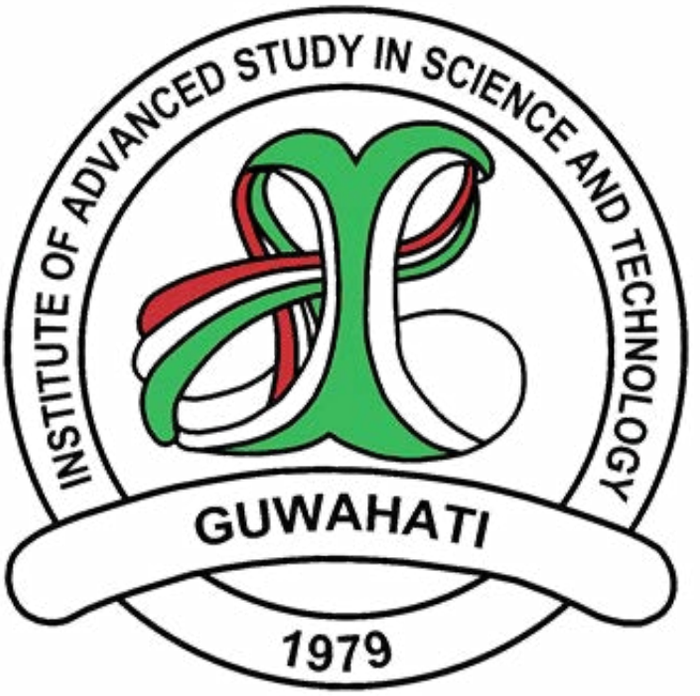
ANNUAL REPORT 2016-17

Institute of Advanced Study in Science and Technology (IASST)
An Autonomous Institute under Department of Science and Technology Govt. of India

As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.

- Albert Einstein

ANNUAL REPORT 2016-17



Institute of Advanced Study in Science and Technology (IASST)
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Contents

FOREWORD

It is a pleasure to present the Annual Report (2016-17) of IASST to the readers. The institute has completed seven years as an autonomous R&D organisation under the Department of Science and Technology, Govt. of India. As part of its continuous effort to fulfil the objectives of the institute, the bygone year also witnessed accelerated activities in all fronts. During the year, core and extramural grant, physical infrastructure and research facilities increased significantly and research approach captured issues of regional relevance under the five ongoing programs.

One main consideration behind taking over of IASST as a national institute was the need for creation of a centre of excellence with State-of-the art Research Facilities (SRF) in North-East India. During the year, sophisticated equipments such as confocal microscope, flow cytometer, transmission electron microscope and XF-24 were added to Central Instrumentation Facility (CIF) of IASST. Construction of a CIF building to house the SRF and installation of a 33 KVA dedicated line for uninterrupted power supply was taken up during this year. These facilities have enabled smooth conduct of research and output delivery in terms of quality of publication, laboratory training of manpower and motivation of science school/college teachers and students from different parts of North-East India.

Since 2013-14, the strength of core scientists has been around 18. However, faculties and postdoctoral fellows started growing in numbers and during the year, 7 national program faculties and 17 PDF joined IASST. The current research scholars on roll pursuing Ph.D. are 105 in numbers. This pool of researchers have published 89 peer reviewed papers with an average impact factor of 2.81 per paper. Eleven patents were filed and published during the year. Nineteen research scholars and scientists were supported to present research papers in international conferences held abroad and had undergone training in advanced laboratories. Sixteen eminent scientists delivered lectures and seven workshops were organised. This effort helped maintain a vibrant and scholarly environment in the campus and the scholars´ dream for scientific excellence. Out of 13 recipients of Ph.D. degree award, three joined as postdoctoral fellow (PDF) in prestigious laboratories abroad and five as PDF in reputed national institutes of the country. During the year, four researchers of IASST had joined as faculty in reputed research laboratories/ universities in India. These are pointers towards humble beginning of growth in quality of research and manpower in this young institute under DST.

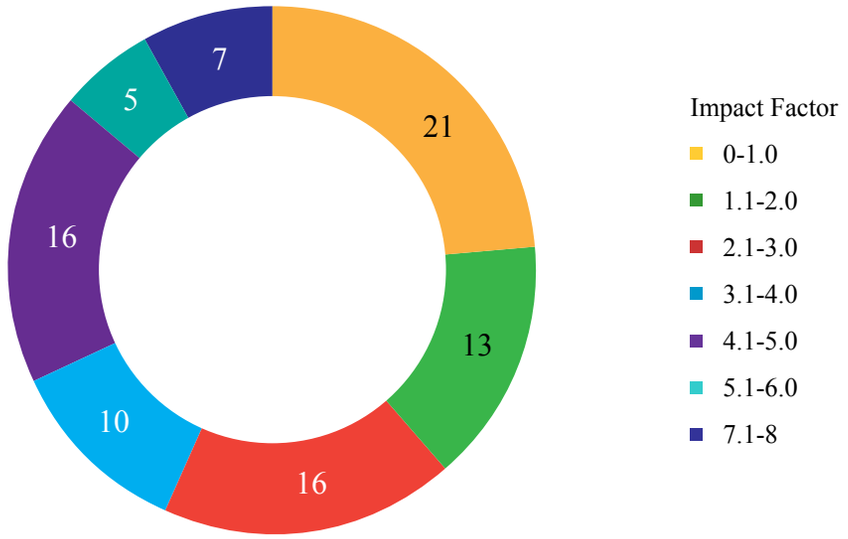
Quality of research and manpower is key to development of technology/innovation required for societal development. During the year, the institute developed 4 technologies of which a pilot scale production of agarwood oil in Guwahati Biotech Park started as a proof of concept with financial assistance from BIRAC, New Delhi. Based on these initial efforts it is expected that IASST will emerge as a national laboratory of high standard and repute to cater to science and technology need of the resource rich North-East region and the country within the time frame typically required for a new institute. Through its societal responsibility program, IASST is spreading awareness of science and technology for the benefit of society and took up outreach activities. Scientists of IASST taught class VIII- XII standard students of 8 schools in and outskirts of the city and hosted visit of 305 students and teachers from 14 schools/colleges of North-East India. In the National Science Day events organised on February 28th and March 1st in the campus, more than 3000 students participated. Two scheduled tribe villages about 20 km away from the institute campus have been adopted and the households are trained to adopt rural technologies such as round the year mushroom cultivation and Eri silk rearing and machine spinning of yarn. IASST's activities in these two adapted villages will continue for few years. Behind all these accomplished activities of the institute were my colleagues, staff and research scholars who put their best efforts. I also put on record the constant support and guidance received from members of Governing Council (GC), Scientific Advisory Council (SAC) and Building works Committee. Last but not the least, I thank all the member of the Annual Report preparation committee for their excellent work.

N. C. Talukdar

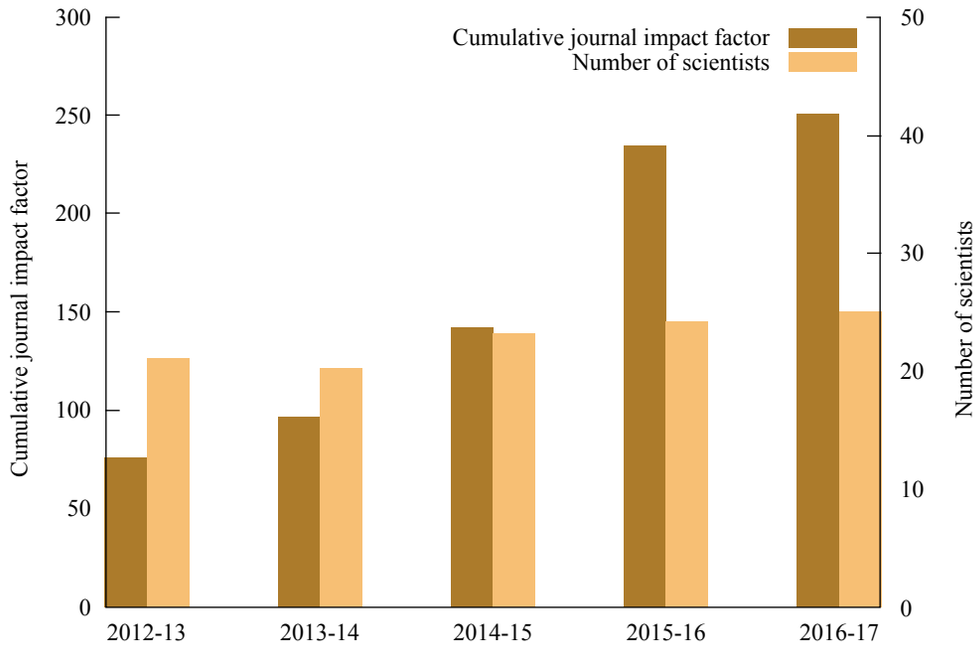
Director

RESEARCH OUTPUT AT A GLANCE

Distribution of journal papers over various impact factor ranges



Impact factor trend over last five years



Total no. of patents : 11 (published)

Total number of peer reviewed journal publications : 89

Total journal impact factor : 249.89

HIGHLIGHTS : 2016-17

Basic Research

- A novel technique for efficient excitation of dust acoustic solitons and socks has been developed.
- Biopolymer silk fibroin scaffold (SF) has been developed as an alternative template in place of traditionally used substrates such as glass and silicon in material development, device fabrication and sensing application.
- In topology, the notion of a metric function between points in multisets are investigated which can later on be useful in fileds like computer science.
- Bioactive fractions of Annona reticulata bark (ARB) and Ziziphus jujuba root bark (ZJ) possess neuroprotective ability and are found to be promising in treatment of diabetic neuropathy along with insulin.
- A study on effect of locally prepared distilled alcoholic liquor (Chulai) on the health of the tea tribes of Assam has produced results of significant implication on tea tribe health.

Innovation Research

- A liquid antifungal product has been developed and validated in commercial Tea plantations in Namrup, Udalguri and Sonitpur district of Assam.
- A highly absorbent, stable, flexible and compact bio-polymeric hydrogel bounded cotton patch is fabricated and found to be a promising bandage material.
- Natural Ramie and Pineapple fiber impregnated with natural hydrogel of Aloe-Vera origin and antimicrobial agents possess property for faster wound healing of surgical wound compared to that of commercial silk suture.
- An in vitro method has been designed for production of fragrant agarwood compounds by treating agarwood callus with a fungus named Fusarium.
- Developed a Decision Software System based on the Image Processing and Pattern Recognition method which would help in designing a comprehensive kit for on-spot screening of PAPsmear samples for cervical cancer.

Manpower generation

PhD awarded	:	13
M.Sc. Projects	:	10
B.Sc. Projects	:	08
Summer training	:	05
Post-doctoral placements	:	05 (national), 03 (abroad)

Academic and research promotion activity

- 16 scientists of national and international repute visited IASST and delivered lectures.
- IASST hosted/organized 15 seminar/workshop/training programmes for exchange of ideas and to ensure exposures at national/global level.
- 06 MoUs were signed with Universities/Research centres/Companies from Assam as well as other parts of the country for collaborative R&D work.
- 08 meetings were held at IASST during last year for policy development and activity enhancement.
- 19 members (scientist/student) presented research papers in conferences/seminars and received advanced training abroad.
- Altogether 305 nos. of students/teachers from 14 different schools/colleges from Assam and other north eastern states visited IASST laboratories.

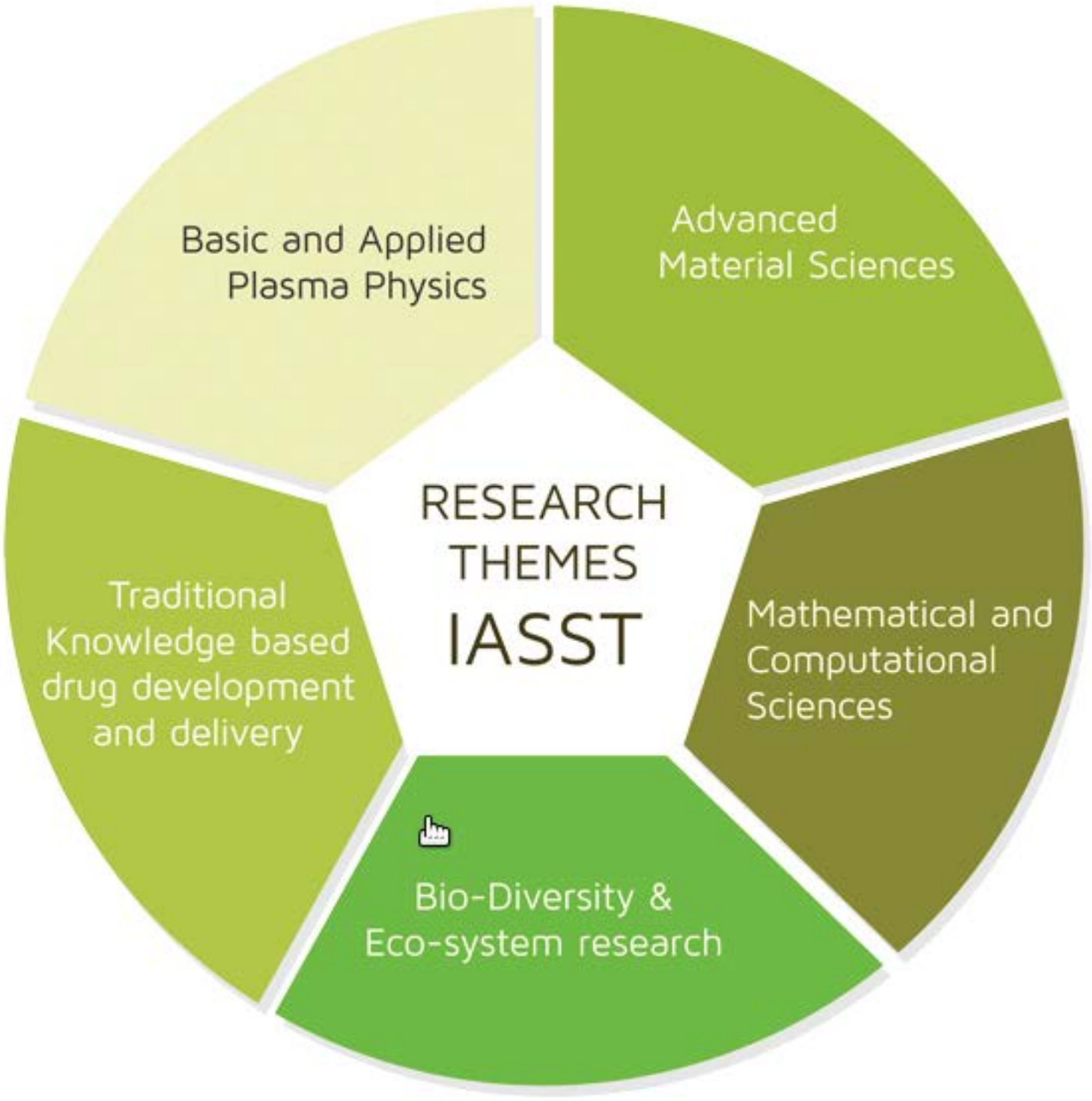
Infrastructure development

- In line with the Prime Minister's vision for a DIGITAL INDIA, the e-file module of e-office has been implemented at IASST.
- A modular integrated data centre has been established for hosting all servers and storages.
- Considearble progress has been made in construction of (a) the building to house central instrumentation facilities (CIF) (b) a dedicated 33 kVA dedicated powerline inside the campus.
- Confocal microscope, Flow Cytometer, Transmission Electron Microscope and XF-24 were added to CIF.

