their scientific reliability of local plant traditional knowledge.

Ongoing Projects

Title of the Project	Funding Agency; Total fund; Duration; PI/ Coordinator	Goal
Development and Elucidation of mechanism of action of herbs to treat Diabetic neuropathic pain	DBT, Govt. of India; Rs 29.9 Lakhs; 2014-2015; **Prof. Jibon Kotoky**	Neuropathy affects diabetic patient due to slow degeneration of the nerves and its conduction. This study has been designed to address this problem and to develop a product to protect the neurons as well as glucose metabolism with herbs stated in Ayurveda. The effect of these herbs on diabetic and its related neuropathic complication is assessed by behavioral, biochemical, neurochemical and molecular mechanism. The outcome of the study will be a new product which can have a duel effect in controlling diabetics as well as neuropathic co-morbidities.
Identification and characterization of bio-active molecules from some indigenous medicinal plants of NE region of India with special reference to antioxidant and hypolipidemic properties.	DBT, Govt. of India; Rs 23 lakhs; 2012- 2016; **Dr. Rajlakshmi Devi**	This research aims to study the medicinal properties of traditionally used herbs/fruits of north-east of India such as *Clerodendron colebrookianum, Garcinia pedunculata and Garcinia morella*. Antioxidant, hypolipidemic, hypoglycemic properties of some medicinal plants/ fruits available in this region will be studied.

Title of the Project	Funding Agency; Total fund; Duration; PI/ Coordinator	Goal
Cell-free nucleic acids as noninvasive biomarker for cancer detection	DST, Govt. of India; Rs. 35 Lakhs; 2015-2020; **Dr. Rosy Mondal** (DST-INSPIRE Faculty)	This research aims to detect the presence and fractions of circulating cell-free tumour DNA (ccftDNA) in plasma of cancer patients and to determine the feasibility of a deep sequencing-based approach to cancer detection. It also aims to determine if ccftDNA mutations or copy number can be used to dynamically monitor response to therapy in cancer.
Epigenetic perspective of environmental effects on mouse uterus: role of microRNA in hormonal regulation with special emphasis on endometriosis	DST, Govt. of India; Rs. 35 Lakhs; 2015-2020; **Dr. Sourav Kundu** (Ramanujan fellow)	This research aims to determine the effect of environmental/ toxicant/ endocrine disruptors (EDCs) exposure on epigenetics, chromatin condensation and gene expression patterns, uterine physiology exposure and the associated molecular mechanisms.

Publications

In Cited Journals

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/ Year
B.Choudhury, R. Kandimalla, J.Monisha, R. Bharali, A.B Kunnumakkara K.Kalita J.Kotoky	Anticancer activity of *Garcinia morella* on T-cell murine lymphoma via apoptotic induction	Frontiers in Pharm-acology	doi: 10.3389/ fphar.2016	August/ 2015
N. K.Roy, D.Bordoloi, J.Monisha, G. Padmavathi, J.Kotoky, R. Golla, A.B. Kunnumakkara	Specific targeting of Akt kinase isoforms: taking the precise path for prevention and treatment of cancer	Current drug targets	17(999)/1-1	January/ 2016
J. Monisha, N. K.Roy, D. Bordoloi, A. Kumar, R. Golla, J.Kotoky, G.Padmavathi A. B. Kunnumakkara	Nuclear factor Kappa B: a potential target to persecute head and neck cancer	Current drug targets	17(999)/1-1	March/ 2016

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/ Year
R. Elancheran, K.Saravanan B.Choudhury, S. Divakar, S. Kabilan, M. Ramanathan , B. Das, R. Devi, J. Kotoky	Design and development of oxobenz-imidazoles as novel androgen receptor antagonists	Medicinal Chemistry Research	25(4)/539-552	February/ 2016
H. Kalita, D.C. Boruah, M. Deori, A. Hazarika, R. Sarma, S. Kumari, R. Kandimalla, J. Kotoky, R. Devi	Antidiabetic and antilipidemic effect of *Musa balbisiana* root extract: A potent agent for glucose homeostasis in streptozotocin induced diabetic rat	Frontiers in Pharma-cology	DOI: 10.3389/ fphar.2016. 00102	May/ 2016
R. Sarma, M. Das, T. Mudoi, K. K. Sharma, J. Kotoky, R. Devi	Evaluation of Antioxidant and Antifungal Activity of Polyphenol-rich Extracts of Dried Pulp of *Garcinia pedunculata* Roxb. and *Garcinia morella* Gaertn. (Clusiaceae)	Tropical Journal of Pharma-ceutical Re-search	15 (1)/133-140.	January/ 2016
S. Kumari, R. Elancheran, J. Kotoky, R. Devi	Rapid screening and identification of phenolic antioxidants in *Hydrocotyle sibthorpioides* Lam.by UPLC-ESI-MS/MS	Food Chemistry	203/521-529	February/ 2016
A. Hazarika, H. Kalita, D. C. Boruah, M. C. Kalita, R. Devi	Pathophysiology of metabolic syndrome: the onset of natural recovery on with-drawal of a high-carbohydraye high-fat diet	Nutrition	DOI http: //dx.doi. org/10. 1016/j.nut. 2016. 03 .005	March/ 2016
J.H. Choudhury, S.A. Singh, S. Kundu, B. Choudhury, F.R. Talukdar, S. Srivasta, R.S. Laskar, B. Dhar, R. Das, S. Laskar, M. Kumar, W. Kapfo, R. Mondal, S.K. Ghosh	Tobacco carcinogen-metabolizing genes CYP1A1, GSTM1, and GSTT1 polymorphisms and their interaction with tobacco exposure influence the risk of head and neck cancer in Northeast Indian population.	Tumor Biology	36(8)/5773-5783	August/ 2015

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/ Year
Veeranki S, Givvimani S, Kundu S, Metreveli N, Pushpakumar S, Tyagi SC	Moderate intensity exercise prevents diabetic cardiomyopathy associated contractile dysfunction through restoration of mitochondrial function and connexin 43 levels in db/db mice	Journal of Molecular and Cellular Cardiology	92/163-173	March, 2016

Patents:

Inventor(s)	Title	File no. for enrollment	Provisional/ final patent grant no.	Issue no. of patent office
S. Kalita, R. Kandimalla, N. C. Talukdar, J. Kotoky	Polymeric nano-capsulated delivery system for enhanced antimicrobial activity	2016/31008544 A	Published	17/2016 Dated 22/4/2016
S. Kalita, R. Kandimalla, B. K. Nath, J. Chutia, J. Kotoky	Antimicrobial suture biomaterials	201631006722 A	Published	10/ 2016 Dated 4/3/2016
R. Kandimalla, S. Kalita, D. Devi, D. Kalita, J. Kotoky	A novel suture biomaterial.	778/KOL/2015A	Published	32/2015 Dated 7/08/201
R. Kandimalla, S. Kalita, B. Choudhury, M. Das, R. Elancheran, N.C. Talukdar, J. Kotoky	*Cymbopogon nardus* essential oil extract to cure fungal infected diabetic wounds and a method of extracting the same.	287/KOL/2015 A.	Published	16/2015 Dated 17/04/2015
S. Kalita, R. Kandimalla, K. K. Sharma, N. C. Talukdar, J. Kotoky	Poly herbal formulation for the treatment of dermatophytic infections	2016/31008545A	Published	17/2016 Dated 22/4/2016
R. Kandimalla, S. Kalita, B. Choudhury, R. Devi, N. C. Talukdar, M. Ramanathan, S. Dash, J. Kotoky	Poly herbal formulation for treatment of painful diabetic neuropathy	201631008543A	Published	15/2016 Dated 8/4/2016

Presentation in Conferences/seminars

Invited talks

Faculty	Title	Programme Name	Date & Venue
Prof. Jibon Kotoky	Drug Discovery from natural sources	Lecture series on "Rare and endangered plants of north east India".	8th March, Dept. of Boatany, Gauhati University
Dr. Sourav Kundu	Biotechnology and Biomedical Research: Recent trends and development	National workshop on "Impact of emerging technologies in biomedical research"	30th March, Guwahati NIPER campus in GMC.

Contributory

Author(s)	Title	Conference name	Oral/ poster	Date & Venue
R.Elancheran, S.Kabilan, M.Ramanathan, A.B. Kunnumakkara, J. Kotoky	Design & Development of therapy for Prostate Cancer based on Synthetic & Semi synthetic molecules	22nd ISCB International Conference on Recent Trends in affordable and sustainable drug discovery and developments	Oral	February 6-8, 2016 at Uka Tarsadia University, Surat, India.
R.Elancheran, S.Kabilan, M.Ramanathan, A.B. Kunnumakkara, J. Kotoky	Design and development of novel AR antagonists for the treatment of Breast and Prostate Cancers	"Natural Product Chemistry: Prospects & Perspectives (NPPP-2016)"	Poster	March 21-22, 2016 at NEIST, Jorhat
M. Das, D.K. Patel, A.K. Sarma, B.K. Baruah, S. Banu, J. Kotoky	Assessment of PAHs and Heavy metals pollution in soils of Guwahati city	61st Annual Technical Session of Assam Science Society, 2016"	Oral	January 23, 2016, at Goalpara College

Conferences/Workshops/Meetings attended

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Mr. R. Elancheran	Hands on workshop on Proteomics-2016	January 20-21, 2016 at IASST

Faculty/research scholar	Conference/Workshop/Exhibitions	Date & Venue
Mr. Sanjeeb Kalita	DBT funded Hands on workshop on nanomaterial synthesis and Characterization for biotechnological applications	27th March to 3 April, 2016 School of technology, NEHU, Shillong
Mr. Sanjeeb Kalita	AICTE funded Hands on Workshop on application of bioinformatics in medical biotechnology	April 24 - 26, 2015 at Gauhati University
Mr. Kishor Haloi	National Seminar on "Science and Technology for sustainable development" (61st Annual Technical session of Assam Science Society)	January 23, 2016 at Goalpara College
Dr. Rajlakshmi Devi, Ms Moni Kankana Kalita Mr. Kishor Haloi, Ms Ankita Hazarika, Ms Himadri Kalita	Workshop on Proteomics- 2016	January 20-21, 2016 at IASST
Ms Anurupa Goswami	DBT-NER training programme on Proteomics	July 13-24, 2015 at ACTREC, Navi Mumbai
Ms Sima Kumari	Advanced Molecular Techniques in Biological Research	March 6-13, 2016 at Tripura University
Dr. Rajlakshmi Devi & Mr. Rahul Sarma	Training course on "Animal health sciences"	February 29 –March 4, 2016 at NIN, Hyderabad
Mr. Rahul Sarma	DST Sponsored National Seminar on Sustainable Conservation Strategies for Bio-resources of North East India	November 6, 2015 at Arya Vidyapeeth College, Guwahati
Mr. Rahul Sarma	61st Annual Technical session of Assam Science Society	January 23, 2016 at Goalpara College, Goalpara, Assam

Other activities

Visits to national/international institutes/laboratories

Faculty/Research scholar	National/international institutes/ laboratories	Date
Dr. Rajlakshmi Devi	Chaired a session in the National Seminar on Science and Technology for sustainable Development on 61st Annual Technical Session of Assam Science Society, 2016	January 23, 2016 at Goalpara College

M.Sc. / B. Tech projects/training courses offered at IASST

Name(s) of trainee	Programme and supervisor	Title of work	Duration
Ms. Mainu Rongpipi	M. Sc. under Dr. Rajlakshmi Devi	To study the antioxidant property of the water extract of the rhizome of *Musa balbisiana*.	1 month
Ms Shikha Mishra	B. Tech. under Dr. Rajlakshmi Devi	Evaluation of antioxidant and antihyperlipidemic activity of few of the medicinal plants of North east.	5 months
Ms Shaoni Dey	M. Sc. under Dr. Rajlakshmi Devi	Evaluation of pharmacological properties of few *garcinia* sp. against metabolic syndrome	4 moths
Ms Bhagyashree Saikia	M. Sc. under Dr. Rajlakshmi Devi	Activity guided identification of marker bioactive compounds in *Clerodendrum colebrookianum*- a plant used as folklore by northeast Indian tribes	2 months
Ms Saptasikha Bhuyan	M. Sc. under Dr. Rajlakshmi Devi	Bioassay guided fractionation of some active molecules of medicinal plants of North East India	2 months
Research scholars of Life Science Division	Training conducted by Dr. Sourav Kundu	1. An introduction to Biosafety 2. Gelatin Zymography 3. How to design experiments? 4. Animal Cell culture: Basics 5. Bio-statistical analysis 6. How to make PowerPoint presentation?	Each class was continued for 3 to 4 hours

Awards/Recognitions/Achievements

Name	Particulars
Prof. Jibon Kotoky was awarded in appreciation as recognition for the contributions in the field of Chemical Sciences.	Awarded by the Indian Society of Chemists and Biologists, CDRI, Lucknow.
Mr. R. Elancheran, SRF	Second Best Poster Presentation Award in the National symposium on Natural products: Prospects & Prospectives held at CSIR-NEIST, Jorhat, Assam, India during 21-22 March 2016.
Ms Momita Das	Rajiv Gandhi National Fellowship 2015-17
Mr. Sanjeeb Kalita & Mr. Raghuram Kandimalla	1st BEST PRESENTATION in the 3rd IASST, Colloquim, 2015

List of PhD awardees:

Name of Student	Name of Supervisor	Title of the Thesis	Award giving University
Ms Juri Devi	Prof. Jibon Kotoky	Studies on fungi causing post harvest decay of onion (*Allium cepa* L.) in different markets and store houses of greater Guwahati and their management.	Gauhati university

Publications from interdisciplinary research

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
S. Kalita, R. Kandimalla, K.K. Sharma, A. C. Kataki, M. Deka, J. Kotoky	Amoxicillin functionalized gold nanoparticles reverts MRSA resistance.	Material Science and Engineering C	61/720-727	January /2016
R.Kandimalla, S.Kalita, B.Choudhury, D.Devi, D. Kalita, K. Kalita, S. Dash, J. Kotoky.	Fiber from ramie plant (*Boehmeria nivea*): A novel suture biomaterial.	Material Science and Engineering C	62/816-822	May/2016
D.Gogoi, A. J.Choudhury, R. Kandimalla, S. Kalita, Y. B. Choudhury, M.R. Khan, J. Kotoky, J. Chutia.	Penicillin impregnation on oxygen plasma surface functionalized chitosan/ *Antherarea assama* silk fibroin: studies of antibacterial activity and antithrombogenic property.	Material Science and Engineering C	60/475-484	March 2016
A.J. Choudhury, D.Gogoi, R. Kandimalla, S.Kalita, Y.B. Choudhury, M.R. Khan, K.Kalita, J. Kotoky, J. Chutia.	Controlled antibiotic-releasing *Antheraea assama* silk fibroin suture for infection prevention and fast wound healing.	Surgery	159 (2)/539-547.	February/2016
M. Das, D.K. Patel, A.K. Sarma, B.K. Baruah, S. Banu, J. Kotoky	Assessment of PAHs and heavy metals pollution in soils of Guwahati city	Current Science	110 (12)/2285-2292	January/ 2016
N. Bhardwaj, Y. P. Singh, D. Devi, R. Kandimalla, J. Kotoky, B.B. Mandal	Potential of silk fibroin/ chondrocyte constructs of muga silkworm *Antheraea assamensis* for cartilage tissue engineering	Journal of Materials Chemistry B	DOI: 10.1039/ C6TB00717A	April/2016

Author (s)	Title	Journal Name	Volume & Issue no./ page no.	Month/ Year of Publication
N.Bhardwaj, R. Rajkhowa, X Wang, D. Devi	Milled non-mulberry silk fibroin microparticles as biomaterial for biomedical applications	International Journal of Biological Macromolecules	81/31-40.	November/ 2015

VISITING RESEARCH PROFESSOR (VRP) AND CONSULTANT

Dr. Govind Gujar
VRP

Dr. Aswani Kumar
VRP

Dr. A.K. Sahu
VRP

Dr.Aswini Bezbaruah
Consultant Medical Officer

Dr. Nalin Mohan
Consultant (Horticulture)

Dr. Jiban Kotoky
Consultant
(Public Relation)

Conferences/Seminar/Workshops Organized

Brain storming session on scented rice of NER, India

The brainstorming session on scented rice was held on 26th June, 2015 at IASST. Dr. K.M. Buzarbaruah, Vice-Chancellor, Assam Agricultural University (AAU), Jorhat and the distinguished scientist from different institutions of the country participated. Dr. K.M. Buzarbaruah, presented a glimpse of the richness of the scented rice diversity followed by a presentation on the theme "Putting heads together for NER-Scented Rice". Dr. Sunil Kr. Mukherjee, Sr. Consultant NER-BPMC highlighted on the rich diversity of rice in the country and in the NER and the researchable issues that require collective efforts. Important issues like, generation of GIS based diversity map, pharmacological evaluation of medicinal properties, traditional knowledge and genome analysis were discussed and a broad framework for a mega project towards its exploitation for benefit of the country was prepared.