Outreach activities

- ST community outreach : IASST has adopted two ST villages located 20Km away from its campus and demonstrated round the year mushroom production, eri silk rearing and machine reeling of eri silk fibre.
- Academic outreach : IASST scientists visited several government schools within and in the outskirts of Guwahati city and delivered lectures and motivated the students towards pursuing career in science.

RESEARCH ACTIVITY



Basic and Applied Plasma Physics

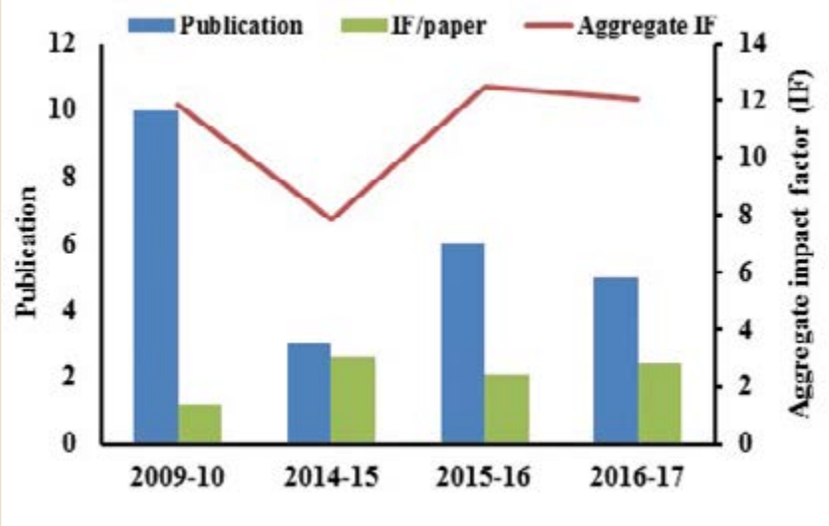
1st row (Front) L to R: Dr. Nirab Ch. Adhikary, Technical Offficer-B; Dr. Sumita Kumari Sharma, DSTINSPIRE Faculty; Prof. Joyanti Chutia, Emeritus Professor; Prof. H. Bailung, HOD, Physical Sciences. 2nd row L to R: Mr. Palashjyoti Boruah, JRF; Mr. Ibnul Farid, JRF; Mr. Abhijit Boruah, SRF; Mr. Bidyut Chutia, JRF; Mr. Tonuj Deka, JRF; Ms. Pallabi Pathak, SRF; Ms. Yoshiko Bailung, JRF; Ms. Binita Borgohain, JRF.

Absent in photograph : Mr. Rakesh Ruchel Khanikar, JRF.

Summary

Scientist (Core): 1 (M:1)
Scientist (Emeritus): 1 (F:1)
Technical Officer: 1 (M:1)
Scientist (National fellows) :
Inspire faculty : 1 (F)
JRF/SRF : 9 (M: 6, F: 3)

Referred Journal Publication : 5
Cumulative Impact factor : 12.046
Invited scientific/chief guest
/guest of honour lectures : 2 (national) & 1 (international)
International visits/ short term training/ conference with national/ International support : 5



The Basic and Applied Plasma Physics (BAPP) program at IASST mainly focusses on two broad areas A. Basic plasma science which mainly includes study of fundamental processes in low temperature laboratory plasma and B. Applied plasma science. The fundamental research mainly encompasses nonlinear processes such as sheath characteristics in ionospheric condition laboratory plasma produced using a magnetic filter, ion acoustic soliton, shock and Peregrine soliton (Rogue wave) in multicomponent plasma, and dust acoustic solitons, shock, Mach cone and vortex formation in dusty plasma. On the other hand, the applied plasma research is directed towards development of Proton Exchange Membrane Fuel Cell (PEMFC) by plasma process.

A. Basic Plasma Science

A.1 Magnetically filtered plasma

It is well known that magnetic filters are used to produce low density and low temperature plasma for variety of applications e.g. neutral beam injection, negative ion sources, ground based facilities for ionospheric plasma interactions etc. In IASST, we developed a plasma device equipped with a magnetic filter to study fundamental processes in low temperature plasma such as electron and ion sheath, production of electron free positive ion – negative ion plasma. The device is capable of producing plasma with density 10^5 – 10^8 cm^{-3} and temperature 0.2 – 1 eV. The plasma is produced in the source section of the device using filamentary discharge. The ions and low energetic electrons can pass through the magnetic filter and form plasma in the diffused section. Plasma parameters are measured with the help of Langmuir probe and emissive probe.
The variation of measured electron and ion density in the source and in the diffused section for fixed discharge condition (discharge current = 100 mA) is shown in Fig. 1. In the source, electron and ion densities are same ~ 2x 10^9 cm^{-3}. In the diffused section, electron density is reduced by two orders while ion density is reduced by one order.

The measured electron temperature and plasma potential in the source and diffused plasma across the magnetic filter are shown in Fig. 2. The electron temperature is reduced by a factor of 10 in the diffused plasma with respect to the source. The plasma potential, on the other hand,

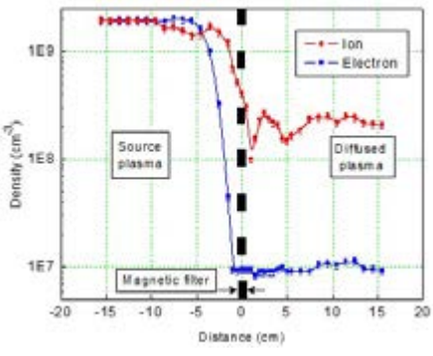


Fig. 1: Measured axial profile of electron and ion densities across the magnetic filter.

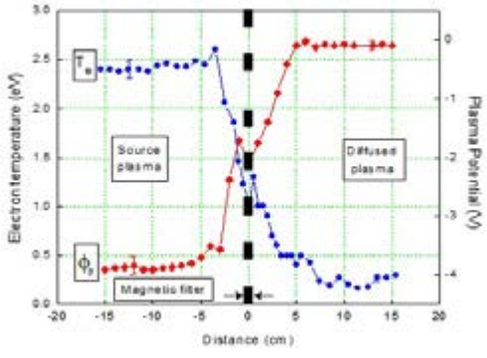


Fig. 2: Electron temperature T_e and plasma potential Φ_p profiles across the magnetic filter.

increases slightly in the diffused plasma. The observed results clearly demonstrates the effectiveness of the magnetic filter in reducing electron temperature and density compared to that of ions.

A.2 Wavelet analysis of ion acoustic rogue wave data

Rogue wave is a rare and extreme wave event observed in ocean with significantly high amplitude compared to the background wave. In multicomponent plasma we have observed ion –acoustic Peregrine soliton which is widely considered as a prototype of rogue wave. Recently we have observed the generation of multi-Peregrine solitons by effectively controlling the initial wave parameters. The wavelet analysis of time series data of the observed soliton is performed and is shown in Fig. 3 (a)-(c). The upper trace in each figure represents the time series data and the lower one represents absolute coefficient matrix (amplitude) in time and frequency plane. The results clearly show increasing number of soliton structures with increase in width of the applied pulse for constant carrier frequency and amplitude at a fixed probe position. The localization of wave energy in space and time domain is clearly observed. The results also show broadening of frequency spectra.

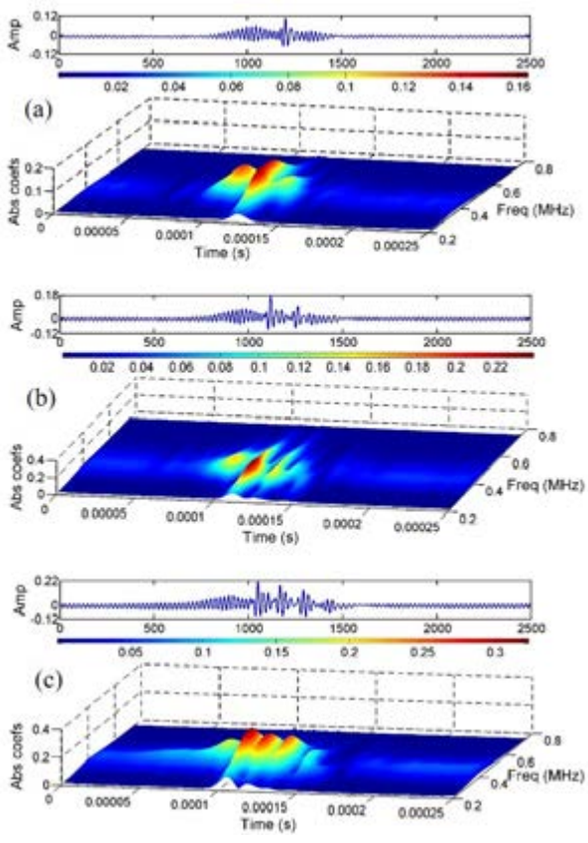


Fig 3 : Wavelet scalogram of the observed Peregrine soliton with different modulation frequency f_m of the applied signal. The upper trace in each figure reresents the time series data. (a) single Peregrine soliton for f_m = 18 kHz (b) two Peregrine solitons for f_m = 12 kHz and (c) three Peregrine solitons f_m = 9 kHz.

A.3 Head on collision of dust acoustic solitons in laboratory dusty plasma

Dusty plasma is one of the relatively fast growing research areas in the field of plasma physics because of its presence in space environment as well as in laboratory devices such as fusion reactor and industrial plasma devices. Dusty plasma contains nanometer to micrometer size dust particles along with electrons and ions. Presence of dust makes plasma more complex and collective effects lead to special features like strong coupling effects, phase transition, propagation of a new wave mode i.e. dust acoustic waves. In the nonlinear regime, dust acoustic waves can transform into dust acoustic solitons. Solitons are special kind of waves observed in every

nonlinear dispersive media which never changes its shape during propagation and survives a collision with other soliton. At IASST, we developed a novel technique for efficient excitation of dust acoustic solitons and shocks. In a recent experiments we have investigated head on collision between two unequal dust acoustic solitons in a dusty plasma with 5 micron diameter dust particle. A typical example of image sequence showing the observed collision process is presented in Fig. 4. Two solitons (dust density compression) move towards each other (t=100-330 ms) and then suffer head on collision (t = 400 ms). At the time of collision, they merge into a single density compression and get separated after some time.

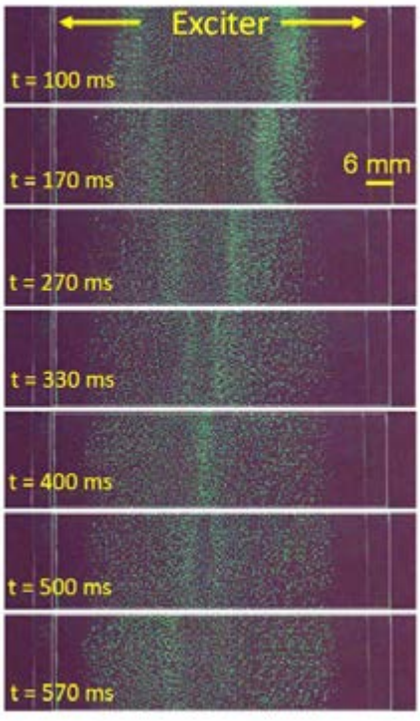


Fig. 4 : Image sequence at different times showing head on collision between two dust acoustic solitons of different amplitudes.

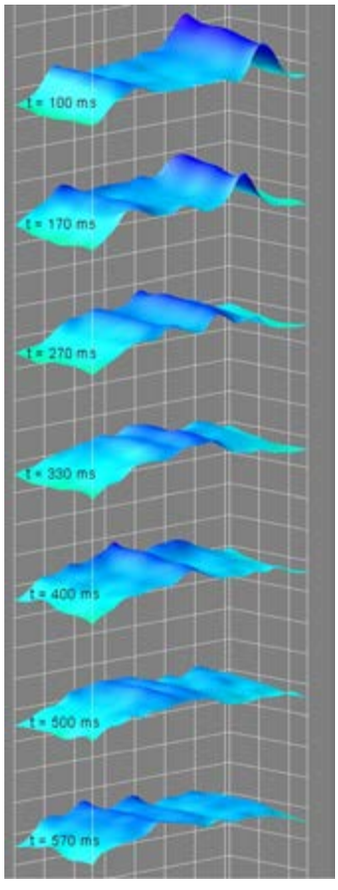


Fig. 5 : 3D pixel intensity profile at different time showing head on collision of unequal solitons.

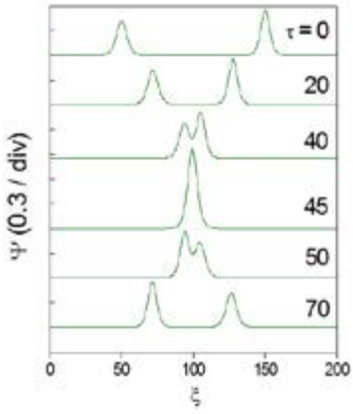


Fig. 6 : Numerical solution of KdV equation for head on collision of two solitons of different amplitude.

A 3D pixel intensity profile extracted from the images is shown in Fig. 5. The survival of the individual solitons after collision is clearly observed. We also investigate the collision process by numerically solving the KdV equation using two soliton solution as initial condition and is shown in Fig. 6. The experimental results are consistent with the theoretical description.

A.4 Observation of self-excited Mach cone in a dusty plasma

Mach cones are experimentally observed and studied in strongly coupled dusty plasma. They are generated spontaneously by heavier charged dust particles moving at a supersonic speed below the main dust layer. Two cones are seen to propagate to and fro, one behind the other, along with the moving dust particle. The top view of the observed Mach cone is shown in Fig. 7 at various time frames. The angle of the second cone is visibly smaller than the first cone but they both move with almost the same velocity. The velocity, V of the heavier dust particle is found to be in the range of (7.53 – 8.65) cms^{-1}. The angle of the observed Mach cone throughout the dust layer is found to vary between 35 and 45 . The dust acoustic velocity, C_{DA}, in our system is ~ 5 - 6 cms^{-1} for a pressure range of (0.5 – 2) Pa. Thus the Mach number, $M=V/C_{DA}$, lies in the range ~ (1.5 - 1.7), which confirms the supersonic behaviour of the moving disturbance. The Mach cone angles at various positions are consistent with the theoretical Mach angle relation, $\mu = \sin^{-1}(1/M)$.

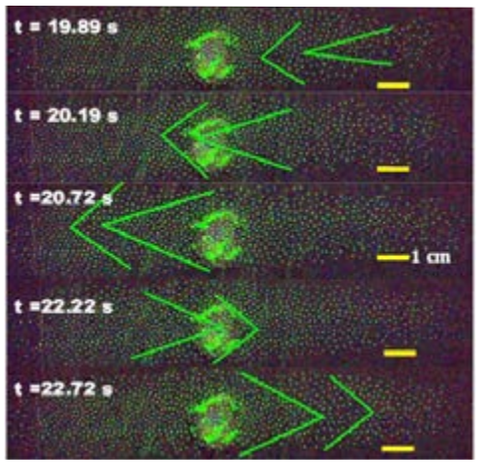


Fig. 7 : The position of the two Mach cones at 5 different time frames.

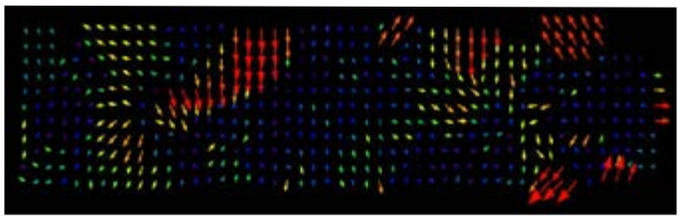


Fig. 8 : PIV analysis of two consecutive still images (t=20.69 s and 20.72 s) showing Mach cone propagation towards left.

PIV (particle image velocimetry) analysis of two consecutive frames (20.69 and 20.72 s) is performed (Fig. 8) which shows the actual movement of particles during the propagation of Mach cone. The first cone is a compression of particles moving outward in front of the void whereas the second cone is formed due to slight push of the particles in the backward direction. The particle positions in the image of PIV analysis corresponds to the Mach cone shown in the still image of t=20.72 s in Fig.7.

A.5 Theoretical investigation of dust ion acoustic soliton and shock

The stationary solution is obtained for K–P–Burgers equation that describes the nonlinear propagations of dust ion acoustic waves in a multi-component, collisionless, un-magnetized relativistic dusty plasma consisting of electrons, positive and negative ions in the presence of charged massive dust grains. In this work, we attempt to solve the problem of nonlinear dust ion acoustic waves in a multi-ion dusty plasma considering the relativistic effect. Here the K–P and K–P–Burgers equations are derived by using the reductive perturbation method including the effects of viscosity of plasma fluid, thermal energy, ion density and ion temperature on the structure of dust ion acoustic shock wave (DIASW). The existence of stationary soliton-like small

amplitude solitary wave is predicted by K–P equation whereas the K–P–Burgers equation predicts the evolution of shock-like structure. From the stationary solution of KP equation, the dependence of the solitary wave amplitude on the temperature of plasma constituent and the relativistic parameter γ (=v/c) are studied (Fig. 9). Also in the presence of kinematic viscosity of dusty plasma and negative ions in weakly relativistic regime, the 3D Burgers equation is derived. Analyzing the stationary solution of 3D Burgers equation numerically, a shock-like structure is seen. It is also seen that the relativistic effect enhances the amplitude of the shock wave and the kinematic viscosities of both the ions also play a key role in the structure of the shock wave.

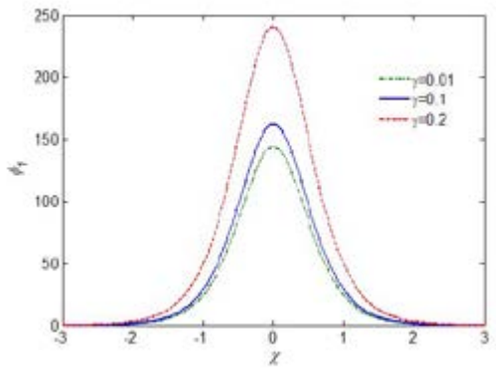


Fig. 9 : The dependence of spatial variation of the solitary wave amplitude for different relativistic plasma condition, dashed line is for γ =0.2, solid line is for γ =0.1 and dash-dotted line is for γ =0.01.

Finally, in the same plasma system we also examine the behavior of K–P–Burgers equation. It is seen that the stationary solution of K–P–Burgers equation contains three terms but the coefficients of tanh and $\tanh^2$ term determine the structure of the wave and here also a shock-like structure is observed. Also it is seen that the relativistic factor and ion temperature ratio control the structure and the amplitude of the shock wave. We hope this work will promote the researchers to carry out further work on the 3D relativistic multi-component dusty plasma related problems.

B. Applied Plasma Science

B.1 Synthesis of Plasma Polymerized Sulfonated Polypropylene PEM for PEMFC

A new kind of proton exchange membrane (PEM) prepared by plasma polymerization of propylene and sulfonic acid has been studied. The synthesis of propylene based PEMs is carried out by co-polymerization technique, using propylene and triflouromethane sulfonic acid (TMSA) in absence of argon plasma for the first time and their properties under different RF power. Although propylene monomer is aliphatic hydrocarbon, still it has some advantages like environment friendly, easy processing and bio-compatible. The membranes are prepared in a vacuum chamber, the base pressure of which is reduced to the order of 10^{-5} mbar with the pumping system. The working pressure is maintained at 0.16 mbar by controlling the amount of TMSA at 5:1 partial pressure ratio of propylene and TMSA during polymerization. RF source of 13.56 MHz is connected to the upper electrode of 10 cm diameter placed inside the chamber and the deposition takes place on the samples placed at the substrate below. Three types of membranes PP-PEM1, PP-PEM2, PP-PEM3 are prepared at 25, 50, 75 watt respectively for 5 minutes of deposition.

The existence of the sulfonate groups in the prepared membrane is revealed by the peaks at 1027 cm^{-1} and 1074 cm^{-1} in the FTIR spectra. The band at 907 cm^{-1} show aliphatic stretching vibrations.

The thermal stability of the membrane increases with the increase of RF power for deposition. The surface morphology study shows the surface structure is uniform at low power. To measure the proton conductivity, electrochemical impedence spectroscopy is performed and real impedance of the membrane is calculated from the Nyquist plot as shown in Fig. 10. The proton conductivity values of the three membranes are found to be 0.146, 0.210, 0.092 Scm^{-1} respectively. The conductivity depends on the sulfonation levels, water uptake and surface structure of the membrane.

The performance of the membrane is tested in a Fuel Cell Station under different conditions. The polymerization curves of the membranes are shown in figure 11. It is seen that the open circuit voltage (OCV) developed for plasma polymerized membranes PP-PEM1, PP-PEM2 and PP-PEM3 are 0.88, 0.92 and 0.95 volts respectively. Small increase in OCV for PP-PEM3 is due to low level fuel cross-over. It is seen that PP-PEM2 membrane has the best cell performance with power density of 610 mW cm^{-2} and current density 0.71 A cm^{-2} at 0.6 V (Fig. 11). The cell performance mainly depends on proton conductivity which is highest for PP-PEM2.

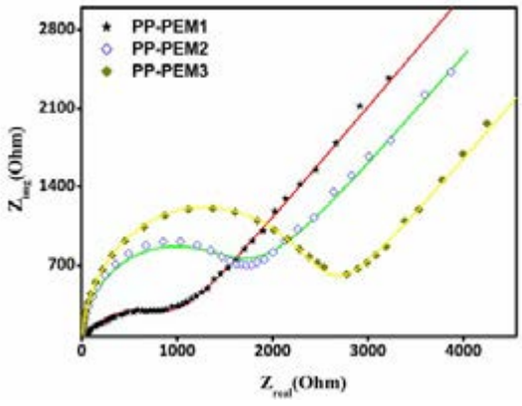


Fig. 10 : Nyquist Plots

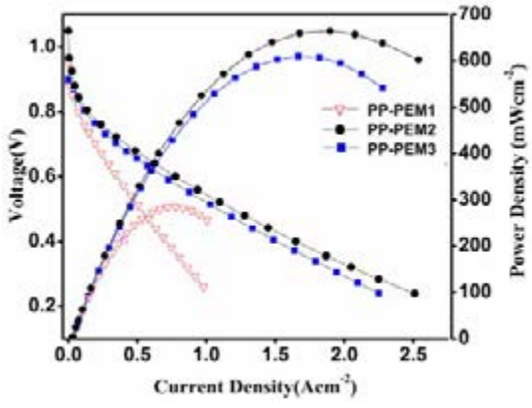


Fig. 11 : Polarizations Curves

Extramural projects

Completed projects

Title of the project	Funding Agency; Total fund; Duration; PI/ Coordinator	Achievement
Investigation on Rogue waves in multicomponent plasma with negative ions	DST Govt. of India; Rs. 29.754 Lakhs; 2013-2016; **Dr. H. Bailung**	1) Second order ion acoustic Peregrine breather with amplitude 5 times that of the background wave height (prototype of super rogue wave), has been observed for the first time in plasma. 2) The observed phenomena is compared with the rational solution of NLSE which shows good agreement. 3) Wavelet analysis of the experimental time series data clearly shows the energy localization to a smaller wave group focusing the amplification of wave amplitude. 4) The evolution of multi Peregrine soliton in multicomponent plasma has been observed for the first time. 5) The observed results are in consistent with the theoretical model developed using NLSE framework.
Investigation of some basic phenomena in a strongly coupled dusty plasma	DST, Govt. of India (INSPIRE Faculty Project) Rs. 35 Lakhs; 2012-2017 **Dr. Sumita K. Sharma**	1) A versatile device has been developed to investigate various fundamental processes in dusty plasma, 2) Characterization of rf plasma parameters, determination of dust charge, formation of plasma crystal, and excitation of dust acoustic wave have been studied. 3) Dust acoustic solitons have been excited and their collision processes (head on and oblique collision) have been studied for the first time in a strongly coupled dusty plasma. 4) First experimental observation of dust acoustic shock wave in a strongly coupled dusty plasma has been reported. 5) Generation of dust acoustic multi-solitons has been observed and studied for the first time.

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 cell by plasma process	SERB,DST, Govt. of India; Rs. 36 lakhs; 2015-2018; **Dr. 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 ºC and low fuel permeability.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/Year of publication
S. K. Sharma, A. Boruah, Y. Nakamura and H. Bailung	Observation of dust acoustic shock wave in a strongly coupled dusty plasma	Physics of Plasmas	23/053702	May/2016
D. Saikia, P. Dutta, N. S. Sarma, N. C. Adhikary	CdTe/ZnS core/shell quantum dot-based ultrasensitive PET sensor for selective detection of Hg (II) in aqueous media	Sensors and Actuators B: Chemical	230/149-156	July/2016
D. Saikia, S. Chakravarty, N. S. Sarma, S. Bhattacharjee, P. Datta, N. C. Adhikary	Aqueous synthesis of highly stable CdTe/ZnS Core/Shell quantum dots for bioimaging	Luminescence	32(3)/401–408	August/2016
A. N. Dev, M. K. Deka, J. Sarma, D. Saikia, N. C. Adhikary	K–P–Burgers equation in negative ion-rich relativistic dusty plasma including the effect of kinematic viscosity	Chinese Physics B	25 (10)/ 105202-7	August/2016
A. Boruah, S. K. Sharma, Y. Nakamura and H. Bailung	Observation of dust acoustic multi-solitons in a strongly coupled dusty plasma	Physics of Plasmas	23/093704	September/2016

No. of publications in conference proceedings: 5 (five)

No. of contributory papers presented in national and regional conferences: 7 (Seven)

No. of Conferences/Workshops/Meetings attended by the staff and students of BAPP: 21

Invited scientific talks

Dr. H. Bailung delivered the following invited talks-

1. 'Experiment on ion acoustic Peregrine soliton' in the 18th International Congress in Plasma Physics (ICPP-2016) held at Kaohsiung, Taiwan during 27th June - 1st July, 2016.
2. 'Ion acoustic rogue waves in multicomponent plasma and experiment on dust acoustic solitons' in the Institute for Plasma Research, Ahmedabad on 3rd February, 2017.
3. Dr. Nirab C. Adhikary delivered a talk on 'Smart nanomaterials for sensing and other applications' in the UGC sponsored national seminar on recent advances in material sciences and their applications held at B.N. College, Dhubri, Assam during 24th - 25th March, 2017.