Dr. K.M. Buzarbaruah delivering his speech (left); Distinguished scientists participating in brain storming session on scented rice of NER (right)

National Knowledge Resource Consortium (NKRC) Nodal Officers/ Librarians meeting

The NKRC Librarians/ Nodal Officers Meeting 2015, a joint platform of electronic journals of CSIR and DST Institutes of India was held on 8th and 9th October 2015 at IASST. The objectives of this meeting was to discuss usage statistics, user awareness of e-resources available from NKRC, best practices of Knowledge Resource Center (KRC) of CSIR & DST labs, standard staffing pattern of KRC, CSIR & DST labs. The Director, IASST welcomed the Nodal officers from CSIR and DST institutes to IASST. Mrs. Deeksha Bisht, Acting Director, National Institute of Science Communication and Information Resources (NISCAIR), New Delhi delivered the inaugural address. Dr. G. Mahesh, Coordinator, NKRC spoke on 350 years of scholarly journals and highlighted the changing trends of scholarly journals. Prof. N Lahkar, Dean, School of Social Science and Head, Department of Library and Information Science, Guwahati University, delivered the keynote address on Indian consortia.

Participants of National Knowledge Resource Consortium (NKRC) Nodal Officers meeting


Mrs. Deeksha Bisht, Acting Director, NISCAIR inaugurating the NKRC meet at IASST (left);
and delivering her speech (right).

3rd IASST Colloquium-2015

IASST celebrated 3rd Annual Colloquium – 2015 on October 10, 2015. This year's topics covered advanced material, nanomaterials, modelling and simulation, set theory, image processing, biotechnology, drug development and biodiversity. The event started with the visionary lecture by the Prof. Dr. P Balaram, Former Director, IISc, Bangalore and the chief guest of the event. Prof. Balaram emphasized on the contemporary need of present day approaches towards science. The Colloquium – 2015 had panel of distinguished judges including Prof. M. N. Mukherjee from Calcutta University, Prof. A.K. Mukherjee, Tezpur University, Dr. S.K. Ray, Tezpur University, Prof. Alika Khare, IIT Guwahati and Prof. P.K. Giri, IIT Guwahati who evaluated the presentations of the students and judged the best three presentations for the awards. The other important component was participation of talented science students of under graduate and post graduate programs of local colleges of Assam. The participant colleges of Assam had sent 5-10 students on our request in the Colloquium who presented posters on science topic of their interest and also attended different lectures. Best three Poster awards were given to college students. The exposure of the science students of Assam science colleges to these lectures in IASST colloquium-2015 constituted a part of the effort of IASST to motivate talented science students towards advanced career goal in scientific research.


Prof. P. Balaram delivering his speech during 3rd IASST Colloquium (left);
Group Photo of IASST staff with Prof. P. Balaram (right).

Proteomics-2016

Bioinformatics infrastructure facility (BIF) of IASST organized two days hands on workshop **"Proteomics-2016"**during 20th & 21st January, 2016 at its premises. The workshop aimed to provide in depth knowledge of various techniques specifically LC-MS/MS, MALDI and 2D Gel electrophoresis for protein study and analysis of the proteomics data using bioinformatics tools. 37 participants comprising faculties, professors and research scholars from Gauhati University, Assam Agricultural University, NEIST and IASST actively took part in the workshop. Dr. Probodh Bora, Coordinator of BIF center of NER and Prof. College of Veterinary Science, Guwahati, underlined the importance of studies of all aspects of proteomics and emphasized meticulous need based application. Dr. Rukmini Govekar, Advance Centre of Training, Research and Education in Cancer (ACTREC), Tata Memorial Centre, Navi Mumbai delivered the keynote address. Prof. S.S. Ghosh, Department of Biosciences and Bioengineering, IIT Guwahati talked about the extensive use of proteomics in the cancer research. Participants were exposed in hands on training in LC-MS/MS (Exactive-Thermo Fisher) and 2D-GEL Eletrophoresis (BioRad).

Dr. Rukmini Govekar delivering her keynote address at Proteomics-2016 (left); Student participants taking hands on experience during Proteomics-2016 workshop (right).

National Workshop on Medical Image Processing

The workshop was held during 19th and 20th February 2016. Through this workshop, IASST aimed to impart training to the 38 participants on the scope of biomedical imaging, its social and commercial relevance and the recent advances taking place in this area. The theme of workshop spread across multiple disciplines where 3 clinicians and 7 invited speakers from ISRI Kolkata, spoke on topics ranging from Role of computers in Medical Laboratory, Computational Pathology, Medical image analysis using multi-resolution analysis tool, Perceptual Image/ Video Hashing and Applications etc. The workshop ended with a rigorous discussion of the developments and future direction of research for the medical imaging team in IASST.

Prof. A. K. Buragohain delivering his speech (left);
Participants of National Workshop on Medical Image Processing (right)

Brainstorming Session-cum-Stakeholders Meeting on Aroma Crops and Technologies for North East Region

The meeting on Aroma Crops and Technologies for North East Region was organized by Department of Biotechnology on March 10th and 11th, 2016 at IASST under the Chairmanship of Dr. R. A. Vishwakarma, Director, IIIM, Jammu. Dr. Mohd. Aslam, Adviser, DBT welcomed the Chairman and all the participants, both from academia and industry along with representatives of State Governments and NGOs in North East Region. The objective of the meeting was to develop a well-focused network program on end-to-end demonstration of aroma cultivation in North East Region for possible funding support by DBT with an aim to develop aroma based future start-ups in North East Region. There were altogether six presenter from industry and fourteen from academic institutions. A few of the key recommendations made by the discussion panel included setting up of State-of-Art quality assurance and quality control facilities in aroma sector in North East Region along with priority research projects to be initiated by DBT on some specific projects. The meeting provided a platform for linking the academia and aroma industries in the country to North East Region.

Dr. Mohd. Aslam, Adviser, DBT welcoming the participants (left); Distinguished scientists and stakeholders participating in brain storming session (right)

Talk of Honourable President of India delivered over video-conferencing

19/01/2016		**Mr. Pranab Mukherjee**, Hon'ble President of India	Talk delivered by video conferencing and interaction between students, scientist, technologist etc. on the topic "Youth and Nation Building"

Distinguished International Scientists visitors, their lectures and interactions in IASST

Date	Name of the visitor and Affiliation		Title of Delivered Talk/Lecture
01/04/2015		**Prof. V. Ramamurthy,** Professor at University of Miami and Senior Editor for the American Chemical Society journal *Langmuir*	Science and Scientists
01/10/2015		**Dr. Axel Brockmann,** Scientist, National Center for Biological Sciences, Bangalore	Honeybees and the mechanisms of animal behaviour
15/10/2015		**Dr. Smritimoy Pramanik,** Frontier Institute for Bio- molecular Engineering Research (FIBER), Konan University, Japan	Thermodynamics of nucleic acid structure formation under cell mimicking conditions
24/11/2015		**Dr. Dulal Borthakur,** Dept. of Molecular Biosciences and Bioengineering, University of Hawaii at Manoa, Honolulu	Mimosine degradation by Mimosinase and Rhizomimosinase

Distinguished National Scientists/Speakers visitors, their lectures and interactions in IASST

Date	Name of the visitor and Affiliation		Title of Delivered Talk/Lecture
08/05/15		**Dr. Sourav Kundu,** Ramanujan Fellow	Diabetic Renovascular Remodeling : Role of Hydrogen Sulfide

Date	Name of the visitor and Affiliation		Title of Delivered Talk/Lecture
14/05/2015		**Prof. A. K Mukherjee,** Head & Coordinator, DBT Nodal Cell, Tezpur University	Research Work done by the DBT Nodal Cell in NER
04/08/2015		**Prof. M K Mathew,** Faculty of Biochemistry, Biophysics & Bioinformatics. National Center for Biological Sciences	Endocytosis in plants with a pinch of salt
14/8/2015		**Dr. Ashwani Kumar,** DBT scientist and Former Director of CSIR - Indian Institute of Toxicology Research, Lucknow	Studies on the biodegradation of a chlorinated insecticide Hexachlorocyclohexane
21/08/2015		**Dr. Tapan Kr Mahanty,** Scientist-B, National Institute of Epidemiology (ICMR), Chennai	Retaining beauty in ornamental fishes
03/09/2015		**Dr. Suvendra Kumar Ray,** Asso. Prof. & Head, MBBT, Tezpur University, Tezpur	Tips for preparation of CSIR-NET exam
18/09/2015		**Dr. Rupjyoti Talukdar,** Consultant, Asian Institute of Gastroenterologist, Hyderabad	Be your own doctor
10/10/2015		**Dr. P Balaram,** Former Director, IISc, Bangalore	3rd IASST Colloquium Talk

Date	Name of the visitor and Affiliation		Title of Delivered Talk/Lecture
26/10/2015		**Mr. Himangshu Sekhar Das,** Chief Information Officer, Govt. of Assam	Vigilance Awareness Week
02/11/2015		**Prof. Kalyan Bidhan Sinha,** Bhatnagar Fellow, JNCASR, Bangalore	Thoughts on mathematics-with examples
06/11/2015		**Dr. Ashok K Varma,** Coordinator- Bioinformatics Center, Tata Memorial Center, Advanced Center for Treatment, Research and Education in Cancer (ACTREC), Mumbai	Structural approach to visualize genetic variants discovered in BRCA1
31/1/2016		**Prof. Sanjukta Subudhi,** Fellow and area convener, Environmental and Industrial Biotechnology Division, The Energy and Resources Institute, New Delhi	Microbial biohydrogen production
04/12/2015		**Prof. Anjan Mukherjee,** Pro Vice Chancellor, Tripura University Tripura	Fuzzy sets and its applications
27/12/2015		**Prof. Ashutosh Sharma,** Secretary, DST, Govt. of India and Chairman, Governing Council, IASST	Lab visit and interaction with faculties and research scholars
29/12/2015		**Dr. Deepak Sharma,** Scientist, IMTECH, Chandigarh	The Hsp90 co-chaperone Cpr7 contributes to [URE3] prion stability in *Saccharomyces cerevisiae*

Date	Name of the visitor and Affiliation		Title of Delivered Talk/Lecture
11/01/2016		**Prof. Anilava Kaviraj,** Dept. of Zoology, University of Kalyani, WB.	Impact of changes in cropping pattern & use of insecticides on environment, biodiversity and human health-an evaluation of Indian perspective
18/03/2016		**Prof. Subhas Ch. Kundu,** Dept. of Biotechnology IIT Kharagpur	Silk as biomedical materials

OTHER ACTIVITIES

- **Outreach Activities**
  - Societal outreach program of IASST
  - Purity test for silk
  - *Eri* Farmers' Meet, 2016 at IASST
  - Training cum Demonstration of Mushroom Spawn Production
  - High value cash crop production using bioinputs in traditional tribal household as an additional income generation venture
  - Outreach program by CEFIPRA at IASST
  - Science Express programme of DST
  - Vibrant North East 2016
  - School outreach program
- **Celebrations**
  - Foundation Day of IASST
  - National Science Day
  - World Environment Day
  - Digital India Week
  - Hindi Diwas
  - "Swachh Bharat Abhiyan" at IASST
  - Vigilance Awareness Week
  - National Mathematics Day
  - Recreational Activities and Health Camp

Outreach Activities

Societal outreach program of IASST:

N E region of India is known as the paradise of silkworm diversity especially for non-mulberry silkworm which plays a key role in ecosystem management. A wide range of naturally abundant food plants scattered in the forest on which the polyphagus non-mulberry silkworms thrive on, is a part of complex ecosystem of this region. Among all the sericigenous insects, *muga* and *eri* silkworms are the main earning sources of more than 3 lakhs people of the weaker section of the society specially the tribal people.

IASST took up a scheduled tribe development programme in which the know-how developed in the seri biotechnology laboratory has been demonstrated in two tribal villages. Ten beneficiaries belonging to ST community from each of the two districts, south Kamrup and undivided Nagaon were selected. The beneficiaries were well versed with basic knowledge of *Eri* silkworm rearing in traditional ways but lack of host plant, disease free seeds (DFLs) and low efficiency of hand spinning resulted in reduced silk yield and are some of the perennial problems associated with the *eri* silk rearing. Using IASST's facility, good quality DFLs of *eri* silkworm produced and were supplied to each family along with seed of castor plant and other rearing appliances (rearing tray, stand, mosquito net etc.).

During the course of the programme, the beneficiaries were given the hands-on training on the scientific grainage operation, maintenance of rearing shed, feeding, etc. Each farmer generated five crops (average) in a year. The data on fecundity, hatching percentage, ERR, price of green cocoon, pupa are analyzed and summarized as below

Heads	Nagaon District	Kamrup District
Total no. of Beneficiary	10	10
Total no. of Crop Harvested	5	4
Income from cocoon (spun cocoon)	130kg@ Rs. 650 = Rs. 84,153.45	112kg @ Rs. 650 = Rs. 72,613.00
Income from edible pupa	556Kg @ Rs. 200 = Rs.1,11,349.43	475Kg @ Rs. 200 = Rs.94,723.45
Total income	Rs. 1,95,502.88	Rs.1,67,336.45
Income/person/year	Rs. 19,550.29	Rs.16,733.64

The *eri* farmers were also demonstrated advanced technique for *eri* spinning using a machine designed and developed by Dr. S.N. Choudhury, former scientist of NEIST, Jorhat. Two hands-on training (5 days) programme were arranged, one at the Department of Zoology, Nowgong College and the other at Boko to train the beneficiaries. Techniques of degumming, making of *eri* silk cake for spinning, quality control operations and techniques were demonstrated during the training session. IASST prepared disease free seed (DFLs) using roper grainage and the service has been provided to the farmers and State Sericulture Farm, Assam.

Purity test for silk

Adulteration of high valued silk with other low graded fiber is a problem and its eradication is a big challenge for the silk industry. Especially mixing of GI certified *muga* silk of Assam with low graded tasar is a threat to the *muga* silk industry of Assam. IASST has standardized a few tests for checking the purity of silk and this service is provided to the user community. Seribiotechnology lab of IASST has been authorised for testing the purity of the silk and to issue purity certificate for the *muga* silk of Assam, as GI product.