Recognitions/Achievements

1. Dr. H. Bailung, Prof. & head was nominated as vice president of Plasma Science Society of India.
2. The Assessment Committee of DST-INSPIRE Faculty program considered 'excellent' grade to the final report of Dr. Sumita K Sharma on her DST Inspire Faculty project.

Advanced Materials Science

1st row (Front) L to R: Dr. Biswajit Choudhury (DST-INSPIRE Faculty), Dr. Devasish Chowdhury (Associate Professor II), Dr. Sagar Sharma (DST-INSPIRE Faculty), Dr. Arup Ratan Pal (Associate Professor I), Dr. Neelotpal Sen Sarma (Associate Professor II), Dr. Munima B. Sahariah (Associate Professor I), Dr. Sarathi Kundu (Associate Professor I).

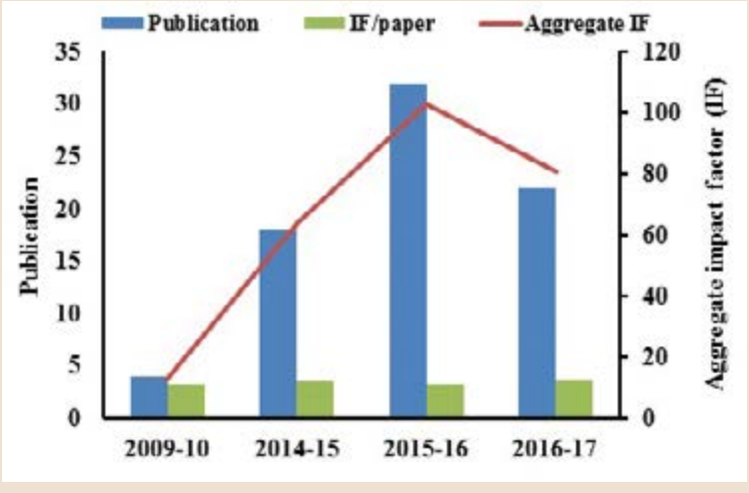
2nd row L to R: Mr. Ujjal Saikia (SRF), Ms. Upama Baruah (SRF), Ms. Sristi Majumdar (SRF), Ms. Bandita Kalita (JRF), Dr. (Md.) Abdul Barik (NPDF), Ms. Gautomi Gogoi (Project Assistant), Ms. Sweety Biswasi (JRF), Ms. Deepshikha Gogoi (JRF), Mr. Jayanta Sarmah Baruah (JRF), Mr. Suman Sarkar (JRF), Mr. Santanu Podder (JRF).

3rd row L to R: Bikash Sharma (SRF), Mr. Subhankar Pandit (JRF), Mr. Manash Jyoti Deka (SRF), Mr. Bablu Basumatary (JRF), Mr. Hrishikesh Talukdar (SRF), Mr. Samiran Upadhyaya (JRF), Mr. Ashim Ch. Bhowal (SRF), Mr. Bijoy Kr. Sah (JRF).

Not in the photograph : Mr. Achyut Konwar (SRF), Mr. Kaushik Das (SRF), Mr. Chabungbam S. Singh(SRF) and Ms. Parijat Borgohain (SRF).

Summary

Scientist (Core): 5 (M: 4, F: 1)
Scientist (National fellows): 3
Ramanujan fellow - 1 (M)
Inspire faculty - 2 (M)
NPDF/ BioCARe/RA: 1 (M)
JRF/SRF: 21 (M: 15, F: 06)
IASST alumni's placement: 8
Assistant Professor in Punjab University-1
Post docs: 4 (national) & 3 (international)
Referred Journal Publication: 22
Cumulative Impact Factor: 81.088
PhD awarded: 6
Invited scientific/chief guest/guest of honour lectures: 12 (national) & 1 (international)
Conference presentation awards: 1
International visits/short term training/conferences with national/international support: 6
Scientific manpower joined IASST from other national organizations: 1
Technology developed: 1



The thrust areas of research in Advanced Materials Science group at IASST are sensors, energy and environment, various aspects of soft materials and designing materials for Bio-medical application. Below are the glimpses of the accomplishments made during last one year.

A. Sensor Materials

Members of the Advanced Materials Science group are actively engaged in studying sensor materials for various applications. Each section below describes different such systems, the approach and application direction.

A.1 PVA-formaldehyde based polymeric composite sponge as sulphur dioxide vapour sensor : The utilization of ac electrical impedance technique for SO_2 vapour detection has been demonstrated for the first time using PVA-formaldehyde based polymeric composite sponge. The sensing material is developed by a simple one pot approach via utilization of 'green' precursor materials coumarin-6 and PVA. Polyvinyl alcohol formaldehyde (PVF) is chosen as a base material for the preparation of polymeric composites and presence of numerous hydroxyl groups in PVF leads to tuning of its surface properties for varied applications. A simple impedimetric technique has been utilized and the composite PVFCOU is found to exhibit a response time of 3 s for 400 ppt SO_2 and a LOD of 1.15 ppb SO_2 at an ambient condition. Further, the interaction is found to be of chemical nature as evidenced from FT-IR. The development of such cost effective materials together with its integration to some portable electrical devices can open up a new area for highly efficient multiple vapour detection system within a single frame.

Fig.1 : Schematic representation of the SO_2 vapour detection system

A.2 Fluorescence Sensor for Aromatic Amino Acids and organic and inorganic sulphur in analytes : A hydrophobic graphene quantum dots(h-GQDs) based PL sensor has been developed which can distinguish between aromatic and non-aromatic amino acids. The h-GQDSs prepared using Chemical Vapour Deposition method from acetylene gas and hydrogen gas was used as cocatalyst. It was observed that photoluminescence (PL) intensity of h-GQDs systems in the presence of aromatic amino acids is enhanced due to electron transfer from aromatic amino acids to h-GQDs whereas with non-aromatic amino acids PL intensity is quenched. Hence h-GQDs systems can selectively distinguish between aromatic and non-aromatic amino acid.

Another paper carbon dot (PCDs) based fluorescence sensor has also been developed which can distinguish between the organic and inorganic sulphur in analytes. PCDs were prepared from paper ash. Further, a conjugate paper carbon dot–Au3+ (PCD–Au3+) system was used to detect organic and inorganic sulphur-bearing analytes based on PL properties. It was found that the PCD–Au3+ system showed enhanced PL behavior towards organic and decreased PL behavior towards inorganic sulphur-bearing analytes. Thus this system could successfully detect and distinguish between organic and inorganic sulphur-bearing compounds. The system was successfully applied in the analysis of real samples like "milk".

A.3 2D materials for sensing water borne drug contaminants : The novel aspects of 2D materials beyond graphene have provided the motivation to investigate the potential application of a few experimentally synthesized 2D materials, namely, graphene, boron nitride (BN), silicene, and phosphorene as sensing materials for acetaminophen. Acetaminophen (N-acetyl-para-aminophenol), commonly known as paracetamol, is a widely prescribed analgesic and antipyretic medication administered for medium to severe pains related to backache, headache, arthritis and postoperative pains. Results based on first principles (DFT-D2) calculation hold promise and potential for future experimental research in the molecular sensing, especially in the treatment of drinking water, wherein the new class of 2D materials can be fabricated as molecular sieves for the uptake of water borne drug contaminants.

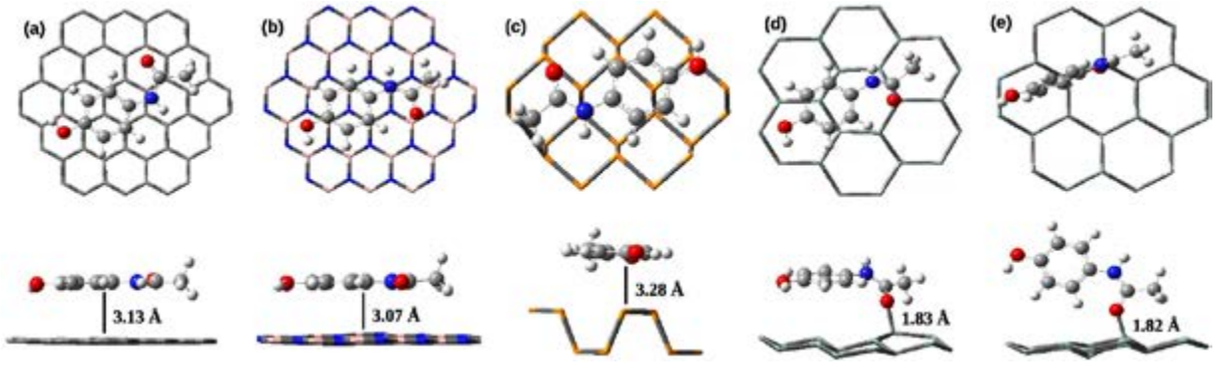


Fig.2 : Fragment of the cluster depicting equilibrium configurations of the acetaminophen/2D conjugate in water solvent phase: (a) graphene, (b) BN, (c) phosphorene and (d) silicene at parallel and (e) silicene at perpendicular orientations. The inter-planar distance is defined as the minimum distance between the two atoms belonging to the acetaminophen molecule and the cluster.

B. Energy and Environment

To contribute towards fulfilling the aggressive need of energy materials in the modern world and urgency to maintain/recover a clean/sustainable environment, attempts are being made by Advanced Materials Science group to understand new concepts of energy materials and environment friendly materials. Following are few categories of work.

B.1 Enhanced Light Harvesting Through Förster Resonance Energy Transfer in Polymer-Small Molecule Ternary System : A conceptually new approach for preparing ternary blend of polymer/small molecule/metal oxide using plasma nanotechnology is realized and utilized in the fabrication of a high performance self-powered broadband photodetector. Here, we demonstrate Förster Resonance Energy Transfer (FRET) effect in a polymer-small molecule system with Plasma Polymerized Aniline (PPA) and Rubrene, a small molecule. The high absorption of Rubrene in the visible region expands the spectral absorption and assists in developing nano-morphology for enhanced charge transport. The polymer absorbs in the UV region and non-radiatively transfers the absorbed energy to Rubrene by FRET effect. The time resolved photoluminescence study reveals efficient excitation energy transfer from polymer to small molecule occurring on a nanosecond timescale thereby confirming the occurrence of FRET. We also demonstrate the synergistic effect of FRET and energy cascade dominated mechanisms when used in the ternary structure (polymer/small molecule/metal oxide (TiO_2)) to realize high performance broadband self-powered photodetector with a very low dark current of 32 pA cm^{-2} and a high photoconductive gain at zero bias (Fig.3). This configuration has the potential to be directly utilized in traditional multiple donor/acceptor systems with separate spectral responses to work synergistically, thereby allowing an enhancement in both light absorption and photocurrent generation.

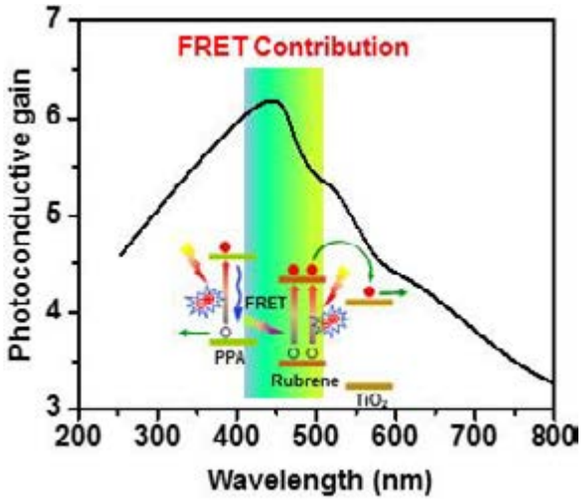


Fig.3 : Photoresponse of the fabricated polymer/small molecule/metal oxide ternary device.

B.2 A sulphonated carbon dot–chitosan hybrid hydrogel nanocomposite as an efficient ion-exchange film for Ca^{2+} and Mg^{2+} removal for purification of water : The carbon dots bearing thiol (–SH) functional groups has been developed for the first time using a one-step method from a novel carbon precursor viz. 11-mercaptoundecanoic acid. The oxidation and subsequent dispersion of the CDs in sodium hydroxide gave carbon dots with sodium sulphonate groups on the surface. These oxidized CDs were used to form a hydrogel with the biopolymer chitosan and fabricated into thin films. The oxidized CD-chitosan nanocomposite films were then successfully exploited as potential platforms for the separation of Ca^{2+} and Mg^{2+} from solution based on the principles of ion exchange. The film was also successfully used to remove Ca^{2+} and Mg^{2+} from a real environmental sample (pond water).

B.3 Study of the role of hydrogen diffusion in the temperature induced transformation of carbon nanostructures produced by fused hollow cathode cold atmospheric pressure plasma : Deposition of carbon nanostructures such as carbon nanofibers (CNFs) and carbon nanotubes

(CNTs) is carried out on inconel substrates at different experimental conditions of substrate pre-treatment using fused hollow cathode cold atmospheric pressure glow discharge (APGD) radio-frequency PECVD process. To carry out the deposition of these nanostructures a hollow cathode is specially designed for this plasma generation. The growth of the carbon nanostructure is carried out at 610 and 660 °C substrate temperatures on inconel substrates using C_2H_2 as precursor gas. Our results show that CNFs and CNTs could be synthesized at 610 and 660°C respectively irrespective of pre-treatment methods. HRTEM results indicate that a temperature-induced transformation of CNFs into CNTs occur when the growth temperature is raised from 610 to 660 °C (Fig.4). It has been observed that an increase in hydrogen diffusion (~44 % increase) into the substrates plays a pivotal role in this transformation where the Inconel substrate provides a sink for hydrogen atoms and it is a better sink at higher temperature. So, an increase in temperature from 610 to 660 °C will cause enhanced diffusion of hydrogen atoms into the substrate making hydrogen less available to terminate the dangling bonds in graphene planes, which leads to the formation of multi walled carbon nanotube (MWCNT) possible at this temperature. But, at 610 °C more availability of hydrogen at neighborhood of the substrate causes the termination of the dangling bonds leading to the formation of CNFs. Further, the field emission results show that most defective CNFs contribute to the maximum emission current density. The outer surfaces of CNFs are more defective due to the presence of the open edges of the graphene planes, which results in better field emission from the outer surfaces of the CNFs.

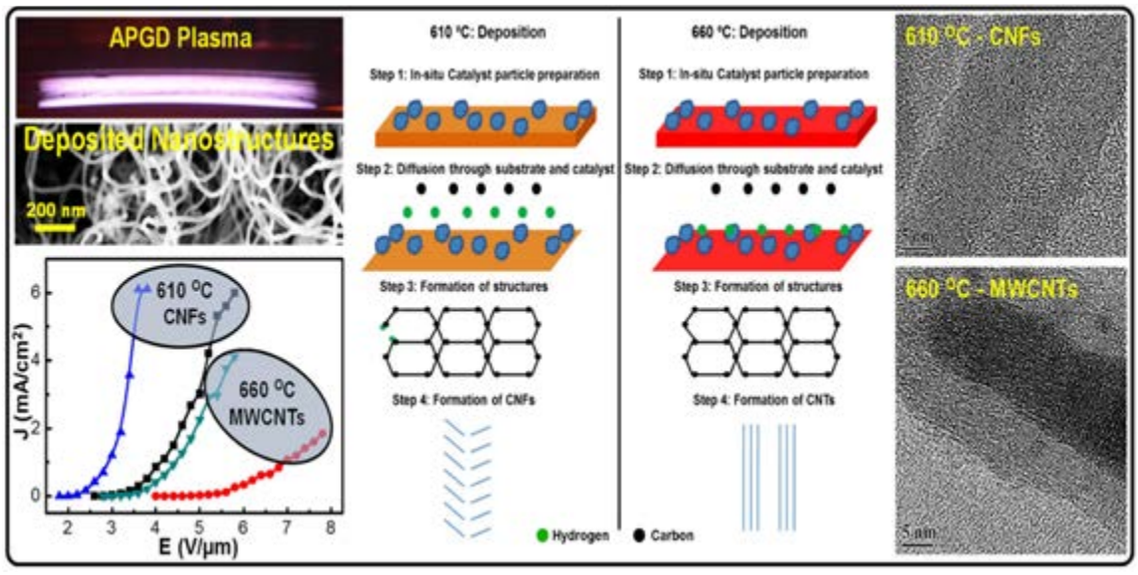


Fig.4 : APGD plasma, FESEM image of deposited nanostructures, field emission results, schematic of temperature induced transformation and HRTEM images of the nanostructures.

B.4 Plasmonic Photocatalysis : Utilization of complete solar spectrum for efficient solar to chemical energy conversion is realized by the advent of plasmonic photocatalyst. A carbon based hybrid nanosystem is constructed by ultrasonic treatment of a solution containing graphene quantum dots (GQD) and graphitic carbon nitride (GCN). Au nanoparticles (NPs) are deposited

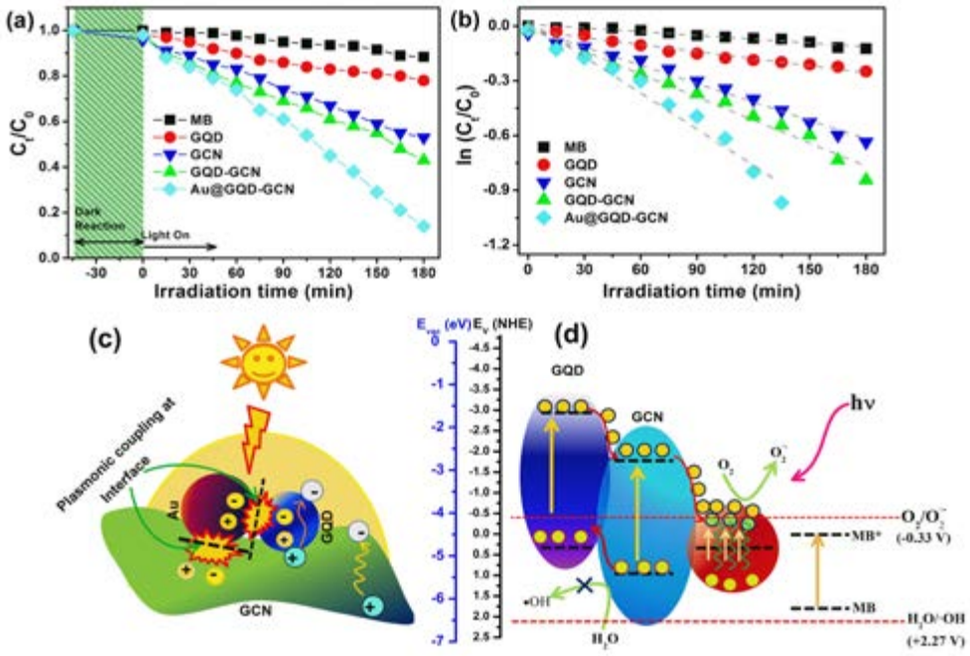


Fig.5 : (a) Photodegradation of MB over different catalysts. (b) Pseudo first order rate kinetics of MB photodecomposition. (c) SPR absorption under visible light and photoexcitation of carriers at the interface between Au-GQD-GCN in the plasmonic hybrid photocatalyst. (d) Schematic of band structure of plasmonic hybrid nanosystem with generation of radical species.

in-situ over the hybrid GQD-GCN by citrate reduction method. Strong surface plasmon resonance (SPR) absorption band of Au NPs cover the light spectrum from UV-Vis to NIR. GQD-GCN hybrid promotes substantial separation of carriers as evident from time resolved photoluminescence studies. Plasmonic activation of Au NPs facilitates charge transfer interaction and migration from GQD-GCN to Au NPs. The plasmonic based hybrid photocatalyst is quite effective in the removal of non-biodegradable methylene blue from water. It is seen that with catalyst loading of 6 mgL-1 and MB concentration 8 mgL-1, 86 % of MB decomposition is achieved for Au decorated GQD-GCN (Au@GQD-GCN) (Fig.5a). Moreover, the plasmonic photocatalyst has a first order rate constant (k) which is 6 fold higher than GQD and more than 2 fold higher than GCN or GQD-GCN (Fig.5b). Illumination of the plasmonic photocatalyst under visible light generates plasmonic hot spot at the interface of Au@GQD-GCN (Fig.5c). This hot spot triggers photoexcitation of carriers and charge transfer migration from GQD-GCN to Au NPs (Fig.5d). The carriers accumulated on Au NPs finally take part in the photodecomposition of MB.

B.5 Heusler alloy as a solid state cooling material : In present time, significant efforts are being invested to replace the conventional gas cooling technology with solid state cooling which is more efficient and environment friendly. The basic mechanism behind solid state cooling is the magnetocaloric effect which is nothing but the change in temperature of a magnetic material under adiabatic conditions through the application or removal of an external magnetic field. Ni-Mn-In

heusler alloy is one such material which shows large magnetocaloric effect and hence is a prospective material for solid state cooling devices. This alloy has been explored to understand its thermodynamics through modelling and simulation. Ni-Mn-In alloy has been doped with Cu to investigate the possible changes in the properties of the material. For this, eight different compositions have been optimized with supercell of 100 atoms.

B.6 Ethylene diamine mediated cobalt nanoparticle studded graphene oxide quantum dots with tunable photoluminescence properties : Preparation of graphene oxide quantum dot-inorganic nanoparticle hybrids is still an unexplored area of graphene-centred research. Demonstration has been made on ethylene diamine mediated in situ synthesis of cobalt oxide nanoparticles (Co_3O_4 NPs) studded on graphene oxide quantum dots (GOQDs). Ethylene diamine(en) is known to form a stable coordination complex with Co^{2+}. $CoCl_2$ was used as a precursor material for Co-nanoparticle formation as small sized Co^{2+} ions can enter the interlayer spacing between the graphene sheets. Ethylene diamine gets attached to the GOQDs via ring opening of epoxy groups on the GOQDs and pulls the Co^{2+} ions from the medium onto the GOQDs. On treating this system with hydrogen peroxide, GOQDs-en-Co_3O_4 nanoparticle composites with enhanced optical properties could be successfully prepared. The possible use of the system as a reversible on/off fluorescence switching material based on oxidation–reduction chemistry was explored and satisfactory results came up. Such systems are believed to act as model systems for quantum level graphene-inorganic nanoparticle hybrid nanocomposites with potential application in optoelectronic devices.

B.7 Organic electronic materials : Design of new types of organic semiconductor materials is important for the evolution of next-generation optoelectronic devices. Focus is to investigate the novel p-type as well as n-type organic electronic materials for their potential applications in OFET devices through computational and experimental approach. Selenium-containing fused bicyclic heterocycle, diselenolodiselenoles has been studied using quantum chemistry tools for their charge carrier properties. These compounds are found to be rigid having low reorganization energy in the range of 0.19-0.20 eV. They can display hole carrier mobility up to 0.027 $cm^2V^{-1}s^{-1}$ in organic field effect transistor devices which is close to the computationally predicted value of 0.083 $cm^2V^{-1}s^{-1}$. Further, based on our computational studies, we also put forward to design new types of n-type organic semiconductors by the linear combination of two electron deficient π-conjugated units, such as diketopyrrolopyrroles and thiadiazoles (Fig.6). The optimized molecular geometries of these new systems are nearly planar, and exhibit a relatively low band gap (1.7-1.9 eV). The electron affinities of these compounds vary from 2.0-2.4

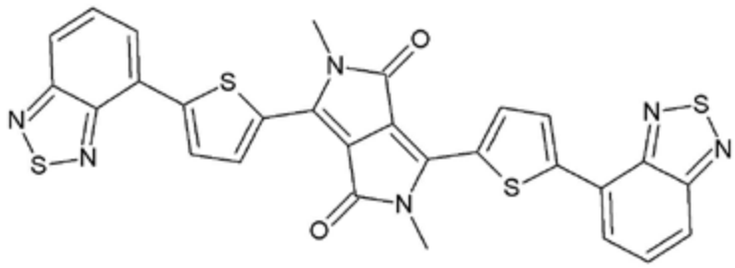


Fig.6 : Representative example of Diketopyrrolopyrrole and Thiadiazoles based compounds under study.

eV and ionization potential lies in the range of 5.7-6.0 eV. In addition, these compounds possess low electron reorganization energies (0.14-0.18 eV) as well as low hole reorganization energies (0.24-0.25 eV). The charge mobilities calculated according to the dimer model (at a distance of 4 Å between the dimers) showed that they possess relatively higher electron charge mobility (2.9-7.4 $cm^2V^{-1}s^{-1}$) as compared with hole charge mobilities (1.4-1.6 $cm^2V^{-1}s^{-1}$) and points their suitability as ambipolar n-type organic semiconductors.

B.8 Cu-Nb multilayered nanocomposite as structural material for extreme environment : Multilayered nanocomposites made of alternate layers of fcc and bcc metals are considered to be feasible structural materials for extreme environments owing to their enhanced mechanical stability at very high pressure/temperature conditions and ability to self annihilate radiation induced defects. In harsh environments, like in a nuclear reactor, defect plays a crucial role in the overall performance of the material. During last one year, focus is primarily on studying the behaviour of various point defects and their elemental interactions in fcc/bcc semicoherent interfaces. Cu-Nb nanocomposite has been considered as the prototype material. Formation energies of defects in optimized defect configurations give informations about which defect is favourable over the others. Binding energy data was useful to assess the defect-defect and defect-host interaction, with deeper understanding of the relative contribution from electronic structure and lattice distortion. Clustering of He atoms at a vacancy site is on the other hand governed by the trapping energy of that particular site. In general, a single metallic vacancy in the interfacial Nb layer was found to be capable of accommodating more He atoms than in the interfacial Cu layer.

C. Soft materials

Soft materials are fascinating system to study to explore basic sciences and are also important for having potential applications. Different structures and related properties obtained from such systems from their bulk and thin film conformations have been identified.

C.1 Monolayer collapse : A Langmuir monolayer can be considered as a two-dimensional (2D) sheet at higher surface pressure which structurally deform with mechanical compression depending upon the elastic nature of the monolayer. The deformed structures formed after certain elastic limits are called collapsed structures. To explore monolayer collapses at lower surface pressure and to see the effect of ions on such monolayer collapses, out-of-plane structures and in-plane morphologies of stearic acid Langmuir monolayers have been studied both at lower (≈6.8) and higher (≈ 9.5) subphase pH in the presence of Mg^{2+}, Ca^{2+}, Zn^{2+}, Cd^{2+}, and Ba^{2+} ions. At lower subphase pH and in the presence of all cations, the stearic acid monolayer remains as a monolayer before collapse, which generally takes place at higher surface pressure (π_c > 50 mN/m). However, at higher subphase pH, structural changes of stearic acid monolayers occur at relatively lower surface pressure depending upon the specific dissolved ions. Among the same group elements of Mg^{2+}, Ca^{2+}, and Ba^{2+}, only for Ba^{2+} ions monolayer to multilayer transition takes

place from a much lower surface pressure of the monolayer, however, as a remains as a monolayer for Mg^{2+} and Ca^{2+} ions. For another same group elements of Zn^{2+} and Cd^{2+} ions, a less covered bilayer structure forms on top of the monolayer structure at lower surface pressure. It has been found that the two conformations formed by the two different metal-headgroup coordinations coexist and the monolayer to trilayer or multilayer transformation takes place when the coverage ratio of the two molecular conformations changes from the critical value (pc) of ≈ 0.66. Such ion-specific monolayer collapses are correlated with the 2D lattice percolation model.