Spinning of *eri* using *Takuri* and training on *eri* silk spinning using machine.

Eri Farmers' Meet, 2016 at IASST:

An *Eri* farmers' Meet was held on 27th April, 2016 at IASST, Guwahati, organized as a part of the project "Empowerment of ST people through rearing of *eri* silkworm *Samia ricini* Donovan in two districts of Assam" executed jointly by IASST and Department of Zoology, Nowgong College, Nagaon. 20 beneficiaries of ST communities such as Lalung, Karbi, Garo and Boro of Nagaon district and Boko area of west Kamrup district attended the meeting. It was an opportunity for the beneficiaries to show their experience in rearing *eri* silkworm round the year through support of IASST. Rearing of *eri* silkworm helped them in generating an extra income in three phases (i) selling of cocoon, (ii) selling of raw silk and (iii) selling of larvae and pupa for human consumption. IASST distributed *eri* spinning machine the "Chowdhury type Charkha" to the beneficiary to replace their traditional method called Takuri followed by them for spinning cocoons. During the meeting, the farmers also highlighted a few problems faced by them during the year, so that next year these problems are eliminated. The beneficiary *eri* farmers were motivated in a way that each one of them will train two farmers in the neighbourhood for year round *eri* rearing during the year 2016-17.

Eri-farmers meet held at IASST. Improved silk machine placed on the floor.

Training cum Demonstration of mushroom Spawn Production

For promoting sustainable livelihood among tribal communities, IASST has established a "Training cum Demonstration of Mushroom Spawn Production" in collaboration with Mushroom Development Foundation (MDF) Guwahati, during the year 2015-16. The main objective of this unit was to provide nutritional food security to the citizens through creation of an alternative livelihood opportunity for tribal farmers. Under this programme, IASST produces and maintains appropriate strains of mushroom for ensuring its round the year production in a cost effective and sustainable manner. IASST has also put efforts in its lab to develop local strains and carry out protoplast fusions for strain up-gradation, skill development among unemployed tribal youth and promote entrepreneurs on mushroom.

Low-cost mushroom production Unit at IASST

Oyster Mushroom branches from packed straw bags inside the Mushroom production cum demonstration unit for tribal educated youths.

High value cash crop production using bioinputs in traditional tribal household as an additional income generation venture

IASST has selected a total of ten tribal farmers from Rani Block of Kamrup District of Assam to generate additional income for their livelihood through providing high value cash crop for production. This year, IASST provided Pineapple sucker, Turmeric, Assam Lemon and Black pepper seedlings which were planted in between arecanut tree of individual 'Bari'. Traditionally, in tribal community coconut plantations are common at households backyard and space between plants are infested by weeds. This venture of IASST aims at utilization of this space for growing high value crops and work out nutrient dynamics and nutrient replenishment strategy using bioinputs such as biofertilizers and vermicompost.

Pineapple, black pepper and turmeric grown in between arecanut for generation of additional income for the tribal household at Rani.

Outreach program by CEFIPRA at IASST:

CEFIPRA also known as Indo-French Centre for the Promotion of Advanced Research, is an Indo-French bilateral program funding joint projects. It organized an outreach program jointly at IASST on 24th July 2015 to reach out to the scientific communities in this region. Approximately 100 scientists, technologist, students participated from different parts of the North East Region. The program started with welcome address from Director, IASST followed by a short presentation of Dr. Debapriya Dutta, Director, CEFIPRA on the scope and activities of CEFIPRA. The mechanism to enable CEFIPRA's Scientific Collaborative Research program and its utility for the North-Eastern states was also discussed. The scientific council member, panelists from the North Eastern Region and audience participated in panel discussion and expressed their views so that the programme can support development of science in north east region of India.

Panel discussion and interaction during the CEFIPRA program.

Science Express programme of DST:

IASST acted as nodal agency for north east India in the Science Express programme of DST. Science Express – Climate Action Special (SECAS) which is a mobile exhibition on train was stationed at four railway stations of Assam from 1st to 9th January 2016. It was stationed in New Bongaigaon on 1st and 2nd January 2016, followed by Mariani (4th and 5th Jan, 2016), New Tinsukia (6th and 7th Jan, 2016) and Lumding Railway Junction (8th and 9th Jan, 2016). IASST nominated its Ph.D. students for all these junctions and they demonstrated its research activity under its major research programs. More than 35,000 visitors, a majority of which included school students, visited exhibition train and interacted with the on-board team of IASST and DST. IASST took an active part in disseminating information about innovations and cutting-edge research in the field of Science and Technology to the visitors. A leaflet in Assamese and English language containing the scientific activities of IASST was distributed among the visitors of Science Express. IASST also presented various models and posters in these railway stations and received very encouraging response from the visitors.

IASST students interacting with students and local people who were visiting the Science Express.

Vibrant North East 2016:

The vibrant North East 2016 Summit was held at Veterinary College Playground, Khanapara, on Feb 18-20, 2016. The Summit was inaugurated by Union Minister of Food Processing Industries, Smt. Harsimrat Kaur Badal. IASST participated by displaying exhibits on outcome of its research activities in the exhibition along with the technologies and innovations developed at the institute. One of the prime attraction of the exhibition was the demonstration of the unique method developed at IASST to identify the purity of different types of silk fibres.

Inaugural session of Vibrant North East 2016 and exhibition of research activities of IASST at Vibrant North East 2016.

School outreach program:

The Outreach Program of IASST provide the opportunity to school and college students of north east to visit the research laboratories and interact with the researchers of the institute. Students are given functional demonstration on the sophisticated instruments of IASST. Research scholars and faculty members elaborate their research works and inspire students to pursue a career in scientific research. Apart from this, during the year, IASST scientists also engaged in visiting government schools within and in the outskirts of Guwahati city to

deliver lectures and motivate the school students towards career in science followed up by a day long exposure visit of selected students of the school to IASST laboratories. This has been a very effective venture in generating genuine interest of students in science. Some of the schools visited by IASST scientists include Lachitgarh High School, Guwahati, Sonapur Higher Secondary School, Sonapur, Dora Kohora High School, Changsari.

IASST faculty member taking class at Sonapur Higher Secondary School (left) and IASST faculty member interacting with visiting students from Sonaram High School (right)

Visiting team from Schools and Colleges to IASST from April 2015 to March 2016

Date of visit	Name of the inst.	No. of visitors			Department Visited
		Teachers	Students	Total	
09-04-2015	Darang College Tezpur T.D.C. 6th Sem (Zoology Dept.)	1	15	16	Life Sciences Division Presenter: Rahul Sarma, Raghu, Himadri Kalita, Monikangkna, Sanjiv, Kishore, Juri Pathak, Seema Kumari
28/08/2015	Goalpara College, Goalpara T.D.C. 6th Sem (Botany Dept.)	2	32	34	Life Sciences Division Presenter: Rahul Sarma, Sanjeev, Raghu, Himadri Kalita, Monikangkna, Dr .J. Kotoky, Dr. R.Devi. Dr. D. Thakur
30/09/2015	Tyagbir Hemchandra Barua College. Sonitpur T.D.C. 6th Sem (Zoology Dept.)	1	9	10	Life Sciences Division Presenter: Rahul Sarma, Raghu, Priyanka Sarkar, Dr. D. Thakur, Monikangkna, Juri Pathak, Seema Kumari
07/10/2015	Kajiranga English Academy Guwahati Class- X	2	17	19	Life Sciences Division Presenter: Dr. R. Devi, Dr. S.C. Bordoloi, Dr. D. Devi,Gitartha Kaushik, Jafrin Ahmed

09-11-2015	Nalbari College Nalbari T.D.C. 6th Sem	1	30	31	Life Sciences Division Presenter: Dr. D. Thakur, Rahul Sarma, Raghu, Bhuban, Mrinal, J. Pathak
21-03-2016	Handique Girls' College Guwahati T.D.C. 5th Sem Physics Dept.	1	5	6	Polymer Science Presenter: Dr. N. S. Sarma
29-03-2016	Barama College Baska T.D.C. 6th Sem Deptt. Of Zoology	1	23	24	Life Sciences Division Presenter: Rahul Sarma, Seema, Himadri, Monikangkana, Mansee Ankita
30-03-2016	Sonaram High School	3	42	45	Life Sciences Division Presenter: Rahul Sarma, Seema, Himadri, Monikangkana, Mansee, Yogesh

Celebrations

Foundation Day of IASST

IASST celebrated its 37th Foundation Day on 3rd November 2015, on the eve of completion of 36 years of its journey. Director Dr. N.C.Talukdar welcomed the gathering and unfurled the institute flag. Prof. Jitendra Nath Goswami, Honorary Professor at PRL and J. C. Bose Fellow of Dept. of Science & Technology, delivered the 37th Foundation Day lecture on "Space Exploration: The Indian Scene". Through his fascinating lecture he dealt on the

Felicitation of Prof. Jitendra Nath Goswami on 37th Foundation Day of IASST

Cultural program and Sports activities on the occasion of 37th Foundation Day of IASST.

journey of Indian space mission from Chandrayan I to Mars Orbiter Mission to the extreme delight of the audience. He also briefly introduced information on the planned mission with Chandrayan-II to the Moon. He exhorted the younger generation of the country to engage themselves honestly and in a dedicated manner in space research activities. The function was presided over by former principal of Cotton College, Prof Anil Kumar Goswami. Prof M.K. Chaudhuri, Vice Chancellor of Tezpur University, Prof H.P. Barthakur, a former professor and Head of the Dept. of Soil Science of Assam Agriculture University, and Prof C.K. Rajkonwar ex-Secretary, IASST and retired Professor and Head of the Department of Gynecology, College of Veterinary Sciences were felicitated for their contributions towards growth of IASST. As a part of the celebration, series of sports events including Volleyball, Table tennis, Badminton and also some minor games were held in the month of September, 2015.

National Science Day

Science Fair 2016 commemorating the National Science Day, was celebrated at the ground of Assam Engineering Institute, Chandmari on 28th and 29th February 2016. The event was jointly organized by Institute of Advanced Study in Science and Technology (IASST) and Cotton College State University (CCSU). The event witnessed a huge participation from various schools, colleges, universities, and several institutions with around 1000 participants registering for the event. The event was targeted to popularize science among community at large and primarily among the school students.

The first day of the program included inaugural speech by then Honorable Chief Minister and Chancellor of Cotton College State University, Shri Tarun Gogoi. He emphasized on the contribution of science to the lives of the common people and to develop scientific temper in the society. Among the several attractions of the Science Fair, exhibition was a major event which pull bigger crowd every year. Participants from various schools, colleges and universities etc. displayed over 100 models in various fields of science. The other important event in the Science Fair was popular talks by eminent scientists. Former Director, Physical Research Laboratory (PRL), Dr. Jitendra Nath Goswami delivered a popular talk on Indian space exploration which was followed by a talk on gravity waves by Dr. Debashish Borah, Asst. Prof, IIT Guwahati. On the second day, a talk was delivered by the well-known nature conservationist, Dr. Gautam Narayan, on “recovery program for critically endangered Pygmy hog”. Dr. Dinesh Chandra Goswami, former scientist G and adviser, NEIST Jorhat, delivered the popular

talk in Assamese on development of science and our society. He emphasized on the acceptance of science by all within society for overall benefit and development of society.

The other popular attractions were the all-women 'Hargila Army' who demonstrated conservation efforts for the Hargila (Greater Adjutant) an endangered species which has resulted in their greater number in Hajo area. Hargilla was adopted as the mascot of Science Fair. The film show and documentaries related to various topics of science and environment were also screened. A quiz competition was also conducted on the event of Science Fair for school and college students. Other attractions of the event were short speech competition, mathematical and statistical puzzles and chemistry magic show.

Former Chief Minister of Assam, Shri Tarun Gogoi visiting Science Fair 2016
and students visiting IASST exhibition stall at Science Fair.

World Environment Day

IASST celebrated the World Environment Day on 5th of June 2015 with the theme "Seven Billion Dreams. One Planet. Consume with Care." The day's event was marked by plantation activity which was followed by the felicitation ceremony of the esteemed invitees by the Director, IASST. Prof. Dulal Ch. Goswami was the invited speaker of the day who gave a popular talk on the topic "Environmental Impact Assessment (EIA) vis-à-vis Sustainable Development". Dr. Hemoprova Saikia, Chairperson of Assam Tourism and Development Corporation Limited, and Prof. D. Saikia, Vice Chancellor of Cotton College State University were among the invited dignitaries for the event.

Plantation of sapling during World Environment Day by Dr. Hemoprova Saikia at IASST campus
and Popular talk by Prof. Dulal Ch. Goswami at IASST.

Digital India Week

The Digital India Week started off at IASST on 15th July 2015. Mr. Diganta Barman, Senior Technical Director, National Informatics Center (NIC), Guwahati was the invited speaker for the occasion. The guest speaker enthralled the audience with a thought provoking topic entitled "Sharing e-Literacy during Digital India Week". He elaborated on transforming India into an empowered society and knowledge economy through e-literacy.

Hindi Diwas

IASST celebrated Hindi Diwas on 14th September, 2015 with great enthusiasm at institute premises. The day started with the institute anthem followed by felicitation of the chief guest of the day, Mr. Amar Nath, Assistant Manager, Rajbhasa Cell, Reserve Bank of India, Guwahati. He delivered an enlightening speech on the importance of celebration of Hindi Diwas. The atmosphere was made cheerful by the songs and poems presented by research scholars and faculty members.

"Swachh Bharat Abhiyan" at IASST

Swachh Bharat Abhiyan was celebrated at IASST on 2nd of October 2015, on the occasion of birth anniversary of the Father of the Nation, Mahatma Gandhi. IASST members including faculty, staff and students actively participated in this nationwide program launched by the Government of India. The activity on this day included cleaning the campus premises along with office building which was followed by light refreshment.

IASST members taking part in Swachh Bharat Abhiyan at IASST campus.

Vigilance Awareness Week

The celebration of Vigilance Awareness Week started on 26th of October at IASST. Prof. N. C. Talukdar, Director, IASST, led the pledge taking ceremony for IASST employees. This was followed by a meeting where the invited speaker Shri Himangshu Sekhar Das, IAS (retd.) and Information commissioner to the Govt. of Assam was introduced to the audience by Prof. Sabitry Choudhury Bordoloi. Sri H. S. Das spoke at length about various rules and regulations of the administrative system and also various constraints faced by different Government agencies while implementing the same.

Director, IASST and Information Commissioner to the Govt. of Assam administering the vigilance day pledge to IASST fraternity.

National Mathematics Day

IASST on 22nd December, 2015 observed National Mathematics Day to celebrate 128th birth anniversary of the great Indian Mathematician Srinivasa Ramanujan. The program began with a short documentary on "Srinivasa Ramanujan" displayed to throw lights on the colorful memories of the great soul. Prof. B. Choudhary, Former Head, IIT Delhi delivered Mathematics Day Lecture titled "Mathematical analysis and the role of G. H. Hardy" where he reevaluated Hardy's influence on the mathematical research community and its analysis during the early 20th century and also recalled the Indian genius Srinivasa Ramanujan with whom Hardy undertook fruitful research in analytic number theory.

Recreational Activities and Health Camp

IASST has a recreation committee to strengthen the environment of the institute by providing recreational activities to its vibrant community. IASST organizes different recreational and leisure activities throughout the year to enhance a healthy lifestyle among its staff and thereby encouraging better work culture. With this aim and objectives, the following activities were carried out during the year at the institute. IASST organized yoga, meditation guided relaxation camps time to time by inviting yoga and meditation specialist from Anandapuram (Institute of Yoga and Meditation), Nalbari, Vivekananda Kendra Institute of Culture (VKIC), Guwahati and Heartfulness, Guwahati. In these camps, staff members and their families took part whole heartedly. IASST has a tie-up program with VKIC, Guwahati and made MoU with them. Recreational activities were conducted through screening of a few socio-cultural movies. Such programmes provide a window of break from the tediousness generated by continuous office work and laboratory research and contribute towards building work culture. the institute also organized indoor and outdoor sports and games like table tennis, badminton, carom, football, chess, volleyball, where member of staff and their families participated. Health camps were organized to ameliorate the general health of our staff and their families. The reputed hospitals and health institutes like GNRC, International

Hospitals, Hayat Hospitals etc. of Guwahati city provide physicians for pathological and physiological check-up of the institute's inmates. The institute is highly grateful to these medical institutions and physicians.

IASST members taking part in various recreational activities at IASST campus.

Meditation by Heartfulness on World Peace Day on 21st September, 2015

Yoga training for mind and body by Institute of Yoga and Meditation on 14th August, 2015

Health Camp lecture at IASST by GNRC Hospitals on 21st July, 2015

IASST staff playing volleyball at the IASST campus.

REPORT FROM ADMINISTRATION

- **Major Administrative Activity**
- **Major Civil and Electrical Works Completed**
- **Major Civil and Electrical Works: Ongoing**
- **Staff Welfare Measures**
- **Revenue Generation**
- **Audited Statement of Accounts**

ADMINISTRATION

Dr. N. C. Talukdar
Director

Dr.Diganta Goswami
Registrar

Pradyut Borkataki
Finance & Accounts

Bipul Ch. Goswami
Estate Management Engineer

Rajesh Sharma
PRO

Prabodh Kr. Deka
Section Officer

Suresh Ch. Sarma
Section Officer

Niranjan Bhagaboti
Technical Officer-B

Juri Pathak
Technical Officer-A

Nayan Talukdar
Technical Officer (Instrument)

Rabin Ch. Kalita
Superintendent

Ramen Mahanta
Superintendent

Saraswati Bora
Superintendent

Dwijendra Deka
Superintendent

Montu Deka
Junior Engineer

Lelin Gogoi
PS to Director

Julie Bordoloi
Technical Assistant –II

Subrata Goswami
Technical Assistant

Manomohan Huzuri
Technical Assistant

Munindra Singh
Technical Assistant

Krishna Kanta Swargiary
Technician

Diganta Das
Assistant

Gora Gupta
Assistant

Prabhat Ch. Barma
Assistant

Md. Mohmad
Junior Engineer (Civil)

Mrinal Thakuria
Junior Engineer
(Electrical)

Sharmina Devi
Receptionist

Pinky Taye
Assistant

Kalpana B. Das
Assistant

Hemanta Sarma
Assistant (Accounts)

Nimai Hazam
Driver

Phatik Baishya
Driver

Kumud Patgiri
Electrician

Milan Jyoti Das
Innovator

Mukta Ram Kumar
Work Supervisor

Ailek Chakhap
Driver

Umesh Deka
Multi-Tasking Staff

Bipul Kumar Das
Multi-Tasking Staff

Babul Ch. Deka
Multi-Tasking Staff

Tarun Talukdar
Multi-Tasking Staff

Bolin Das
Multi-Tasking Staff

Sabin Kalita
Multi-Tasking Staff

Haren Medhi
Multi-Tasking Staff

Srikanta Baishya
Multi-Tasking Staff

Balabhadra Pathak
Multi-Tasking Staff

Lakshmi Kanta Saud
Multi-Tasking Staff

Madhabi Das
Multi-Tasking Staff

Nripen Ch. Goswami
Multi-Tasking Staff

Satish Ch. Das
Multi-Tasking Staff

Niren Sarma
Multi-Tasking Staff

Ratul Baishya
Multi-Tasking Staff

Binoy Kr. Choudhury
Multi-Tasking Staff

Pradip Das
Multi-Tasking Staff

Munna Basfor
Multi-Tasking Staff

Madhu Ram Kalita
Multi-Tasking Staff

Madan Chandra Kalita
Multi-Tasking Staff

Dinesh Deka
Gardener

Manindra Deka
Cook cum Hostel
Care Taker

Madan Kumar Das
Cook

Ajay Baishya
Mali

Niru Rajbangshi
Cleaner

Anima Baishya
Cleaner

KNOWLEDGE RESOURCE CENTER

Dr.Tarini Dev Goswami
Assistant Librarian
and i/c KRC

Kumud Baishya
Assistant

Sarala Deka
Multi-Tasking Staff

Major Administrative Activity

Highlights of major administrative activities accomplished during the year 2015-16 are presented below:

Purchase of buses and Tata Safari Car

Two number of buses one Mahindra Cosmo AC bus and the other Tata Marcopolo AC bus were purchased at a cost of Rs.1820326/- and Rs. 2396913/-, respectively from income generated by the institute including extramural project overhead for providing commutation to institute staff and research scholars. It was a long standing problem for undertaking to and fro travel to the institute as the staff and research scholars reside in scattered area of Guwahati due to lack of residential accommodation facility inside the campus and the institute is located in a remote area. Plying of staff buses partly solved the problem. It has ensured convenience and timely arrival of research scholars and some staff members of the institute. One Tata Safari Storm car has also been purchased utilizing funds from extramural project overheads for conducting research tours mainly for sample collection.

Empanelment of New Hospital and Diagnostic Centre

(i) GNRC Hospital, Six mile, Guwahati was empanelled w.e.f 14-12-2015 for providing medical treatment to IASST employees, their family members and research scholars.

(ii) Panacea Medical Research and Diagnostic Centre has also been empanelled w.e.f 01/04/2016 for the benefit of IASST beneficiaries.

Adding extra features in e-finance software

E-finance software is in operation at IASST since the year 2012 and during the year 2015-16 some extra features such as Pay Bill Register, LTC claim Register, CEA/Tuition fee reimbursement Register and Register of Valuables have been added.

Drafting and approval of the Comprehensive Medical scheme (CMS) Rules

The comprehensive medical scheme (CMS) Rules have been implemented in the institute since 01-09-2015.

Major Civil and Electrical Works Completed

Paving of Court Yard, Chajja Projection for Students & Scientists' Home of IASST.

The project started on 19.05.2015 and completed on 20.11.2015. The work was allotted to M/S AIC construction and Consultants vide work order no. IASST/1130/2015-16/1300 dated 08.05.15. The executed value was Rs. 20, 65,126.

Renovation of first floor of old hostel

View of Ph.D. research scholar room in old Hostel after renovation

The project was started on 08.01.2015 and completed on 03.12.2015. Renovation of the ground floor rooms (3nos.), VIP room and its kitchen and seven rooms of the first floor and the corridor of the old hostel was taken up. The cupboard work was allotted to M/S Nishita Enterprise vide work order no IASST/594(Pt-II)/2015-16/13332 dated 08.01.16. The executed value was `6, 20,840. The civil work, toilet renovation and aluminium work was executed departmentally through Engineering Activity Committee. The total value of the work was `1339097.

Supply & installation of 8 layer synthetic Badminton sports surface (2 Nos)

The project was started on 04.09.2015 and completed on 23.11.15. The work was allotted to M/S Nishita Enterprise vide order No. IASST/594(Pt-II)/15-16/6728 Dt. 14.09.15. The executed value was `379809.

View of Students and Scientists' Home after Paving of Court Yard, Chajja projection and making badminton sports surface

Garage for institute staff bus

The project was started on 11.06.2015 and completed on 12.02.2016. The work was allotted to M/S AIC Construction and Consultant vide work order no. IASST/1030pt.-2/2014-15/9766 dated 06-11-2015. The executed value was Rs. 921654.

Front view of the institute staff bus garage

Renovation work at Canteen- supply, fitting & fixing of floor tiles, wall tiles, aluminum sliding windows etc.

The work was executed by M/S Ankur Appliances, Guwahati vide work order No. IASST/610(Pt-II)/2015-16/4983 dated 30.07.15. The executed value was Rs. 631247.

Look of the Canteen after renovation

Work for Supply, Fitting and Fixing of Laboratory Cupboard under RCC Granite Slab in Existing Research Lab. of IASST.

The project was started on 13.11.2015 and completed on 28.12.2015. The work was allotted to M/S Maya Kitchen, Guwahati vide work order no. IASST/594(Pt-II)/15-16/10189 dated 13.11.15. The executed value was Rs. 5,09,212. Similarly another two labs were also renovated.

A view the research lab of IASST after renovation

Major Civil and Electrical Works: Ongoing

Interior decoration and renovation (a) Director's chamber (b) P.S. to Director's space (c) Confidential conference room and (d) Auditorium stage portion.

The work was allotted to Mr. Pankaj Baruah vide work order No..IASST/637(Pt-II)/2015-16/ 16428 dated 22.02.16. The work Order value was Rs.16, 33,215.00. The work is under progress.

Look of the Director's chamber after interior decoration and renovation

Construction of "Director Quarter and Housing for Support Staff at IASST.

The work was allotted to M/S D.S Trading, Guwahati vide work order no. IASST/1184/2015-6/16423 dated 20.02.16. The work order value was Rs.1,45,51,939.00. The work is under progress.

Construction of Boundary Wall Including Soil Nailed Wall for Stability of Embankment at IASST.

To protect the institute land from the encroachment and to give stability the work of boundary wall and soil nailed wall have been undertaken in the low lying area of the campus .The work was allotted to M/S D.S Trading, Guwahati vide work order No. IASST/708(Pt-I)/15-16/16907 dated 02.03.16. The work order value was Rs.1,31,47590.00. The work is under progress.

Car Garage and Bus/Car Washing Ramp at IASST

The work was allotted to Mr. D.P. Agarwala vide work order No. IASST/1030(Pt-III)/15-16/371 dated 08.04.16. The work order value was Rs. 8,22,462. 00. The work is under progress.

View of the vertical extension work over the Library building

Vertical extension of Library building at IASST

The work was allotted to M/S Buidrite Construction, Guwahati vide work order No.IASST/919(Pt-II) 15-16/13239 dated 06.01.16. The work order value was Rs. 99, 94,686. The work is under progress.

Staff Welfare Measures

Medical Facility

View of free health checkup camp organized by GNRC hospital at IASST, Guwahati

The institute has its medical reimbursement system through which bills on expenses of both indoor and outdoor treatment in respect of all employees and their dependent family members are reimbursed as per CGHS rates. One allopathic doctor was appointed by the IASST who pays visit to the institute thrice a week and provides free consultation in the institute. Facilities like rest bed and pressure machine are readily available in the doctor's chamber. The institute has empenelled few renowned hospitals of Guwahati to provide medical facilities to employees and their dependent family members as per central government/CGHS rates. The institute organized the following camp for the general health of employees and research scholars.

a. Japanese Encephalitis Vaccination Camp: Two doses of Japanese Encephalitis Vaccine were injected on 2nd June, 2015 and 30th June, 2015. A total of 128 employees and research scholars were vaccinated through this camp.

b. Free Health Checkup Camp on Cardiology and Health Awareness Talk on 7(seven) salient killer disease was held on 21.07.2015 at IASST which was organized by GNRC Hospital Ltd., Dispur, Guwahati. Another free health checkup camp was organized by International Hospital, Guwahati at IASST on 1.04.2016. A total of 121 employees and research scholars did health checkup in the camp.

Canteen Facility

The institute is having a canteen run by a private party. In the canteen meals, snacks and beverages are prepared in hygienic condition and are served to employees, students and guests at subsidized rates.

Benevolent Fund

An IASST employees' Benevolent Fund was established by equal contribution from employees and the IASST. All the regular staff members are member of the Fund. The fund envisages a benefit in the form of onetime payment to nominees of the members in case of death and permanent disability while in service.

Group Insurance

A Group linked Insurance Scheme for the employees of the institute is operating with the Life Insurance Corporation of India. All the regular employees of the institute are members of the scheme. Subscription for the scheme is made by the institute to get appropriate insurance cover for each group of employees.

Reservation Policy

The Institute is following post based rosters for affecting the prescribed percentage of reservations to SC/ST/OBC in all its new recruitments as per Government of India Rules.

Official Language Policy

The institute is paying emphasis on implementation of provisions of Official Language Act and the rules made and instructions issued thereunder. All the letter heads of the institute are in bilingual format. Annual Report of the institute is published both in English and Hindi. The institute is also celebrating Hindi Diwas with great zeal every year.

Recreation

The Institute of Advanced Study in Science and Technology has a Recreation Committee to oversee the cultural, health and motivational activities. The committee has a chairman and three members who belong both to the academic and student community. As a part of activity outside the lab research, the committee organizes seminars on stress management and healthy living for better research output. The committee also arranges for projection of movie which is of substance and moral and at the same time entertaining, once every month. Health camps and yoga camps are also held at intervals to maintain the physical and moral spirit of the employees and scholars. The institute has a Yoga club which has members from both the communities. The institute also houses facilities for many outdoor and indoor sports. It also arranges different sports activities. Indoor sports facilities like carom and chess are available in the indoor sports room while two synthetic badminton courts, one table tennis and a volley ball court of international standard are available. Outdoor games are arranged in the flood-lit sports fields.

Housing

The institute has limited housing facility. At present, six (6) nos. of quarters are allotted to a few essential staff of the institute. In the newly constructed Dorothy Hodgkins Students and Scientists Home (SSH) provisions for accommodation has been made for the Director and Superintendent of SSH. Construction of the Director's quarter and a building for providing accommodation to maintenance staff is going on. In the SSH and the Old hostel, accommodation has been made for 52 nos. of research scholars. Moreover, there are 3 (three) nos. of VIP suites and six (6) nos. of scientist room for accommodating guests who visit IASST from various parts of India and abroad.

Revenue Generation

Sl. No.	Source of Income	Amount (in Rupees)
1	Laboratory Instrument uses charge	5,04,437.00
2	Sale Proceeds	56,070.00
3	Other Receipts (KRC Life Membership Fee,etc.)	0.00
4	SSH Rent Recovered (JRF)	5,02,539.00
5	SSH Rent Recovered (Guests)	1,62,680.00
6	Institutional Charge for extramural projects	10,97,901.00
7	Tender Fee collection	2,74,700.00
	Total	**25,98,327.00**

Audited Statement of Accounts

K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

UTILIZATION CERTIFICATE

Certified that out of a sum of ₹ **20,63,94,000.00** (Rupees Twenty Crores Sixty Three Lacs Ninety Four Thousand Only) received as Grant-in-Aid from Government of India, Ministry of Science & Technology during the Financial Year 2015-16 vide letter mentioned hereunder and Interest from Bank ₹ **12,46,262.72** and opening surplus balance of ₹ **20,46,800.03** (being Cash & bank Balance of ₹ 27,12,176.03 plus advance given ₹ 48,000.00 during previous year less earnest money refundable ₹ 7,13,376.00) as on 31.03.2015, a sum of ₹ **20,55,51,409.14** has been utilized for the purpose for which it was sanctioned (total expenditure of ₹ 20,80,15,874.14 less other receipts of ₹ 24,64,465.00 of current year) and a surplus balance of ₹ **41,35,653.61** (being Cash & Bank Balance of ₹ 48,01,029.61 plus advance given ₹ 48,000.00 less earnest money refundable ₹ 7,13,376.00 of previous year) stands unutilized as on 31.03.2016.