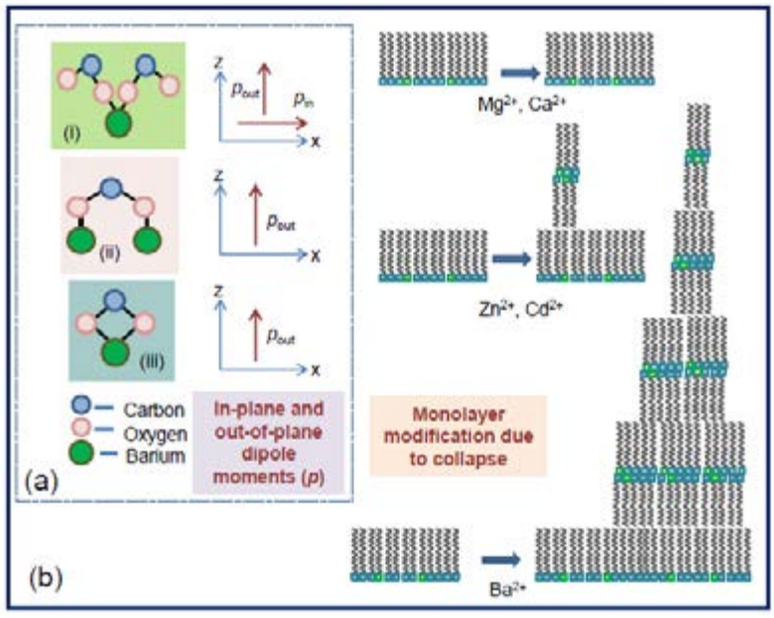


Fig.7 : (a) Cartoon to show the (i) unidentate, (ii) bidentate bridge and (iii) bidentate chelate coordinated head groups and the corresponding effective in-plane and out-of-plane dipole moment components. (b) Three different structural modifications of stearic acid Langmuir monolayer at higher (≈ 9.5) subphase pH and lower surface pressure (25 mN/m), i.e., formation of monolayer (for MgSt and CaSt), trilayer (for ZnSt and CdSt), and multilayer (for BaSt) structures.

C.2 Protein-protein interactions in presence of ethanol : Structures and interactions among globular proteins BSA and lysozyme are explored by small angle neutron scattering technique by varying ethanol concentration. It is seen that for both lower and higher BSA concentrations and in the presence of NaCl, combination of intermediate-range repulsion and weak long range attraction is responsible for the effective interaction behaviours with the variation of ethanol concentration. For lysozyme, interaction nature is same as BSA in absence of NaCl but in presence of NaCl, fractal structure factor explains the interaction behaviours.

C.3 Optical responses from protein-polyelectrolyte complexes : Globular proteins (lysozyme and BSA) and polyelectrolyte (sodium polyacrylic acid) are used to form protein-polyelectrolyte complexes (PPC). This study reveals that the thin films of PPC show a larger red-shift of 23 and 16 nm in the optical emissions in comparison to that of pure protein whereas bulk PPC shows a small blue-shift of ≈ 3 nm. A small amount of peak-shift is found to occur due to the heat treatment or concentration variation of the polyelectrolyte/protein in bulk solution but cannot produce such film thickness independent larger red-shift. Position of the emission peak remains nearly unchanged with the film thickness. Dissipation of energy through non-radiative ways is the most probable mechanism for such larger red-shift obtained in the emission spectra of protein-

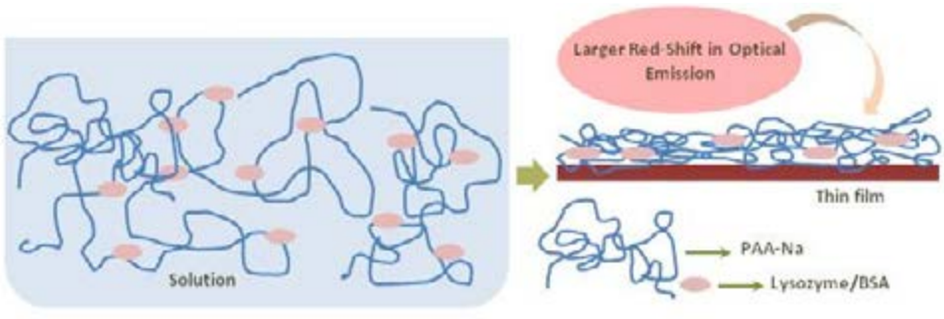


Fig.8 : Thin films of protein (Lysozyme/BSA)-polyelectrolyte (PAA-Na) complexes show larger red-shift in optical emission.

polyelectrolyte complexes in thin film conformation.

C.4 Growth of Gold nanoclusters and nanocrystals on protein surfaces : Thin films of proteins (BSA and lysozyme) are used to grow initially nanoclusters and in the later stage from nanoclusters to nanocrystals. It is observed that if different interaction times are provided between BSA thin films and HAuCl4 aqueous solutions, then initially formed tiny gold nanoclusters transform into nanocrystals of different shapes and sizes. Langmuir-like growth behavior is identified for both BSA and lysozyme films induced gold nanoclusters and nanocrystals formation and it is found that for BSA both have nearly the same growth dynamics, however, for lysozyme nanocrystal growth is relatively slower than nanocluster.

D. Materials for Bio-Medical Application

D.1 Carbon-Dot-Coated Alginate Beads as a Smart Stimuli-Responsive Drug Delivery System : A smart stimuli-responsive drug delivery system (DDS) has been successfully developed that can release drug depending upon the amount of pathogen (MRSA) present in the target. A greater amount of MRSA in the system will lead to more release of drug and vice versa. Carbon-dot-coated novel alginate beads (CA-CD) exhibiting superior stability was used as smart drug delivery vehicle. Garlic extract (GE), which contains allicin, was taken as model drug system to demonstrate the phenomena. It was observed that GE loading was 19 and 78% with CA and CA-CD, respectively. CA-CD-GE shows pH dependent controlled drug release, which results in increased therapeutic efficiency. CA-CDGE is not only stimuli responsive but also a controlled drug release system as it releases drug according to the pathogen concentration (MRSA). All the three factors viz. drug release, MRSA concentration and pH of the medium are interdependent as when the cell divides, it produces secondary metabolites that lead to the decrease in pH of the medium. The drop in the pH value triggers drug release from the beads. And the effect of the drug is reflected by the MRSA cell death. Hence, we demonstrate a smart stimuli responsive DDS. However, such DDS will be useful in cases where increased amount of pathogen in the system will lead to reduction in pH.

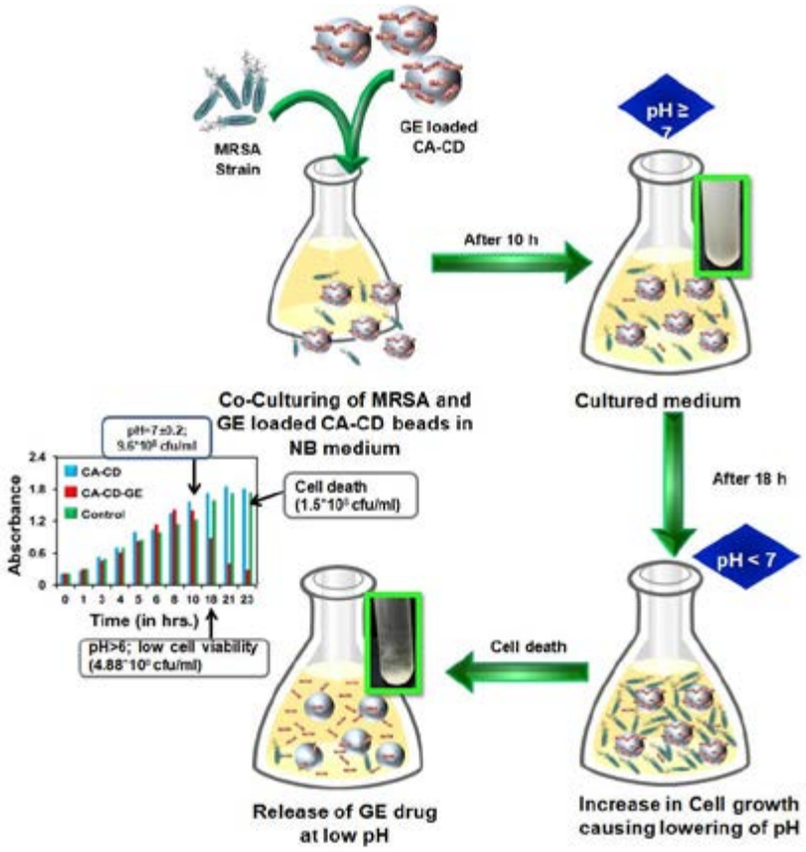


Fig.9 : Schematic representation to demonstrate the procedure used to show the working of smart drug delivery system.

Extramural projects

Completed projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Achievement
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**	We were successful in exfoliation of graphene from graphite. The exfoliated graphene were further subjected to functionalization to obtain reduced graphene (r-GO), acid chloride functionalized graphene oxide (GO-COCl), ester functionalized graphene oxide (GO-COOR), and amide functionalized graphene oxide (GO-CONH2). The impedance measurements were done on functionalized graphene by a simple layer-by-layer (LbL) assembly technique on silicon wafer substrate using chitosan as cationic binder. Further, the role of lateral dimension of the graphene sheet in a.c conductivity established. The electrical properties of exfoliated functionalized graphene were also tuned by interaction with π stacking organic molecule. We were successfully prepared Graphene Oxide Quantum Dots-Poly(vinyl alcohol) hybrid hydrogels as colorimetric sensor for Fe2+,Co2+ and Cu2+. In addition fluorescence based sensors using functionalized graphene quantum dots also developed.
Physico-chemical study of carbon dots and its application as sensors	DAE-BRNS, Mumbai 22.1 Lakhs; 2014-2017 **Dr. Devasish Chowdhury**	Synthesis of nanomaterials from different biological sources has already been mentioned in different publications but most of them involve the use of hazardous chemicals or high temperature. In this study we will try to use the biomaterials in a way which necessitate less or no chemicals, low temperature and less time for nanomaterial production. Such a facile method can be obtained with the assistance of microwave. We have successfully prepared few carbon based nanomaterials prepared from paper and ascorbic acid. The prepared paper carbon dots (PCDs) showed good photoluminescence intensity. The PCDs possessed negative surface charge which was successfully utilized to cap the same with Au3+ ions based on the electrostatic attraction between oppositely charged surfaces. This conjugate system was used to detect organic and inorganic sulphur-bearing analytes based on PL properties. It was found that the PCD-Au3+ system showed enhanced PL behavior towards organic sulphur bearing analytes like cysteine, methionine etc while decreased PL towards inorganic sulphur-bearing analytes like Na2S, H2SO4 etc. Thus this system could successfully detect and distinguish between organic and inorganic sulphur-bearing analytes. We also developed carbon dot coated calcium alginate beads (CA-CD) as smart drug delivery system. The system not only delivers drug at a particular pH but also the drug release depends on the number of pathogen cells. The more number of cell in the system results in more drug release.
Polymer and polymer nanocomposites: structure and property correlation	BRNS-DAE, Govt. of India; Rs 24.275 Lakhs; 2014-2017; **Dr. S. Kundu**	Structure, morphology, optical and electrical responses from polymer thin films are obtained in presence of biopolymers, nanoparticles, etc.
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.

Extramural projects

Ongoing projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
New n-type organic semiconductors for optoelectronics: Synthesis, characterization and device fabrication	DST, Govt. of India; Rs. 35 Lakhs; 2014-2019; **Dr. Sagar Sharma**	The aim of the research is to design and investigate new types of n-type organic semiconductor. It involves the computationally investigation of the properties of new n-type organic semiconductor, followed by their synthesis and possible applications in organic field effect transistor devices.
Development of Nanoparticle or Microparticle Adjuvanted Subunit Oral Vaccine against Poultry Salmonellosis	DBT, New Delhi ; Rs. 18.43 Lakhs; 2016-2019; **Dr. Devasish Chowdhury**	The present study has been undertaken with the hypothesis that the subunit vaccine formulation comprising whole outer-membrane protein (obtained from capsular type A and D of Pasteurella multocida) that are adjuvanted with either calcium phosphate nanoparticle or aluminum hydroxide nanoparticles or poly-lactide co-glycolide microparticles would confer protective immune in pigs against swine pasteurellosis. . In the present proposal it is hypothesized that calcium phosphate nanoparticle or aluminum hydroxide nanoparticle adjuvanted outer membrane protein vaccine would give strong antibody response and would replace the conventional alum adjuvanted vaccine.
Structure, pattern and elastic behaviour of model membranes in presence of nanomaterials	DST, Nano Mission, Govt. of India; Rs. 57.00 Lakhs; 2015-2018; **Dr. S. Kundu**	Aim of this research is to explore structure, pattern, mechanical and optical properties of lipid layer at interfaces in absence and presence of nanomaterials and biomaterials.
Plasmonic metal nanoparticles deposited hybrid nanosystem of 2D nanomaterials and metal oxide nanostructures and their photocatalytic activity under the illumination of visible light	DST, Govt. of India Rs. 35 Lakhs 2016-2021 **Dr. Biswajit Choudhury**	The aim of this project is to develop a hybrid nanosystem which can utilize the incident light of entire solar spectrum from UV-Visible-NIR for photocatalytic applications. Simple metal oxide based nanostructures suffer from poor absorption of visible light as well large charge carrier recombination. In this project we aim to construct a hybrid nanosystem of 2D materials with metal oxides or other carbon nanosystems decorated with plasmonic metal. The interface of the hybrid will help in charge separation, while size and shape tunable plasmonic metal can absorb visible and NIR light spectrum. This will make the photocatalyst effective in entire solar spectrum.
Electronic, magnetic and lattice dynamical properties of magnetic shape memory alloys	DST, Govt. of India; Rs. 26 Lakhs; 2013-2017; **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.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
S. Chakravarty, A. Datta and N. Sen Sarma	An electrical solid-state sulphur dioxide vapour sensor based on a polyvinyl alcohol formaldehyde composite	Journal of Materials Chemistry C	5/ 2871 - 2882	March/2017
S. Chakravarty, N. Bhardwaj, B. B. Mandal and N. Sen Sarma	Silk fibroin–carbon nanoparticle composite scaffolds: a cost effective supramolecular 'turn off' chemiresistor for nitroaromatic explosive vapours	Journal of Materials Chemistry C	4/ 8920 - 8929	August/ 2016
S. K. Parida, S. Sahu, S. Sharma	Regioselectivity of third-row main group dicarbides, C2-X (X = K-Br) for CO interaction: Fukui function and topological analyses	Chemical Physics Letters	659/216-220	August/2016