Sl. No.	Sanction Letter No.	Amount (Rs.)
1	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/3, dated 14/10/15.	5,900,000.00
2	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. I/IASST/ST/GEN/003/2015/2, dated 14/10/15.	1,500,000.00
3	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/2, dated 14/10/15.	500,000.00
4	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/4, dated 19/11/15.	17,100,000.00
5	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/3, dated 14/10/15.	20,000,000.00
6	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/5, dated 12/02/16.	31,207,000.00
7	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/4, dated 12/02/16.	12,031,000.00
8	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/SC/003/2015/2, dated, 12/02/16.	175,000.00

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K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

9	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/3, dated 18/02/16.	500,000.00
10	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2015/3, dated 24/02/16.	3,500,000.00
11	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/3, dated 28/03/16.	14,594,000.00
12	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2015/1, dated 26/06/15.	5,000,000.00
13	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/1, dated 26/06/15.	1,500,000.00
14	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/2, dated 26/06/15.	18,836,000.00
15	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2015/1, dated 26/06/15.	3,375,000.00
16	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/2, dated 26/06/15.	17,000,000.00
17	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/2, dated 22/06/15.	22,643,000.00
18	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/1, dated 17/04/15.	8,493,000.00
19	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/1, dated 17/04/15.	9,418,000.00

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K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

20	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/1, dated 10/04/15.	11,322,000.00
21	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2014/3, dated 21/01/15.	1,800,000.00
	Total	**20,639,4000.00**

We have verified the records e.g. vouchers, bills etc to see that the money was actually utilized for the purpose for which it was sanctioned.

Kinds of check exercised:

1. Examining of Cash Book, Bank Book & ledger Accounts.
2. Verification of compliance to terms of Sanction of Grants.
3. Verification if Vouchers.

For K.P. Sarda & Co.
Chartered Accountants
FRN : 319206E

K. P. Sarda & Co. Guwahati Chartered Accountants

(CA. K P Sarda)
Partner
Membership No. 054555

Place : Guwahati
Date : 08/08/2016

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Form No. GFR-19A
FORM OF UTILIZATION CERTIFICATE

Sl. No.	Sanction Letter No.	Date	Amount (Rs.)
1	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/3	14/10/15	5,900,000.00
2	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. I/IASST/ST/GEN/003/2015/2	14/10/15	1,500,000.00
3	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/2	14/10/15	500,000.00
4	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/4	19/11/15	17,100,000.00
5	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/3	14/10/15	20,000,000.00
6	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/5	12/02/16	31,207,000.00
7	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/4	12/02/16	12,031,000.00
8	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/SC/003/2015/2	12/02/16	175,000.00
9	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/3	18/02/16	500,000.00
10	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2015/3	24/02/16	3,500,000.00
11	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/3	28/03/16	14,594,000.00
12	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2015/1	26/06/15	5,000,000.00
13	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2015/1	26/06/15	1,500,000.00
14	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/2	26/06/15	18,836,000.00
15	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2015/1	26/06/15	3,375,000.00
16	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/2	26/06/15	17,000,000.00

17	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/2	22/06/15	22,643,000.00
18	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2015/1	17/04/15	8,493,000.00
19	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2015/1	17/04/15	9,418,000.00
20	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2015/1	10/04/15	11,322,000.00
21	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2014/3	21/01/15	1,800,000.00
	Total		**206,394,000.00**

Certified that out of **₹ 20,63,94,000/-** Grant-in-Aid sanctioned during the financial year 2015-16 in favour of The Institute of Advanced Study in Science and Technology, Guwahati under this Ministry/Department's sanction letter vide details annexed above and Interest from Bank **₹ 12,08,000.72** and opening surplus balance of **₹ 3,96,734.17** (being Cash & bank Balance of Rs. 10,62,110.17 plus advance given Rs. 48000 during previous year less earnest money refundable Rs. 7,13,376.00) as on 31.03.2015, a sum of **₹ 20,63,18,981.14 /-** has been utilized for the purpose for which it was sanctioned (total expenditure of ₹ 20,65,15,106.14 less other receipts of ₹ 1,96,125.00 of current year) and a surplus balance of **₹ 16,79,753.75** (being Cash & Bank Balance of ₹ 23,45,129.75 plus advance given ₹ 48,000.00 less earnest money refundable ₹ 7,13,376.00 of previous year) remaining unutilized at the end of the year which will be utilized and adjusted towards the grants -in - aid payable during the next year 2016-17.

Further certified that I have satisfied myself that the conditions, on which the Grant-in-Aid was sanctioned, have been duly fulfilled and that I have exercised the following checks to see that the money was actually utilized for the purpose for which it was sanctioned.

Checks exercised :

1. Examining of Cash Book, Bank Book & Ledger Accounts
2. Verification of compliance to terms of Sanction of Grants.
3. Verification of Vouchers.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

INDEPENDENT AUDITOR'S REPORT

TO
THE MEMBERS
THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
GUWAHATI

We have audited the accompanying Financial Statements of The Institute of Advanced Study in Science & Technology, Paschim Boragaon, Garchuk, Guwahati which comprise the Balance Sheet as at 31st March, 2016, the Receipts and Payments Account and the Income and Expenditure Account for the year then ended, and a summary of significant accounting policies and other explanatory information.

Management's Responsibility for Financial Statements :

Management is responsible for the preparation of these financial statements that give a true and fair view of the financial position and financial performance of the society in accordance with the Accounting Standards generally accepted in India. This responsibility includes the design, implementation and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from misstatement, whether due to error or fraud.

Auditor's Responsibility :

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with the Standards on Auditing issued by the Institute of Chartered Accountants of India. Those standards require that we comply with ethical requirements and plans and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the society's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of the accounting estimates made by management, as well as evaluating the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Cond..P/2

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K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

(2)

Opinion:

In our opinion and to the best of our information and according to the explanations given to us, the financial statements give the information required by the Act in the manner so required and give a true and fair view in conformity with the accounting principles generally accepted in India :

(a) In the case of the Balance Sheet, of the state of affairs of the Society, as at 31st March, 2016;

(b) In case of the Income and Expenditure Account of the Income/Expenditure of Society for the year ended 31st March, 2016;

(c) In case of the Receipts and Payment Account of the Receipts/Payments of Society for the year ended 31st March,2016

We further report that:

(a) We have obtained all the information and explanations to the best of our knowledge and belief were necessary for the purpose of our audit;

(b) In our opinion, proper books of account, as required by law have been kept by the Society so far as appears from our examination of those books;

(c) The Balance Sheet, the Receipts and payment Account and the Income and Expenditure Account dealt with by this Report are in agreement with the books of account.

For K.P. Sarda & Co.
Chartered Accountants
FRN : 319206E

K.P. Sarda & Co. Guwahati Chartered Accountants

(CA. K P Sarda)
Partner
Membership No.054555

Place : Guwahati
Date : 08/08/2016

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2016

PARTICULARS	Annexure	Amount (₹) 2015-16	Amount (₹) 2014-15
RECEIPT			
Grant - in - Aid	1	246,450,049.00	198,006,448.00
Bank Interest Received		1,168,248.00	1,394,120.00
Fixed Deposit Interest		491,742.72	1,411,032.00
Other Income	2	3,840,082.00	3,354,639.00
Earnest Money Receipts	3	218,782.00	764,976.00
Recovery of Loans and Advances	4	-	0.00
TOTAL :		**252,168,903.72**	**204,931,215.00**
PAYMENT			
Payment on Grants	5	146,488,506.00	120,769,751.71
Aquisition of Fixed Assets	6	67,838,743.00	72,595,823.00
Advances for Fixed Assets	7	21,944,072.00	2,541,748.00
Advances against Expenditures of Grants	8	4,327,601.00	1,936,314.00
Advance to Staff	4	1,526,000.00	1,074,000.00
Earnest Money Payments	9	376,150.00	1,309,583.00
Refund of Unlitilised Grant		48,213.00	2,956.00
Outstanding Liabilities of Previous Years		0.00	650,311.00
Investment in Fixed Deposits with Vijaya Bank		10,000,000.00	0.00
TOTAL :		**252,549,285.00**	**200,880,486.71**
OPENING BALANCE		**21,576,224.89**	**17,525,496.74**
EXCESS OF RECEIPT OVER PAYMENT		**(380,381.28)**	**4,050,728.29**
CLOSING BALANCE		**21,195,843.61**	**21,576,225.03**

NOTES ON ACCOUNT - SCHEDULE "6"

In terms of our report of even date annexed hereto.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2016

PARTICULARS	Annexure	Amount (₹) 2015-16	Amount (₹) 2014-15
INCOME			
Grant - in - Aid	10	143,601,590.28	115,257,282.71
Interest	11	1,855,438.72	3,196,500.00
Other Income		3,840,082.00	3,355,239.00
TOTAL :		**149,297,111.00**	**121,809,021.71**
EXPENDITURE			
Expenditure on Grants	12	149,297,111.00	121,809,021.71
TOTAL :		**149,297,111.00**	**121,809,021.71**

NOTES ON ACCOUNT - SCHEDULE "6"

In terms of our report of even date annexed hereto.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

BALANCE SHEET AS ON 31ST MARCH, 2016

PARTICULARS	Schedule	Amount (₹) 2015-16	Amount (₹) 2014-15
CAPITAL FUND & LIABILITIES			
Capital Fund	1	485,196,330.82	437,836,771.96
Current Liabilities and Provisions	2	70,276,729.79	37,814,343.07
TOTAL :		555,473,060.61	475,651,115.03
ASSETS			
Fixed Assets	3	489,178,504.00	441,818,945.00
Investments	4	14,726,473.00	4,547,274.00
Current Assets, Loans and Advances	5	51,568,083.61	29,284,896.03
TOTAL :		555,473,060.61	475,651,115.03

NOTES ON ACCOUNT - SCHEDULE "6"

In terms of our report of even date annexed hereto.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

SCHEDULE - 1 : :: CAPITAL FUND ::

	Amount(₹) 2015-16	Amount(₹) 2014-15
Opening Balance	437,836,771.96	351,062,588.96
Add : Contribution towards Capital Fund (Addition to Fixed Assets)	70,180,491.00	106,593,875.00
	508,017,262.96	457,656,463.96
Less : Depreciation for the year	22,820,932.00	19,819,692.00
TOTAL :	**485,196,330.96**	**437,836,771.96**

SCHEDULE - 2 : :: CURRENT LIABILITIES AND PROVISIONS ::

	Amount(₹) 2015-16	Amount(₹) 2014-15
(a) **CURRENT LIABILITIES :**		
Unutilised Grant in Aid	67,411,718.79	34,791,964.07
Other Current Liabilities (Details 4)	1,719,334.00	1,719,334.00
Earnest Money	1,145,677.00	1,303,045.00
(b) **PROVISIONS :**	0.00	0.00
TOTAL :	**70,276,729.79**	**37,814,343.07**

SCHEDULE - 4 : :: INVESTMENTS ::

	Amount(₹)
Opening Balance	4,547,274.00
Add : Investment in Fixed Deposit during the year	10,000,000.00
Add : Interest Accrued	195,448.00
Less : TDS	16,249.00
Balance as on 31/03/2016	**14,726,473.00**

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

SCHEDULE - 5 : :: CURRENT ASSETS, LOANS & ADVANCES ::

		Amount(₹) 2015-16	Amount(₹) 2014-15
CURRENT ASSETS :			
Cash in hand		50,000.00	70,909.00
Balance with Banks	**Account No.**		
SBI Khanapara Branch	(943972)	2,040,909.58	694,327.00
SBI Khanapara Branch - Workshop	(943723)	12,482.88	11,299.88
SBI Garchuk Branch - Project	(260721)	16,394,814.00	18,863,949.00
SBI G.U. Branch - Upgrading	(131613)	43,122.86	41,447.86
SBI Garchuk - Seminar	(888433)	66,111.00	66,741.00
Vijaya Bank - Overhead/Miscellaneous	(000466)	2,412,777.00	1,608,618.00
Vijaya Bank - Travel	(000411)	126,160.29	173,902.29
Vijaya Bank - Conference	(000918)	38,537.00	36,078.00
SBI Khanapara - International Conference	(635294)	10,929.00	8,953.00
LOANS, ADVANCES & OTHER ASSETS :			
Crest Award		343,770.00	343,770.00
TDS Receivable		127,923.00	111,674.00
Loans to Staff		3,117,193.00	2,775,165.00
Current Year Advances			
Advances against Expenditure of Grants		4,327,601.00	1,936,314.00
Advances for Equipments		2,787,032.00	871,666.00
Advances for Vehicles		50,000.00	455,082.00
Advances for Books			215,000.00
Advances for Building & Site Development		19,107,040.00	1,000,000.00
Previous Year Advances			
Advances against Expenditure of Grants		311,681.00	0.00
Advances against Fixed Assets		200,000.00	0.00
TOTAL :		**51,568,083.61**	**29,284,896.03**

Previous Year Advances Still unadjusted (31/03/2015) :

Advances against Expenditure on Grants :			
General Fund :			
Contingency		103,589.00	
Salary (SC/ST)		127,800.00	
Training and Conference		16,064.00	
Works and Services		55,000.00	
			302,453.00
Project Fund :			
Consumables (Jhumming)		9,228.00	
			9,228.00
TOTAL :			**311,681.00**
Advances against Fixed Assets :			
Books and Journal			
Books (13/01/2015)			200,000.00
TOTAL :			**200,000.00**

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

SCHEDULE - 3 : **:: FIXED ASSETS ::**

DESCRIPTION	GROSS BLOCK			DEPRECIATION			NET BLOCK	
	As on 01/04/2015	Addition / (Deletions)	As on 31/03/2016	As on 01/04/2015	For the year	As on 31/03/2016	As on 31/03/2016	As on 31/03/2015
Building & Site Development	235,584,722.00	32,555,558.00	268,140,280.00	11,229,489.00	4,370,687.00	15,600,176.00	252,540,104.00	224,355,233.00
Equipments	221,126,205.00	25,394,871.00	246,521,076.00	32,389,340.00	11,709,751.00	44,099,091.00	202,421,985.00	188,736,865.00
Air Conditioner	2,727,481.00	1,010,381.00	3,737,862.00	301,299.00	177,548.00	478,847.00	3,259,015.00	2,426,182.00
Refrigerator	19,600.00	0.00	19,600.00	3,724.00	931.00	4,655.00	14,945.00	15,876.00
Projector	142,995.00	0.00	142,995.00	27,168.00	6,792.00	33,960.00	109,035.00	115,827.00
Vehicles	1,088,194.00	1,905,850.00	2,994,044.00	516,890.00	284,434.00	801,324.00	2,192,720.00	571,304.00
Furniture & Fixtures	19,031,420.00	5,524,301.00	24,555,721.00	2,658,782.00	1,554,377.00	4,213,159.00	20,342,562.00	16,372,638.00
Library	16,445,427.00	1,881,446.00	18,326,873.00	10,206,790.00	3,665,375.00	13,872,165.00	4,454,708.00	6,238,637.00
Computer	4,491,254.00	1,908,084.00	6,399,338.00	1,534,596.00	1,037,333.00	2,571,929.00	3,827,409.00	2,956,658.00
Printer & Xerox Machine	44,041.00	0.00	44,041.00	28,556.00	7,139.00	35,695.00	8,346.00	15,485.00
Computer Software	40,500.00	0.00	40,500.00	26,260.00	6,565.00	32,825.00	7,675.00	14,240.00
TOTAL	**500,741,839.00**	**70,180,491.00**	**570,922,330.00**	**58,922,894.00**	**22,820,932.00**	**81,743,826.00**	**489,178,504.00**	**441,818,945.00**
PREVIOUS YEAR	**394,147,964.00**	**106,593,875.00**	**500,741,839.00**	**39,103,202.00**	**19,819,692.00**	**58,922,894.00**	**441,818,945.00**	**355,044,762.00**

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

:: ANNEXURES FORMING PART OF RECEIPTS & PAYMENTS ACCOUNT ::

Annexure - 1 : **:: GRANT-IN-AID ::**

Sl.No.	Name of the Project/General Fund	Amount(₹) 2015-16	Amount(₹) 2014-15
1	Actinomycetes	0.00	325,112.00
2	Androgen	420,000.00	493,000.00
3	Anurupa Goswami	231,200.00	0.00
4	Atmospheric	546,400.00	227,920.00
5	Bio Informatics	566,000.00	0.00
6	Biosurfactance	120,600.00	0.00
7	Biosurfactant Soil for Oil	0.00	463,359.00
8	Biotech Hubs	571,000.00	0.00
9	Brain storming	165,200.00	0.00
10	Brain storming cum stakehold	300,000.00	0.00
11	Chemical input	65,120.00	341,971.00
12	Citrus fruits	0.00	365,837.00
13	Crops of Assam	0.00	1,890,000.00
14	CSIR	0.00	245,400.00
15	DBT RA (Supriyo Sen)	361,222.00	395,600.00
16	DBT RA (R. Thakur)	525,200.00	0.00
17	DST (Suitable Plant)	996,954.00	400,000.00
18	Department of Science and Technology - General	206,394,000.00	171,824,000.00
19	Electronic Alloys Magnetic	0.00	350,000.00
20	Flora & Fauna	400,000.00	0.00
21	Govt of Assam	2,000,000.00	1,000,000.00
22	Helfer Fibers	401,970.00	0.00
23	Image Processing (LB Mahanta)	0.00	375,000.00
24	Image Processing (Tabassum Y)	400,000.00	48,422.00
25	Indentification	507,000.00	515,000.00
26	Inspire Faculty (S Pramanic)	1,900,000.00	0.00
27	Inspire Fellow (Kangkana Bora)	380,000.00	0.00
28	Inspire Fellow (Rosy Mondal)	1,900,000.00	0.00
29	Inspire Fellow (Y bailung)	380,000.00	0.00
30	Inspire Fellow (Tulsi Joshi)	380,000.00	0.00
31	Inspire faculty (Sumita Sarmah)	1,255,860.00	1,405,214.00
32	Inspire faculty (Sagar Sarmah)	0.00	1,900,000.00
33	Investigation of Rogue Waves	700,000.00	200,000.00
34	Intestinal Microbiodata	0.00	1,076,000.00
35	Jhumming	1,408,989.00	1,796,992.00
36	Library Workshop	200,000.00	0.00
37	MR Khan (New)	5,431,000.00	0.00
38	Nanomaterial & Bimaterials	0.00	4,607,365.00
39	Normal Tea Plant	0.00	1,020,000.00
40	Chemical study of Carbon dots	533,066.00	1,343,250.00
41	Peste-in-tea (Microbial)	0.00	620,400.00
42	Physico Sensor	500,000.00	287,981.00
43	Plasma modified	1,400,000.00	0.00
44	Polymer & Polymer Nano	1,220,601.00	763,150.00

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:: ANNEXURES FORMING PART OF RECEIPTS & PAYMENTS ACCOUNT ::

Annexure - 1 : **:: GRANT-IN-AID ::**

		Balance b/d	**232,561,382.00**	**194,280,973.00**
45	Polymer Based Sensors		38,400.00	0.00
46	Proton Exchange		0.00	847,000.00
47	Ramalingaswami (MR Khan)		1,610,000.00	1,630,667.00
48	Ramalingaswami (S Nandi)		2,110,000.00	0.00
49	Ramalingaswami (S Kundu)		1,780,000.00	0.00
50	Ramanujan Fellow		1,780,000.00	0.00
51	SANS (S Kundu)		0.00	55,795.00
52	School Project (H Bailung)		250,000.00	0.00
53	Single Step		5,267.00	31,513.00
54	Stimulus Responsive		0.00	88,500.00
55	Structure of Enzymes		382,000.00	522,000.00
56	Tissue Repairs		820,000.00	0.00
57	Treatment of oil field		908,000.00	0.00
58	VRP (G T Gujar)		1,665,000.00	0.00
59	VRP (A K Sahu)		875,000.00	0.00
60	VRP (Ashwani Kumar)		1,665,000.00	0.00
61	Grant towards Training and Conference		0.00	550,000.00
			246,450,049.00	**198,006,448.00**

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Annexure - 2 : :: OTHER INCOME ::

Name of the Project/General Fund	Amount(₹) 2015-16	Amount(₹) 2014-15
Financial Assistance	0.00	43,917.00
Other receipts	2,322,093.00	325,855.00
Institutional Charges Receipts	1,326,634.00	2,063,700.00
Registration Fees Receipts of Conferences	0.00	774,245.00
Contributions from NPS	191,355.00	146,922.00
Total :	3,840,082.00	3,354,639.00

Annexure - 3 : :: EARNEST MONEY RECEIPTS ::

Name of the Firm	Details of Works	Amount(₹) 2015-16
M/s Rhino	IASST Lift	40,560.00
M/s Kalita Enterprise	Hotel Mess	10,000.00
M/s BMG Informatics	Scientific Instrument	26,500.00
M/s Planters	Scientific Instrument	19,527.00
M/s VT Vacuam	Scientific Instrument	8,110.00
M/s Techno Scientific Kolkota	Scientific Instrument	15,000.00
M/s Microtech Intruments	Scientific Instrument	1,885.00
M/s Accurion Scientific Instruments	Scientific Instrument	75,000.00
M/s Inkarup Instruments	Scientific Instrument	4,500.00
M/s Thermo Fisher Scientific	Scientific Instrument	11,000.00
M/s North East Enterprise	Scientific Instrument	700.00
		6,000.00
	Total :	218,782.00

Annexure - 4 : :: LOANS TO STAFF ::

	Amount(₹) 2015-16	Amount(₹) 2014-15
Opening Balance	2,775,165.00	2,740,435.00
Add : Advances for the year	1,526,000.00	1,074,000.00
	4,301,165.00	3,814,435.00
Less : Recovered during the year	1,183,972.00	1,039,270.00
Total :	3,117,193.00	2,775,165.00

Annexure - 5 : :: PAYMENT ON GRANTS ::

	Amount(₹) 2015-16	Amount(₹) 2014-15
Bank charges	5,093.00	11,049.00
Contingency - Emiratus Scientist	52,463.00	39,205.00
Contingency (Details 1)	15,981,438.00	11,854,182.00
Contributory Provident Fund	5,277,819.00	4,026,578.00
Honorarium	1,852,580.00	833,982.00
Laboratory Consumables (Details 2)	10,093,987.00	10,560,087.00
Meeting Expenses	284,569.00	0.00
Miscellaneous Expenses	132,228.00	0.00
Overhead Expenses	1,331,901.00	893,754.00
Salary	85,368,958.00	70,782,743.00
Salary - Emiratus Scientist	0.00	480,000.00
Salary - RA	0.00	86,400.00
Security Services	1,406,036.00	1,107,910.00
Balance c/d	**121,787,072.00**	**100,675,890.00**

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY
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:: 2 ::

		Amount(₹) 2015-16	Amount(₹) 2014-15
	Balance b/f	121,787,072.00	100,675,890.00
Technical Assistance		0.00	32,575.00
Training and Conference		1,444,580.00	7,013,903.00
Travelling Expenses		4,257,749.00	2,499,405.71
Works & Services (Details 3)		18,704,055.00	10,547,978.00
Outsourcing		264,555.00	0.00
Labour Charge		6,000.00	0.00
Analysis		11,275.00	0.00
SC/ST		13,220.00	0.00
	Total :	146,488,506.00	120,769,751.71

Annexure - 6 : :: ACQUISITION OF FIXED ASSETS ::

Particulars	Amount(₹) 2015-16	Amount(₹) 2014-15
(A) GENERAL FUND :		
Building and Site Development	31,555,558.00	40,126,886.00
Equipments	16,978,391.00	18,422,627.00
Furniture and Fixtures	5,524,301.00	8,419,067.00
Library Books	1,866,446.00	3,245,615.00
Computer	1,908,084.00	1,434,271.00
Air Conditioner	1,010,381.00	947,357.00
(B) PROJECT FUND :		
Equipment	7,544,814.00	0.00
Bus (Overhead A/c)	1,450,768.00	0.00
Total :	67,838,743.00	72,595,823.00

Annexure - 7 : :: ADVANCES FOR FIXED ASSETS ::

Name of Fixed Assets	Date	Amount(₹) 2015-16
(A) GENERAL		
a) Equipment :		
Horizontal Laminar Air Flow	22/02/2016	170,968.00
Nafion Membranes	03/12/2015	19,676.00
GC-MS-MS	27/04/2015	44,173.00
Plant Growth Chamber	28/01/2016	2,508,132.00
		2,742,949.00
b) Vehicles :		
Tata Safari (Overhead A/c)		50,000.00
		50,000.00
c) Building and Site Development :		
	25/02/2016	441,000.00
	02/03/2016	9,000.00
(i) Land and Building	08/03/2016	427,826.00
	31/03/2016	14,551,939.00
	31/03/2016	2,527,275.00
(ii) Students and Scientist Home	31/03/2016	1,150,000.00
		19,107,040.00
(B) PROJECT FUND :		
(a) Equipment :		
Analog Penning Gauge	30/04/2015	44,083.00
		44,083.00

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Annexure - 8 : :: ADVANCES AGAINST EXPENDITURE OF GRANTS ::

Particulars	Amount(₹) 2015-16
(A) **GENERAL FUND :**	
Consumables	214,419.00
Contingency	296,257.00
Salary	244,210.00
Training & Conference	534,005.00
Travel	41,200.00
SC/ST	465,000.00
Works and Services	2,047,747.00
	3,842,838.00
(B) **PROJECT FUND :**	
Contingency	18,740.00
Travel	242,611.00
Consumables	106,912.00
Training & Conference	112,500.00
Outsourcing	4,000.00
	484,763.00
Total (A+B)	4,327,601.00

Annexure - 9 : :: EARNEST MONEY PAYMENTS ::

Name of the Firm	Details of Works	Amount(₹) 2015-16
M/s. Jyoti Pharmaceuticals	Scientific Instrument	40,000.00
Mr. Hari Das	Work of embankment at low land area of IASST	43,100.00
M/S. Accurion Scientific	Scientific Instrument	75,000.00
M/S. Thermo Fisher	Scientific Instrument	15,000.00
Mr. Nizzam Uddin Ahmed	Scientific Instrument	4,000.00
M/S. Planters	Scientific Instrument	16,774.00
M/S. Microtech Instrument	Scientific Instrument	1,885.00
M/S. S. V. Scientific	Scientific Instrument	28,791.00
M/S. Inkarup Instruments	Scientific Instrument	4,500.00
Mr. Nizzam Uddin Ahmed	Work of Gypboard, ceiling, partition etc. at server room	47,600.00
Mr. Hari Das	Construction of Lobby and pouch	63,000.00
Mr. Amarendra Phukan	Hotel Mess and Canteen of IASST	10,000.00
M/S. BMG Informatics	Scientific Instrument	26,500.00
	Total :	376,150.00

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Annexure - 10 : :: GRANT - IN - AID ::

Particulars	Amount(₹) 2015-16	Amount(₹) 2014-15
Grants	246,450,049.00	198,006,448.00
Add : Unutilised Grant Brought forward from previous years	34,791,964.07	58,639,629.78
	281,242,013.07	256,646,077.78
Less : Transferred to Capital Fund	70,180,491.00	106,593,875.00
	211,061,522.07	150,052,202.78
Less : Refund of Unutilised Grant	48,213.00	2,956.00
	211,013,309.07	150,049,246.78
Less : Unutilised Grant Carried forward	67,411,718.79	34,791,964.07
	143,601,590.28	115,257,282.71

Annexure - 11 : :: INTEREST INCOME ::

Bank Interest	1,168,248.00
Fixed Deposit Interest (Received)	491,742.72
Fixed Deposit Interest (Accrued)	195,448.00
	1,855,438.72

Annexure - 12 : :: EXPENDITURE ON GRANTS ::

Particulars	Current Year			Previous Year
	Payments Amount(₹)	P.Y. Advances adjusted Amount(₹)	Total Expenditure Amount(₹)	Amount(₹)
Bank charges	5,093.00		5,093.00	11,049.00
Contingency - Emiratus Scientist	52,463.00	3,200.00	55,663.00	39,205.00
Contingency (Details 1)	15,981,438.00	711,395.00	16,692,833.00	11,854,182.00
Contributory Provident Fund	5,277,819.00		5,277,819.00	4,026,578.00
Honorarium	1,852,580.00		1,852,580.00	833,982.00
Laboratory Consumables (Details 2	10,093,987.00	70,112.00	10,164,099.00	10,560,087.00
Meeting Expenses	284,569.00		284,569.00	0.00
Miscellaneous Expenses	132,228.00		132,228.00	0.00
Overhead Expenses	1,331,901.00		1,331,901.00	893,754.00
Salary	86,552,930.00		86,552,930.00	71,822,013.00
Salary - Emiratus Scientist	0.00		0.00	480,000.00
Salary - RA	0.00		0.00	86,400.00
Security Services	1,406,036.00		1,406,036.00	1,107,910.00
Technical Assistance	0.00		0.00	32,575.00
Training and Conference	1,444,580.00	555,550.00	2,000,130.00	7,013,903.00
Travelling Expenses	4,257,749.00	242,800.00	4,500,549.00	2,499,405.71
Works & Services (Details 3)	18,704,055.00	41,576.00	18,745,631.00	10,547,978.00
Outsourcing	264,555.00		264,555.00	0.00
Labour Charge	6,000.00		6,000.00	0.00
Analysis	11,275.00		11,275.00	0.00
SC/ST	13,220.00		13,220.00	0.00
Total :	**147,672,478.00**	**1,624,633.00**	**149,297,111.00**	**121,809,021.71**

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Details 1 : Contingency Expenses :

	Amount(₹) 2015-16	Amount(₹) 2014-15
General Fund :		
Meeting Expenses	1,475,616.00	350,968.00
Advertisement	513,188.00	545,664.00
Postage	195,977.00	119,320.00
Electricity & Power	6,678,369.00	5,312,223.00
Audit Fee	45,592.00	23,596.00
Telephone Charges	671,931.00	53,510.00
Repairs & Maintenance - Vehicle	830,433.00	703,478.00
Printing & Stationery	1,549,948.00	1,866,483.00
Computer Stationery	266,796.00	109,606.00
Hospitality	1,354,973.00	1,134,390.00
Conveyance	87,382.00	53,620.00
Hostel Rent & Electricity	0.00	101,425.00
	13,670,205.00	10,374,283.00
Project Fund :	2,311,233.00	1,479,899.00
	15,981,438.00	11,854,182.00

Details 2 : Laboratory Consumables :

	Amount(₹) 2015-16	Amount(₹) 2014-15
General Fund :		
Laboratory Gas Refilling	68,551.00	122,058.00
Chemicals & Glassware	6,460,076.00	5,978,529.00
Sample Collection	249,793.00	227,245.00
Renewal/Other Fee Payments	458,517.00	172,902.00
Experimental Animal Maintenance	99,042.00	179,756.00
	7,335,979.00	6,680,490.00
Project Fund :	2,758,008.00	3,879,597.00
	10,093,987.00	10,560,087.00

Details 3 : Works & Services :