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
S. Debnath, S. Chithirave, S. Sharma, A. Bedi, K. Krishnamoorthy, S. S. Zade	Selenium-Containing Fused Bicyclic Heterocycle Diselenolodiselenole: Field Effect Transistor Study and Structure-Property Relationship	ACS Applied Materials and Interfaces	8(28)/18222-18230	June/2016
M.J. Deka, D. Chowdhury	CVD Assisted Hydrophobic Graphene Quantum Dots:Fluorescence Sensor for Aromatic Amino Acids	Chemistry Select	2, 1999 – 2005	February/2017
S. Majumdar, G. Krishnatreya, N. Gogoi, D. Thakur, and D. Chowdhury	Carbon dot coated alginate beads as a smart stimuli respon-sive drug delivery system	ACS Applied Material Interfaces	8, 34179−34184	December/2016
D.S Agarwal, N. Gogoi, D. Chowdhury, R. Sakhuja	Amino Acid Appended Cholic acid-Azobenzene Dyad: An Effective & Smart Phase selective Gelator for Aromatic solvents	RSC Adv	6, 76632-76641	August/2016
A. Konwar, S. Kalita, J. Kotoky, D. Chowdhury	Chitosan-iron oxide coated graphene oxide nanocomposite hydrogel: A robust and soft antimicrobial bio-film.	ACS Applied Material Interfaces	8, 20625-20634.	August/2016
U. Baruah, D.Chowdhury	Ethylene diamine mediated Cobalt nanoparticle studded graphene oxide quantum dots with tunable photoluminescence properties.	RSC Advances	6, 67102-67112	July/2016
S. Majumdar, U. Baruah, G. Majumdar, D.Thakur, D.Chowdhury,	Paper Carbon dots based fluorescence sensor for distinction of organic and inorganic sulphur in analytes	RSC Advances	6, 57327	June/2016
U. Baruah, D.Chowdhury	Sulphonated Carbon Dots-Chitosan hybrid hydrogel nanocomposite as an efficient ion-exchange film for Ca2+ and Mg2+ removal	Nanoscale	8. 8542	April/2016
K. Das, B. K. Sah, S. Kundu	Cation-induced monolayer collapse at lower surface pressure follows specific headgroup percolation	Phys. Rev. E	95 (2)/ 022804	February/2017
S. Kundu, V.K. Aswal, J. Kohlbrecher	Effect of ethanol on structures and interactions among globular proteins	Chem. Phys. Lett.	670/71	January/2017
A. C. Bhowal, S. Kundu	Time dependent gold nanoclusters and nanocrystals formation on BSA at solid-water and air-solid interfaces	Journal of Molecular Liquids	224/ 89	September/2016
H. Talukdar, S. Kundu, S. Basu	Larger red-shift in optical emissions obtained from the thin films of globular proteins (BSA, lysozyme) – polyelectrolyte (PAA) complexes	Appl. Surf. Sci.	382/ 121	April/2016
A. C. Bhowal, S. Kundu	Growth of gold nanoclusters and nanocrystals induced by lysozyme protein in thin film conformation	Chem. Phys.	475/ 77	July/2016
S. Kundu, V.K. Aswal, J. Kohlbrecher	Synergistic effect of temperature, protein and salt concentration on structures and interactions among lysozyme proteins	Chem. Phys. Lett.	657/ 90	May/2016
U. Saikia, M. B. Sahariah and R. Pandey	Stability of Cu-Nb layered nanocomposite from chemical bonding	Chemical Physics Letters	655–656/59–65	May/2016
S. Chabungbam, P. Borgohain, S. Ghosh, N. Singh and M. B. Sahariah	Martensitic transformation and magnetism in Ni and Fe-rich compositions of Ni-Fe-Ga shape memory alloys	Journal of Alloys and Compounds	689/ 199–207	December/2016
A. A. Hussain and A. R. Pal	Enhanced Light Harvesting Through Förster Resonance Energy Transfer in Polymer-Small Molecule Ternary System	Journal of Materials Chemistry C	5, 1136-1148	January/ 2017

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
B. Sharma, R. Kar, A. R. Pal, R. K. Shilpa, R. O. Dusane, D. S. Patil, S. R. Suryawanshi, M. A. More and S Sinha	Role of hydrogen diffusion in temperature-induced transformation of carbon nanostructures deposited on metallic substrates by using a specially designed fused hollow cathode cold atmospheric pressure plasma source	Journal of Physics D: Applied Physics	50, 1552017 (11 pp)	March/ 2017
B. K. Sarma, P. Barman, B. Sarma, A. Das, A. R. Pal	Biomimetic deposition of carbonate apatite and role of carbonate substitution on mechanical properties at nanoscale	Materials Letters	185, 387-388	December/2016

No. of publications in conference proceedings: 4 (four)

No. of contributory papers presented in international, national and regional conferences: 32 (Thirty two)

No. of Conferences/Workshops/Meetings attended by the staff and students of AMS: 31 (Thirty one)

Invited scientific talks

Dr. N. S. Sharma delivered the following invited talks-

1. 'Sensors developed from bio-based polymers' in the National Seminar On Advances In Chemical Science And Technology held at Jadavpur University and Bankim Sardar College, Kolkata during 12th -13th December, 2016.
2. 'Detection of Nitro-aromatic Compounds using impedimetric and fluorescence methods' in the National Seminar On "Chemistry in Interdisciplinary Research" held at Nagaland University during 16th -17th March, 2017.
3. 'Exploitation of nanoparticles on the swelling properties of Polymer gels' in the International Conference on Advances in Nanotechnology (ICAN) held at Assam Don Bosco University, Guwahati, Assam and Sustainable Nanotechnology Organization, Washington, DC on 11th January, 2017.
4. 'Nano Science & Nano Technology' in the Human Resource Development Centre: Gauhati University as a Resource Person for the Refresher Course on 24th March, 2017.

Dr. D. Chowdhury delivered the following invited talks-

5. 'Introduction to Hybrid Nanostructured Material' in the National Seminar on 'Recent Advances In. Material Sciences and their Applications' held in the Department Of Physics and Chemistry, B. N. College, Dhubri, Assam on 24th March, 2017.
6. 'Introduction to hybrid carbon nanomaterials' in the UGC-SAP (DRS III) sponsored National Seminar on Advances in Materials Science held in the Department of Physics, Gauhati University on 25th March, 2017.
7. 'Introduction to Hybrid Nanostructured Material' in the UGC-DAE CSR Kolkata Centre a thematic workshop on 'Advances in Nanostructured Materials: Applications and Perspectives'2016' held in Assam Kaziranga University, Jorhat, Assam during 1st -2nd June, 2016.
8. 'Carbon Nanomaterial' in the NEQIP project sponsored by AICTE, Advance Materials for Engineering Applications held in Assam Engineering College, Guwahati during l 25th -29th April, 2016.

Dr. A. R. Pal delivered the following invited talks-

9. 'Nanocomposite films for optoelectronic devices by plasma process' in the UGC-SAP (DRS-III) sponsored National Seminar on Advances in Material Science held in the Depertment of Physics, Gauhati University during 24th -25th March, 2017.
10. 'Plasma for nanomaterial synthesis and device realization' in the Depertment. of Physics, Gauhati University on 27th November 2017.

Dr. S. Kundu delivered the following invited talks-

11. 'Biopolymers in solutions and thin films' in the International Conference on Polymer Processing and Characterization (ICPPC – 2016) held in Mahatma Gandhi University, Kottayam, Kerala, India during 9th -11th December, 2016.

12. 'Structures at interfaces and in bulk' in the UGC-SAP (DRS III) sponsored National Seminar on Advances in Materials Science held in the Department of Physics, Gauhati University during 24th -25th March, 2017.
13. Dr. M. B. Sahariah delivered lectures on 'Some Basics of Condensed Matter Physics', 'Density Functional Theory' and 'Introduction to Quantum Espresso' in the Workshop on "High performance scientific computing" held in IISER Trivandrum during 6th -10th June, 2016.

Awards

1. Ms S. Chakravarty received 2nd best poster award in the National Conference on Recent Advances in NanoScience and Nanotechnology held in NEHU, Shillong during 8th -9th September, 2016.
2. Ms S. Chakravarty admitted as an associate member of the royal society of chemistry and is entitled to use the designatory letters AMRSC.
3. Ms U. Baruah and Mr. A. Konwar received CSIR-Senior Research Fellowship 2017.
4. Ms A. A. Hussain received National Postdoctoral Fellowship (NPDF) awarded by SERB, DST to carry out research work at IIT Indore.
5. Mr. T. Barman received Postdoctoral fellowship awarded by the FCIPT, Institute for Plasma Research, Gandhinagar, India.

Honours

Dr. S. Kundu chaired a technical session in the International Conference on Polymer Processing and Characterization (ICPPC – 2016), held at Mahatma Gandhi University, Kottayam, Kerala during 9th -11th December, 2016.

Other activities

Visits to national/international institutes/laboratories

1. Dr. S. Kundu visited BARC, Mumbai during 22nd -25th November, 2016.
2. Dr. S. Kundu, Mr. K. Das and Mr. A. C. Bhowal visited SOLEIL Synchrotron, France during 8th -10th February, 2017.
3. Mr. U. Saikia visited Michigan Technological University (MTU), Houghton, MI 49931-1295, USA during 9th May – 15th August, 2016.

Mathematical and Computational Sciences

1st row (Front) L to R: Dr. Tarini Kumar Dutta, Consultant professor; Dr. Lipi B. Mahanta, Associate Professor-I; Dr. Gautam Choudhury, Associate Professor-II.

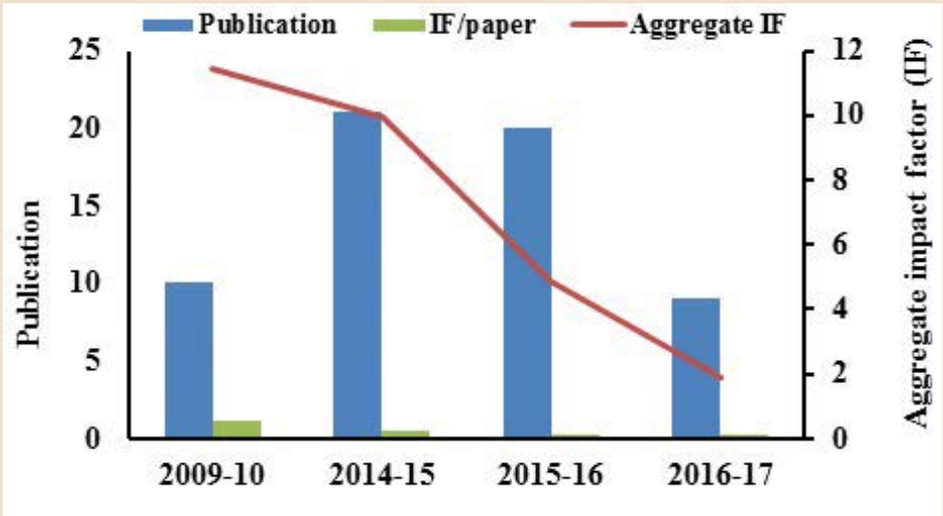
2nd row L to R: Ms. Karishma Shravan, JRF; Ms. Daisy Das, JRF; Ms. Silpisikha Goswami, JRF; Mr. Ajay Kumar Shaw, JRF; Ms. Snigdha Mahanta, JRF; Ms. Elima Hussain, JRF.

Absent in photograph : Priyanka Kalita, JRF; Kangkana Bora, JRF; Tabasshum Rahman, Women Scientist; Manas Das, JRF.

Summary

Scientist (Core) : 3 (M: 2, F: 1)
NPDF/ BioCARe/RA : 7 (M: 5, F: 2)
JRF/SRF : 10 (M: 2, F: 8)
Referred Journal Publication : 9
Cumulative Impact factor : 1.862

Invited scientific/chief guest/
guest of honour lectures : 1 (national)
International visits/ short term training/ conference with national/ International support : 1



Researchers within this programme carry out research in six major areas of mathematical sciences viz. Topology; Fuzzy set and its application; Dynamical Systems, Fractal Geometry and Chaos; Stochastic Process and Image processing. Fuzzy set and its application part is included in the interdisciplinary section.

A. Topology

Many fields of modern mathematics have been emerged by violating a basic principle of a given theory only because useful structures could be defined this way. A multiset is one of such concepts that has arisen violating the conventional assumption that every mathematical object occurs without repetition. Topologies on multisets can be useful in studying similarities and dissimilarities between objects which are multisets. We have studied many basic concepts on topological structures of multisets. Closed sets, which is a fundamental concept in Topology have been generalised in a Multiset topological space. This has given rise to many unique behaviours of Multiset Topology and also to modify the concept of intersection between two multisets to the notion of Quasi-coincidence. The notion of a metric (distance) function between points in multisets are also investigated which can be later proved to be useful in fields like computer science etc. We, at the same time endeavour to study if a metric can be defined in a multiset topological space which in turn generates the topology on that space. Such spaces are called metrizable spaces which are considered to be very well-behaved due to some of their beautiful characteristics.