	Amount(₹) 2015-16	Amount(₹) 2014-15
General Fund :		
Repairing & Maintenance (Equipment)	470,238.00	859,196.00
Gardening & Landscaping	149,797.00	528,363.00
Repairing & Maintenance (Electrical)	1,914,285.00	1,012,696.00
Repairing & Maintenance (General)	16,030,803.00	8,088,930.00
Repairing & Maintenance (SSH)	138,932.00	46,793.00
	18,704,055.00	10,535,978.00
Project Fund :	0.00	12,000.00
	18,704,055.00	10,547,978.00

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

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Details 4 : Other Current Liabilities :

(a) Movement during the year :

	Amount(₹) 2015-16	Amount(₹) 2014-15
Opening Balance	1,719,334.00	2,369,645.00
Add: Committed for Fixed Assets	0.00	0.00
	1,719,334.00	2,369,645.00
Less : Last year liabilities paid off	0.00	650,311.00
Less : Last year liabilities written back	0.00	0.00
	1,719,334.00	**1,719,334.00**

(b) Detailed Breakup of Closing Balance of Other Current Liabilities :

Sl.	Project Name	Head	Amount(₹) 2015-16	Amount(₹) 2014-15
1.	Upgrading	Earth Filling	1,715,513.00	1,715,513.00
2.	DST Govt of Assam	Grants-in-Aid	3,821.00	3,821.00
			1,719,334.00	**1,719,334.00**

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

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RECEIPTS & PAYMENTS ACCOUNT OF EXTRAMURAL PROJECTS FOR THE YEAR ENDED 31ST MARCH 2016

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **EXPENDITURES :**		
Cash in Hand	100.00		Contingency		2,329,973.00
Cash at Bank	18,863,949.00	18,864,049.00	Consumables		2,864,920.00
(As per Annexure A&B)			Overheads		1,331,901.00
			Salary		16,999,864.00
" Grant- in-Aid		40,056,049.00	Travel		2,093,725.00
(As per Annexure C)			Training		197,141.00
			Outsourcing		268,555.00
" **OTHER RECEIPTS :**		2,008,127.00	Labour Charges		6,000.00
(As per Annexure B)			Analysis		11,275.00
			Meeting		284,569.00
			Miscellaneous		132,228.00
			" Equipments		7,588,897.00
			" Investment in Fixed Deposit		10,000,000.00
			" Earnest Money refund payments		376,150.00
			" Refund of unutilised grant		48,213.00
			" **CLOSING BALANCE :**		
			Cash in hand	0.00	
			Cash at Bank	16,394,814.00	16,394,814.00
			(As per Annexure A&B)		
		60,928,225.00			60,928,225.00

We have verified the above statement of Receipts & payments Account of Extramural Projects of the Institute of Advanced Study in Science & Technology, Paschim Boragaon, Guwahati - 781 035, Account - Plan for the period from 1st April 2015 to 31st March, 2016 from the Books of Accounts and vouchers produced before us.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

K. P. Sarda & Co. Guwahati Chartered Accountants

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

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INCOME & EXPENDITURE ACCOUNT OF EXTRAMURAL PROJECTS FOR THE YEAR ENDED 31ST MARCH 2016

INCOME	Amount (₹)	EXPENDITURE	Amount (₹)
Grants	24,058,754.00	**Expenditure on Grants :**	
Interest on Saving Bank A/c	452,179.00	Contingency	2,311,233.00
Interest on Fixed Deposit	148,838.00	Consumables	2,758,008.00
Other Income	1,375,617.00	Overheads	1,331,901.00
		Salary	16,999,864.00
		Travel	1,851,114.00
		Training	84,641.00
		Outsourcing	264,555.00
		Labour Charges	6,000.00
		Analysis	11,275.00
		Meeting	284,569.00
		Miscellaneous	132,228.00
	26,035,388.00		26,035,388.00

NOTES ON ACCOUNT - SCHEDULE "6"

In terms of our report of even date annexed hereto.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

K. P. Sarda & Co. Guwahati Chartered Accountants

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

ANNEXURE : "A"

Project Name	Opening Balance	Grant/ Interest	Total Grants	Salary	Contingency	Equipment	Travel	Consumable	Training	Overhead	Labour Charges	Analysis	Misc.	Outsourcing	Meeting	Refund	Total	Balance as on 31/03/2016
nomytes	68.00	-	68.00													68.00	68.00	-
ngen	(271,332.00)	420,000.00	148,668.00	47,367.00	-	-	7,663.00	98,773.00		-							174,021.00	(25,353.00)
upa Goswami	-	231,200.00	231,200.00	-	-	-	-	-									-	231,200.00
tic Biodiversity	(17,308.00)	-	(17,308.00)														-	(17,308.00)
ospheric	81,061.00	546,400.00	627,461.00	442,543.00	3,380.00	44,085.00	43,905.00	58,156.00		25,000.00							619,275.00	8,188.00
ala River	(379,338.00)	-	(379,338.00)														-	(379,338.00)
nformatics	735,230.00	560,000.00	1,301,230.00	292,318.00	4,889.00	183,140.00	30,000.00		84,641.00								595,988.00	705,322.00
rfactance	536,923.00	120,600.00	659,520.00	172,800.00	45,205.00	-	36,415.00	246,253.00	-	25,000.00							525,675.00	133,845.00
sh Hulks	438,796.00	571,000.00	1,009,796.00	222,179.00	172,452.00	-	27,134.00	-	-	-							421,765.00	588,041.00
storming	-	165,200.00	165,200.00	-	-												-	-
storming cum stakehold	-	300,000.00	300,000.00		20,950.00		-	-							245,439.00		245,439.00	(80,259.00)
ical input	155,528.00	65,120.00	220,648.00	168,968.00	7,070.00	-	20,586.00	21,231.00		-					39,110.00		60,068.00	239,932.00
e fruits	11,334.00	-	11,334.00	-	-		-	-								11,334.00	11,334.00	-
of Assam	540,364.00	-	540,364.00	131,080.00	9,295.00	-	26,270.00	369,329.00		50,000.00							586,174.00	2,810.00
	(73.00)	-	(73.00)														-	(73.00)
-Crest (D Devi)	(343,770.00)	-	(343,770.00)	-	-	-	-	-		-							-	(343,770.00)
RA (Supriya Sen)	311,837.00	361,221.00	673,059.00	547,203.00	24,860.00	-	100,349.00	-		-							672,209.00	850.00
RA (Molecular Genetic uity)	46,970.00	-	46,970.00	-	46,970.00	-	-	-		-							46,970.00	-
RA (R. Thakur)	-	525,200.00	525,200.00	98,419.00	-												98,419.00	426,781.00
tic Neuropathic	308,483.00	-	308,483.00	26,012.00	20,029.00	84,239.00	-	238,881.00		-							369,161.00	(60,678.00)
J Medhi)	(63,015.00)	-	(63,015.00)	-	-	-	-	-		-							-	(63,015.00)
Suitable Plant)	(360.00)	996,954.00	996,608.00	725,000.00	-	-	202,456.00	-		100,000.00							1,027,456.00	(30,848.00)
tion	(33,598.00)	-	(33,598.00)														-	(33,598.00)
onic Alloys magnetic	263,519.00	-	263,519.00	195,200.00	6,518.00	-	22,857.00	-		-							224,575.00	38,944.00
& Fauna	243,709.00	400,000.00	643,709.00	298,920.00	4,991.00	-	31,646.00	82,560.00		106,656.00	6,000.00	11,275.00	132,228.00				694,276.00	(50,567.00)
colour	(1,153.00)	-	(1,153.00)							-							-	(1,153.00)
of Assam	(135,488.00)	2,000,000.00	1,864,512.00	-	5,130.00	1,999,495.00											2,004,625.00	(140,113.00)
Fibers	(248,176.00)	401,970.00	153,794.00	-	-	-	7,930.00	-		49,995.00							57,925.00	95,869.00
Processing (Tabassum Y)	117,429.00	400,000.00	517,429.00	390,000.00	4,382.00	-	-	-		50,300.00							424,382.00	93,047.00
Processing (LB Mahanta)	2,329.00	-	2,329.00	-	1,124.00												1,124.00	1,205.00
ification	289,732.00	507,000.00	796,732.00	201,925.00	99,922.00	-	66,126.00	135,237.00		50,000.00							553,210.00	243,522.00
e Faculty (S Pramanic)	-	1,900,000.00	1,900,000.00	298,667.00	5,000.00	-	-	-									303,667.00	1,596,333.00
e Fellow (Kangkana Bora)	-	380,000.00	380,000.00	479,033.00	8,537.00												487,570.00	(107,570.00)
e Fellow (Rosy Mondal)	-	1,900,000.00	1,900,000.00	917,333.00	64,351.00	19,273.00	-	-		50,000.00							1,050,957.00	864,043.00
e Fellow (Y bailung)	-	380,000.00	380,000.00	77,419.00	-												77,419.00	302,581.00
e Fellow (Tulsi joshi)	-	380,000.00	380,000.00	77,419.00	-												77,419.00	302,581.00
e faculty (Sumita Sarmah)	600,562.00	1,255,860.00	1,856,422.00	1,024,404.00	135,045.00	214,643.00	14,708.00	7,408.00		-							1,396,208.00	460,214.00
e Faculty (Sagar Sarma)	1,479,355.00	-	1,479,355.00	920,258.00	26,269.00	-	8,297.00	316,690.00		33,000.00							1,304,514.00	174,841.00
nal Microbiota	148,071.00)	-	(148,071.00)														-	148,071.00)
igation of Rogue Waves	316,221.00	700,000.00	1,016,221.00	324,720.00	4,704.00	116,948.00	34,348.00	112,748.00		100,000.00							693,468.00	322,753.00
ning	181,669.00	1,408,389.00	1,590,058.00	824,571.00	38,662.00	-	271,330.00	301,366.00	112,500.00								1,568,429.00	22,229.00
y Workshop	-	200,000.00	200,000.00	-	-	-	-									-	-	200,000.00
efund	5,000,000.00	-	5,000,000.00														-	5,000,000.00
han (New)	-	5,431,000.00	5,431,000.00	-	-	-	-	-									-	5,431,000.00
RD	29,255.00	-	29,255.00														-	29,255.00
Material & Biomaterials	4,607,365.00	-	4,607,365.00	343,510.00	43,106.00	4,078,539.00	27,354.00	77,124.00		35,000.00							4,424,633.00	182,732.00
d Tea Plant	721,775.00	-	721,775.00	183,167.00	1,710.00	148,797.00	30,790.00	73,316.30		-						9,025.00	446,805.00	274,970.00
tive degradation	(171,901.00)	-	(171,901.00)	-	-	-	-	-		-							-	(171,901.00)
n tea (Microbial)	36,676.00	-	36,676.00	67,200.00	30,114.00	-	-	95,010.00		-							192,324.00	(155,648.00)
cal study of Carbon dots	138,961.00	533,366.00	672,027.00	354,000.00	9,421.00	-	19,905.00	166,241.60		-							549,566.00	122,461.00
a Sensor	16,805.00	500,000.00	516,805.00	185,497.00	57,479.00	-	17,509.00	94,154.00		100,000.00							454,639.00	62,166.00
modified	-	1,400,000.00	1,400,000.00	120,000.00	8,300.00	1,238.00	-	5,450.00		84,000.00							219,078.00	1,180,922.00
r & Polymer Nano	102,118.00	1,220,601.00	1,322,719.00	334,000.00	37,390.00	698,300.00	32,039.00	137,180.00		86,250.00							1,345,928.00	(23,209.00)
r film	-	-	-	-	-	-	-										-	-
r Based Sensors	(368.00)	38,400.00	37,832.00	38,400.00	-												38,400.00	(568.00)
Exchange	(137,261.00)	-	(137,261.00)	-	-	-	-	-		-							-	(137,261.00)
ngarwami (MR Khan)	646,780.00	1,610,000.00	2,256,780.00	1,133,000.00	356,316.00												1,466,516.00	790,267.00
ngarwami (S Nandi)	-	2,110,000.00	2,110,000.00	1,306,368.00	933,026.00	-	25,736.00	-									2,065,130.00	44,870.00
ngarwami (S Kundu)	-	1,790,000.00	1,790,000.00	765,000.00	5,000.00	-	22,334.00	-		60,000.00							852,334.00	937,666.00
ajan Fellow	-	1,790,000.00	1,790,000.00	85,000.00	5,000.00	-	-	-		60,000.00							150,000.00	1,630,000.00
Kundu)	1,225.00	-	1,225.00	-	-	-	-	-								1,225.00	1,225.00	-
Project (H Bailung)	-	250,000.00	250,000.00	-	-		-	-									-	250,000.00
otein Based	32,073.00	-	32,073.00	-	-	-	-	-		-							-	32,073.00
Step	(3,267.00)	3,267.00	-														-	-
	26,361.00	-	26,361.00													26,361.00	26,361.00	-
	1,413.00	-	1,415.00														-	1,415.00
re of Enzymes	193,829.00	382,080.00	577,829.00	140,438.00	-	-	34,000.00	-		-							194,438.00	383,391.00
Repaire	6,498.00	820,000.00	826,498.00	455,000.00	19,516.00	-	45,769.00	259,613.00		-							813,896.00	12,602.00
nt of oil field	(3,667.00)	908,000.00	902,333.00	168,779.00	-	-	6,480.00	-		50,000.00				268,555.00			493,734.00	408,599.00
ant (MD shadab)	156,120.00	-	156,120.00	141,120.00	17,615.00	-											158,735.00	(2,615.00)
T Gogoi)	-	1,665,000.00	1,665,000.00	936,774.00	1,949.00	-	-	-		100,000.00							1,038,723.00	626,277.00
K Sahu)	-	875,000.00	875,000.00	719,999.00	21,364.00	-	-	-		50,000.00							791,363.00	83,637.00
obwani Kumar)	-	1,665,000.00	1,665,000.00	886,452.00	-	-	13,270.00	-		100,000.00							999,722.00	665,278.00
	16,340,243.00	40,056,049.00	56,396,292.00	34,924,639.00	2,329,973.00	7,568,897.00	1,232,932.00	2,964,920.00	197,141.00	1,331,901.00	6,000.00	11,275.00	132,228.00	268,555.00	284,549.00	48,213.00	53,221,243.00	23,175,049.00

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON,GUWAHATI- 781035

ANNEXURE : "B"

RECEIPTS & PAYMENTS ACCOUNT OF IASST FUND (OTHER UNCERTIFIED FUND) FOR THE YEAR ENDED 31ST MARCH 2016

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **EXPENDITURES :**		
Unspent as on 31/03/2015		2,523,806.00	Salary	75,225.00	
			Travel	860,793.00	936,018.00
" **OTHER RECEIPTS :**					
Interest on Saving Bank A/c	452,179.00		" Investment in Fixed Deposit		10,000,000.00
Earnest Money Deposit	218,782.00				
Miscellaneous Receipts	5,292.00		" Earnest Money refund payments		376,150.00
Other Receipts	1,370,325.00				
	2,046,578.00				
Less: Interest Transferred to Development of Atmospheric Pressure	38,451.00	2,008,127.00	" **CLOSING BALANCE :** Unspent as on 31/03/2016		(6,780,235.00)
		4,531,933.00			4,531,933.00

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No.054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

ANNEXURE : "C"

DETAILS OF GRANT-IN-AID OF EXTRAMURAL PROJECTS FOR THE FINANCIAL YEAR 2015-16

Sl.No.	Name of the Project	Amount(₹)
1	Androgen	420,000.00
2	Anuprupa Goswami	231,200.00
3	Atmospheric	546,400.00
4	Bioinformatics	566,000.00
5	Biosurfactance	120,600.00
6	Biotech Hubs	571,000.00
7	Brain storming	165,200.00
8	Brain storming cum stakehold	300,000.00
9	chemical input	65,120.00
10	DBT RA	361,222.00
11	DBT RA	525,200.00
12	DST (Suitable Plant)	996,954.00
13	Flora & Fonna	400,000.00
14	Govt of Assam	2,000,000.00
15	Helferfibers	401,970.00
17	Image Processing	400,000.00
18	Indentification	507,000.00
19	Inspaire Faculty	1,900,000.00
20	Inspaire Fellow	380,000.00
21	Inspaire Fellow	1,900,000.00
22	Inspaire Fellow	380,000.00
23	Inspaire Fellow	380,000.00
24	Inspare faculty	1,255,860.00
25	Investigation of rogue	700,000.00
26	Jhumming	1,408,989.00
27	Library Workshop	200,000.00
28	MR Khan (New)	5,431,000.00
29	Physic-chemical..carbon	533,066.00
30	Physico Sensor	500,000.00
31	Plasma modified	1,400,000.00
32	Polimer & Polimer Nano	1,220,601.00
33	Polymer Base Sensors	38,400.00
34	Ramalingaswami	1,610,000.00
35	Ramalingaswami	2,110,000.00
36	Ramalingaswami	1,780,000.00
37	Ramanujan Fellow	1,780,000.00
38	School Project	250,000.00
39	Single Step	5,267.00
40	Structure of enzymes	382,000.00
41	Tissue Repair	820,000.00
42	Treatment of oil field	908,000.00
43	VRP	1,665,000.00
44	VRP	875,000.00
45	VRP	1,665,000.00
		40,056,049.00

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

RECEIPTS AND PAYMENTS ACCOUNT OF DST GENERAL FUND FOR THE YEAR ENDED 31ST MARCH 2016

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **SALARY & ALLOWANCES :**		
Cash in hand	70,809.00		Salary	62,123,694.00	
Cash at Bank	991,301.03	1,062,110.03	P.F Contribution	5,277,819.00	
			Gratuity Premium	2,500,000.00	
* **GRANT-IN-AID :**			Children Education	1,236,039.00	
From Ministry of Science and Technology Department of Science & Technology, New Delhi			Medical Contribution	1,254,265.00	
			Leave Travel Concession	990,856.00	
Letter No.			Telephone/Internet Charges	237,711.00	
AI/IASST/GEN/003/2015/3	5,900,000.00		Newspapers & Periodicals	124,178.00	
AI/IASST/ST/GEN/003/2015/:	1,500,000.00		Uniform Allowances	146,561.00	
AI/IASST/ST/003/2015/2	500,000.00		Loans and Advances	1,526,000.00	75,417,123.00
AI/IASST/SAL/003/2015/4	17,100,000.00		* **GENERAL :**		
AI/IASST/SAL/003/2015/3	20,000,000.00		Contingency	13,966,462.00	
AI/IASST/SAL/003/2015/5	31,207,000.00		Bank Charges	5,093.00	
AI/IASST/GEN/003/2015/4	12,031,000.00		Emiritus Scientist Expense	52,463.00	
AI/IASST/SC/003/2015/2	175,000.00		Consumables	7,550,398.00	
AI/IASST/ST/003/2015/3	500,000.00		Training & Conference	1,893,944.00	
AI/IASST/ST/GEN/003/2015/:	3,500,000.00		Travelling	2,447,835.00	
AI/IASST/CAP/003/2015/3	14,594,000.00		Honorarium	1,852,580.00	
AI/IASST/ST/GEN/003/2015/	5,000,000.00		Security Service	1,406,036.00	
AI/IASST/ST/003/2015/1	1,500,000.00		Works and Services	20,751,802.00	49,926,613.00
AI/IASST/CAP/003/2015/2	18,836,000.00		* **CAPITAL :**		
AI/IASST/SC/003/2015/1	3,375,000.00		Equipments	19,721,340.00	
AI/IASST/GEN/003/2015/2	17,000,000.00		Library		
AI/IASST/SAL/003/2015/2	22,643,000.00		Books & Journal	1,804,046.00	
AI/IASST/GEN/003/2015/1	8,493,000.00		Newspapers & Periodicals	62,400.00	
AI/IASST/CAP/003/2015/1	9,418,000.00		Computer & Peripherals	1,908,084.00	
AI/IASST/SAL/003/2015/1	11,322,000.00		A.C.	1,010,381.00	
AI/IASST/SC/003/2014/3	1,800,000.00	206,394,000.00	Furniture & Fixtures	5,524,301.00	
			Land & Building;	38,037,564.00	
			Student Scientist Home	12,625,034.00	80,693,150.00
* **INTEREST FROM BANK :**					
Bank Interest		716,258.00	* SC/ST		478,220.00
Interest on Fixed Deposit		491,742.72			
			* **CLOSING BALANCE :**		
* **OTHER RECEIPTS :**			Cash in hand	50,000.00	
Contribution from NPS		191,355.00	Cash at Bank	2,295,129.75	2,345,129.75
Miscellaneous Receipts		4,770.00			
		208,860,235.75			208,860,235.75

We have verified the above statement of Receipts & payments Account of the Institute of Advanced Study in Science & Technology, Paschim Boragaon, Guwahati - 781 035, Account - Plan for the period from 1st April 2015 to 31st March, 2016 from the Books of Accounts and vouchers produced before us.

Place : G u w a h a t i
Date : 08/08/2016

K. P. Sarda & Co. Guwahati Chartered Accountants

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

(CA. K P Sarda)
Partner
Membership No. 054555

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

INCOME AND EXPENDITURE ACCOUNT OF DST GENERAL FUND FOR THE YEAR ENDED 31ST MARCH 2016

INCOME	Amount (₹)	EXPENDITURE	Amount (₹)
Grants	121,857,597.28	**Expenditure on Grants**	
Bank Interest	716,258.00	Salary	74,830,885.00
Interest on Fixed Deposit	491,742.72	Contingency	14,381,600.00
Other Income	196,125.00	Bank Charges	5,093.00
		Emiritus Scientist Expense	55,663.00
		Consumables	7,406,091.00
		Training & Conference	1,915,489.00
		Travelling	2,649,435.00
		Honorarium	1,852,580.00
		Security Service	1,406,036.00
		Works and Services	18,745,631.00
		SC/ST	13,220.00
	123,261,723.00		123,261,723.00

NOTES ON ACCOUNT - SCHEDULE "6"

In terms of our report of even date annexed hereto.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E

K. P. Sarda & Co. Guwahati Chartered Accountants

(CA. K P Sarda)
Partner
Membership No. 054555

Place : G u w a h a t i
Date : 08/08/2016

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

BREAK UP OF UNUTILIZED GRANTS AS ON 31ST MARCH 2016

Particulars		Amount (₹)
Unutilised Grants (as a whole) as on 31.03.2016		67,411,718.79
Unutilised Fund lying in Project Fund (As per Details "A")	16,394,814.00	
Balance in General Fund (As per Details "B")	51,016,904.79	
		67,411,718.79
TOTAL :		-

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

Details "A"

BREAK UP OF PROJECT FUND AS ON 31ST MARCH 2016

Sl. No.	Name of the Project	Balance (₹)
1	Actinomytes	0.00
2	Androgen	(25353.00)
3	Anurupa Goswami	231200.00
4	Aquatic Biodiversity	(17308.00)
5	Atmospheric	8188.00
6	Bharalu River	(579338.00)
7	Bio Informatics	720322.00
8	Biosurfactance	153845.00
9	Biotech Hubs	588041.00
10	Brain storming	(80259.00)
11	Brain storming cum stakehold	239932.00
12	Chemical input	2833.00
13	Citrus fruits	0.00
14	Crops of Assam	230.00
15	CSIR	(73.00)
16	DBT -Crest (D Devi)	(343770.00)
17	DBT RA (Supriyo Sen)	850.00
18	DBT RA (Molecular Genetic Diversity)	0.00
19	DBT RA (R. Thakur)	426781.00
20	Diabetic Neuropathic	(60678.00)
21	DST (J Medhi)	(63015.00)
22	DST (Suitable Plant)	(30848.00)
23	Education	(33598.00)
24	Electronic Alloys magnetic	38944.00
25	Flora & Fauna	(50567.00)
26	Food colour	(1153.00)
27	Govt of Assam	(140113.00)
28	Helfer Fibers	95869.00
29	Image Processing (Tabassum Y)	93047.00
30	Image Processing (LB Mahanta)	1205.00
31	Indentification	243522.00
32	Inspire Faculty (S Pramanic)	1596333.00
33	Inspire Fellow (Kangkana Bora)	(107570.00)
34	Inspire Fellow (Rosy Mondal)	864043.00
35	Inspire Fellow (Y bailung)	302581.00
36	Inspire Fellow (Tulsi Joshi)	302581.00
37	Inspire faculty (Sumita Sarmah)	460214.00
38	Inspire Faculty (Sagar Sarma)	172841.00
	Balance c/f	**5009759.00**

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Details "B"

BREAK UP OF GENERAL FUND AS ON 31ST MARCH, 2016

Sl. No.	Particulars		Balance (₹)
1.	**BALANCE IN CASH AND BANK**		
	Cash in Hand		50,000.00
	Balance with Banks		
	SBI Khanapara Branch		2,040,909.58
	SBI Khanapara Branch - Workshop		12,482.88
	SBI G.U. Branch - Upgrading		43,122.86
	SBI Garchuk - Seminar		66,111.00
	Vijaya Bank - Overhead/Miscellaneous		2,412,777.00
	Vijaya Bank - Travel		126,160.29
	Vijaya Bank - Conference		38,537.00
	SBI Khanapara - International Conference		10,929.00
2.	**LOANS, ADVANCES AND OTHER ASSETS**		
	Crest Award	343,770.00	
	TDS Receivable	127,923.00	
	Loans to Staff	3,117,193.00	
	C.Y. Advances		
	Advances against Expenditure of Grants	4,327,601.00	
	Advances for Equipments	2,787,032.00	
	Advances for Vehicles	50,000.00	
	Advances for Books	-	
	Advances for Building & Site Development	19,107,040.00	
	P.Y. Advances		
	Advances against Expenditure of Grants	311,681.00	
	Advances against Fixed Assets	200,000.00	
	Term Deposit	14,726,473.00	
	Fixed Assets Purchased but the same was not transferred to Capital Fund (The Difference is from F.Y. 2010-2011	3,982,173.04	
		49,080,886.04	
	Less :		
	Other Current Liabilities	1,719,334.00	
	Earnest Money	1,145,677.00	
		2,865,011.00	46,215,875.18
	TOTAL :		51,016,904.79

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SCHEDULE FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED ON 31ST MARCH, 2016

SCHEDULE " 6 " : SIGNIFICANT ACCOUNTING POLICES :

1. **ACCOUNTING CONVENTION :**

   The Financial Statements are prepared on the basis of historical cost convention, unless otherwise stated and on the Cash method of accounting.

2. **REVENUE RECOGNITION :**

   Income on interest bearing securities and term deposits is recognised on accrual basis as and when these are realised.

3. **INVESTMENTS :**

   Term deposits with Banks are taken as investments and valued at accrual basis.

4. **FIXED ASSETS :**

   Fixed Assets are stated at cost of acquisiton, inclusive of inward freight, duties and taxes and incidental and direct expenses related to acquisiton.

5. **DEPRECIATION :**

   (a) Depreciation on Fixed assets purchased/acquired/ constructed out of government grants is charged on Straight Line Method as per the rates specified under the Companies Act, 2013 except in case of library books, where depreciation is charged at the rate 20% as ano specific rate of depreciation on library books is given in Companies Act, 2013. Also, depreciation is charged for entire year on additions made to fixed assets during the year.

   (b) Depreciation is charged to Capital Fund by way of reducing the net value of fixed assets.

   (c) No depreciation is charged on assets sold/discarded/demolished or destroyed during the year.

   (d) Depreciation is charged only to the extent of 95% of the book value and thereafter, the residual valueof 5% is shown in the books as balance against that asset.

6. **GOVERNMENT GRANTS/SUBSIDIES :**

   (a) Grants are shown as income on realisation basis and expenditure thereof is charged to appropriate revenue heads. In the case of expenditure of capital nature out of such grants, the respective fixed assets are debited and credit to the same extent is taken to the Capital Fund.

   (b) Grants utilised during the year towards acquisition of fixed assets are credited to Capital Fund.

NOTES ON ACCOUNTS :

(i) Interest earned/accrued on term deposits on removal, if any, are accounted for.

(ii) No provision has been made in respect of Leave Salary.

(iii) Purchase of consumable items during the year are treated as expenditure and charged to revenue.

(iv) In the opinion of the Management, the current assets, loans and advances have a value on realisation equal or atleast to the aggregate amount shown in the Balance Sheet.

(v) Balances under Current Liabilities, Loans and Advances are subject to conformation /reconciliation /adjustments, if any.

(vi) No provision is made for contingent liability, except for cases where provision needs to be made, based on expert opinion.

(vii) Previous years figure have been rearranged and regrouped wherever considered necessary to facilitate comparison.

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

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STALE CHEQUES TO BE REVERSED

SBI Khanapara Branch A/c No. #943972 (Core Budget)

Year	Head	Name of Party	Date	CV No.	Cheque No.	Amount
2011-12	Works & Services	M/s Computech System	24/04/11	16	120879	18,401.00
	Contingency	A.O. (Telephone charges)	14/11/11	551	187510	2,718.00
	Works & Services	M/s. Thyssen Krupp Elevator Private Ltd	30/01/12	803	268208	13,600.00
	Salary	Branch Manager, South Ghy	29/02/12	904	268250	3,600.00
	Equipment Expense	M/s. UD Scientific	30/03/12	1103	902676	87,649.00
2012-13	Contingency	M/s. New Maa Kamkhya Art	24/01/13	907	321646	2,400.00
	Salary	Registrar Gauhati University	27/02/13	1076	793132	8,982.00
	Salary	Executive Engineer	27/02/13	1079	793135	40,926.00
2013-14	Works & Services	M/s. Pintu Hood	11/09/13	563	104145	3,080.00
	Works & Services	M/s. Kristi Nursery	24/12/13	1079	940718	3,370.00
	Equipment Expense	Superintendent of Taxes, Government of Assam	10/01/14	1219	001519	2,417.00
	Consumable	Head, SAIF	30/01/14	1267	382265	28,109.00
2014-15	Equipment Expense	AIMIL Ltd.	08/05/14	139	292784	95,506.00
	Contingency	M/s. Moments Creation	24/11/15	1221	418310	5,000.00
	Works & Services	M/s. Daffodil Nursery	27/01/15	1609	005853	21,115.00
						336,873.00

SBI Garchuk Branch A/c No. #260721 (Extramural Projects)

Year	Head	Name of Party	Date	CV No.	Cheque No.	Amount
2012-13	Consumable (Project : Citrus Fruits)	Jain Infosys P. Ltd.	21/02/13	723	040382	5,238.00
2013-14	Earnest Money Refund (IASST Fund)	M/s. International Certification Service	11/09/13	440	348218	4,445.00
	Consumable (Project : Ramalingswami)	North East Chemical Corporation	18/06/13	187	829665	4,744.00
2014-15	Consumable (Project : Peste-in-tea)	M/s. Jaldhara & Co.	04/12/14	517	679437	50,004.00
	Travel (Project : Diabetic Neuropathy)	Dr. J Kotoky	31/03/15	818	684459	10,143.00
						74,574.00

K. P. Sarda & Co. Chartered Accountants







For further details please contact

DIRECTOR

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