B. Dynamical system, Fractal Geometry and Chaos

Dynamical systems and Fractal Geometry is a newly emerging interdisciplinary area of research in the field of Mathematical Sciences. A dynamical system is a branch of mathematics where we study time depending changes of an object in space. Fractal geometry is a branch which is beyond the Euclidean geometry to study the shapes of higher degree as well as having a different level of complexity. Both Fractal geometry and Dynamical systems have a long history of development and have provided fertile ground for many great mathematicians in order to link with other branches of science and technology. These two areas interact with each other and with the theory of chaos in a fundamental way. Many dynamical systems (even some very simple ones) produce fractal sets, which are in turn a source of irregular "chaotic" motions in the system. In our research work, we consider some nonlinear maps and nonlinear differential equations as models in order to study (i) their bifurcation behaviour leading to chaos, and (ii) $F(x) = \mu x e^{-\frac{c}{v}x}$ time series analysis and Lyapunov exponent for existence of chaos. In case of the model: we can have bifurcation diagram and strange attractor as shown in Fig 1.

Moreover, in many models, we have developed techniques so that chaos can be converted to a normal system as shown in Fig 2. In case of nonlinear differential equations in which more challenging problems can be created, a bifurcation diagram of the Duffing Nonlinear differential equation $\ddot{x} + \gamma(p1 + p2x)\dot{x} + \alpha x + \beta x^3 = \beta\, F\, Cos\, \omega\, t$

can be shown as in Fig 3.

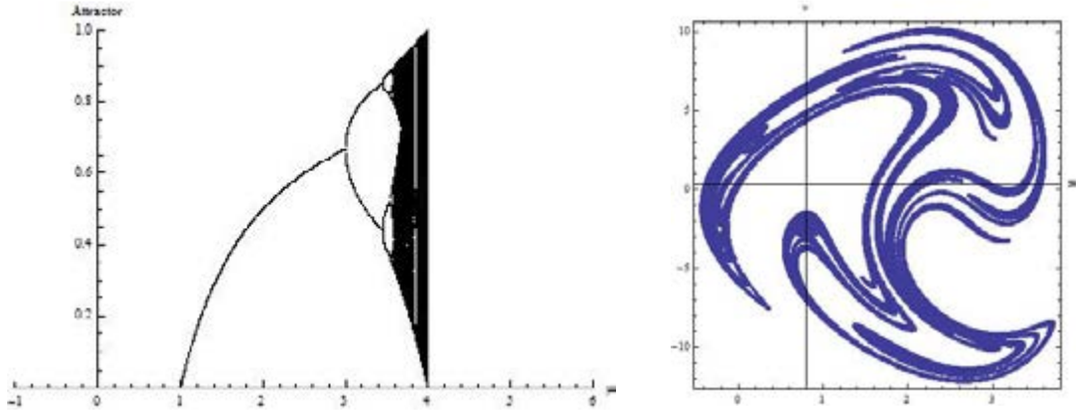


Fig 1 : (a) shows how a regular system emerges to a chaotic region via period doubling bifurcations. (b) shows the existence of a strange attractor of a nonlinear model.

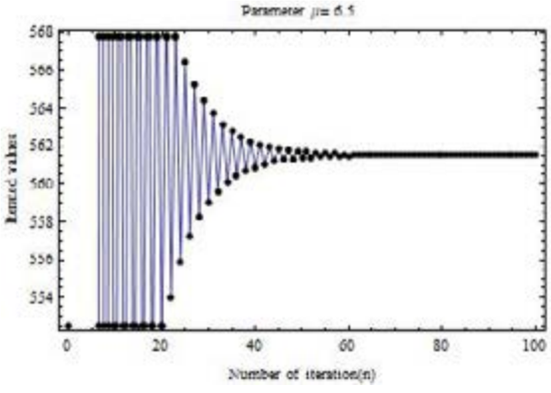


Fig 2 : Shows how chaos can be controlled and brought to a regular system.

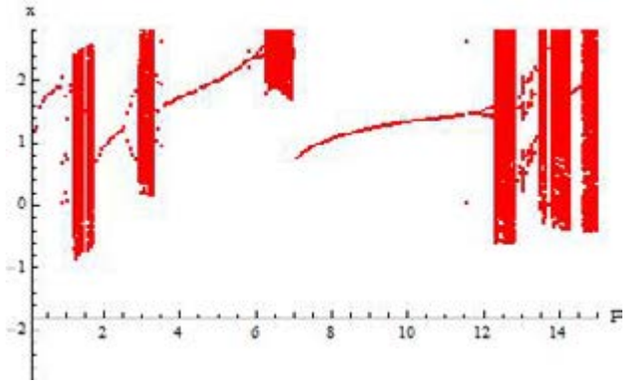


Fig 3 : Shows how a regular system goes to chaos and vice-versa in nonlinear differential equations.

We have also developed some useful techniques in order to study classification of chaos, dynamical properties and fractal dimensions by applying topological conjugacy and ergodic theory . In addition, other objectives are to study multi-structures of fractals observed in Nature, application in Graph theory, causes and remedy of different human diseases , etc.

C. Stochastic Processes

Queueing theory is an important area of current research which falls under the umbrella of one of the thrust area Stochastic Process Modelling for the vision of the Mathematical Sciences of

DST.In this context, various stochastic processes of a vacation model for two phase of service for unreliable server have been studied. Vacation models are characterized by the fact that the idle time of the server may be used for other secondary jobs. Different types of vacation models or policies with non-exhaustive service Discipline has been studied in the literature. However, we have investigated Bernoulli schedule discipline for two phase of service under randomized vacation policies.

Investigation of a new service policy for two type of heterogeneous service system has been carried out for unreliable server queue . In such a system the server provide two type of heterogeneous and in coming customer have an option to choose any one type of service . After completing the service by the customer , if he/she is not satisfied by his/her service , then he /she will get one more option to repeat its service .

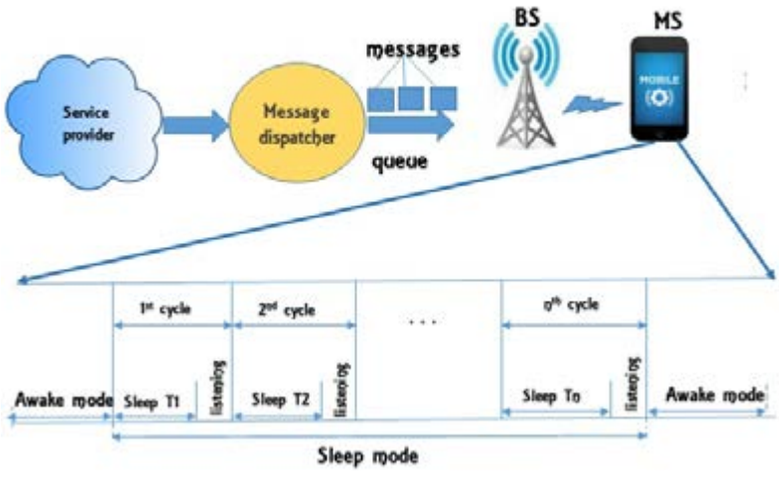


Fig 4 : Sleep model based IEEE802.16e sturucture

A random vacation policy vacation model has been studied for batch arrival single server queue showing application in IEEE 802.16e system (Fig 4). In random vacation policy, the server is allowed to take a maximum number, denoted by Y, successive vacations if the system remains empty after the end of a vacation. After completing Y successive vacations if the system is still empty, the server becomes dormant in the system and waits for the upcoming arrival. The maximum number of Y vacations taken by the server is a discrete random variable.

The steady state behaviour of Public hospital problems for state dependent service Markov processes has been studied using Markovian queueing model. This has potential applications in many real life situation. Also, we have investigated heavy-traffic approximations for large-scale service systems i.e. infinite server queueing system as a limiting case of existing model .

Another study is being conducted on Queue process on incoming patients in public hospitals. We studied an infinite Markovian model with time-varying rates. More specifically, the heavy-traffic approximations here are for large-scale service systems, having many servers and a high arrival rate. The main focus is on systems that have time-varying arrival rates. The system is considered under the assumption that there are alternating periods of overloading, which commonly occurs when service providers are unable to adjust the doctors frequently enough (due to leave or

attending other emergencies) to economically meet demand at all times. When the model parameters are constant, convergence to the steady state as time evolves is established.

Secondly, we consider a single server queue in a hospital environment whose service time is governed by a Markov process. It is possible that the server changes its service speed many times while serving a patient. Here we have been studied the order statistics for Waiting Time Distribution (WTD) where the pdf of single order statistics, cdf of joint pdf and pdf of extreme order statistics. The moments and recurrence relation of order statistics, the pdf of sample range and sample median have also been considered. We derive minimum and maximum order statistics of the service time of patients in the system using first step analysis to obtain an insight on the service process. Further, we use order statistics to compute performance measures such as average queue length and waiting time for severe diseases especially in the Outpatient Department. This result effectively establishes that as the number of server increases, then the utmost and the minimum waiting time of the patient's decreases. Also we illustrate the application of the simple Markovian model by using real hospital data.

Finally, we introduced a fractional order of simple Markovian model with severe patient, where the arrival rate of the patient is Poisson, i.e., independent of the patient size. It is also assumed that there exists a severe disease related arrival rate. We show the existence of the model, and also give a detailed stability analysis of hassle free service. A numerical example is also presented.

D. Image processing and Pattern Recognition in cancer

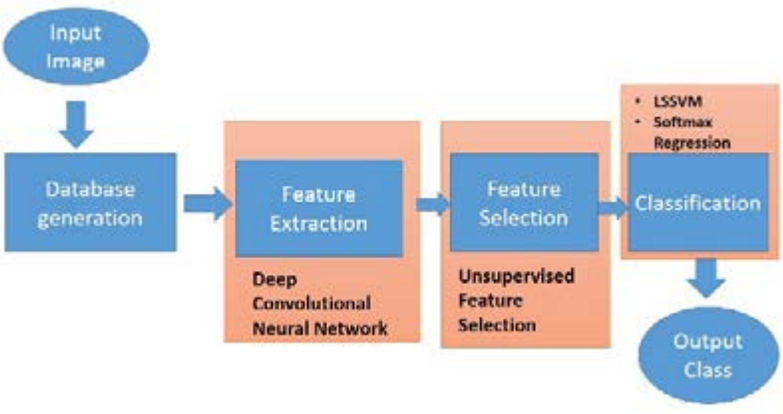


Fig 5. : Overview of Deep learning approach as applied to Pap images.

Cancer is a menace to the whole world and in India it has become difficult to remove this disease from society because of poverty, illiteration and lack of awareness. As a small contribution towards the total fight against this deadly disease, the team in IASST is striving to develop efficient and robust methodologies for diagnosis of cancer of different domains using Image Processing and Pattern recognition techniques, depending upon the suggestions of the clinicians and pathologists of the region regarding higher incidence and prevalence and also on availability of images.

D.1 Cervix cancer (conventional smear)

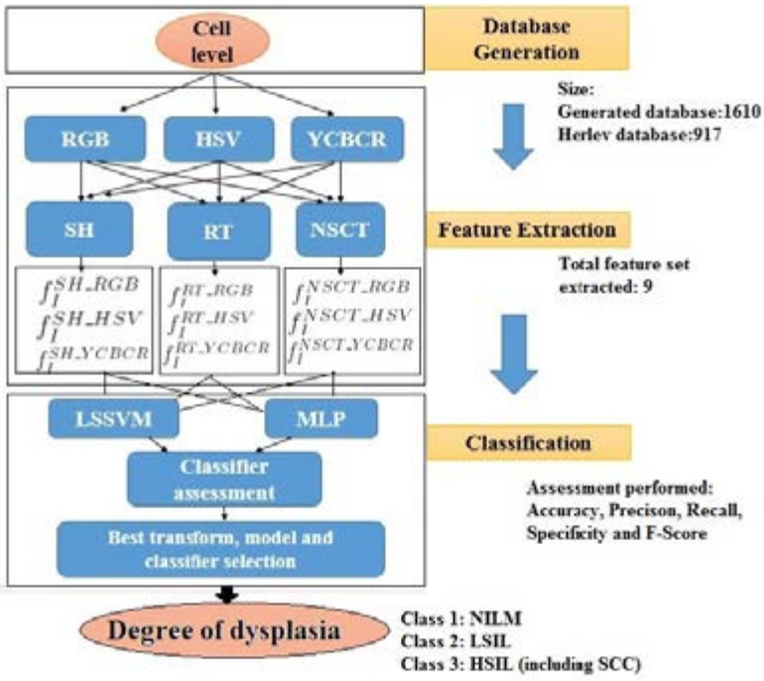


Fig. 6 : Overview of transform domain feature based approach as applied to Pap images.

Research work is in progress on Pap smear images taken by conventional method.

Based on Deep Convolutional Neural Network based features: This work presents the result of a comprehensive study on deep learning based Computer Aided Diagnostic techniques for classification of cervical dysplasia using Pap smear images. The overview is given in the Fig 5.

Based on transform domain features: Literature is rich in studying different feature extraction techniques to design automated classifiers of Pap smear images. However, hardly any detail study is reported so far on effectiveness of different advanced transform domain features in classification of Pap smear images. This motivates the current work where three transform domain features also termed as Multi-Scale Geometric Analysis (MGA) tools namely Shearlet (SH), Ripplet (RT) and Non-subsampled Contourlet Transform (NSCT) have been studied in detail and compared to select the best possible transform to represent Pap smear images (Fig 6).

D.2 Lung cancer

One of the objective of this research work is to compute continuous wavelet transform (CWT). The CWT values that we obtain can be used for various analysis, the implementation of CWT was initially done in Matlab. The problem with the Matlab code was performance, to calculate a data set of Million data points it takes substantial time. The only possible way to get speed up is to get a more powerful hardware to run the codes. But without powerful hardware we can reduce this computational time by optimizing and parallelizing the algorithm. To achieve speed up we have to shift to other programming languages(C, C++, OpenMP and MPI) that offer more control over the execution of the programmes.

To achieve speed up we have altered the algorithm so that we can take advantage of the symmetries that are there in the computation of CWT like the Hermitian symmetry, so we only need to compute one half of the algorithm. Restructuring, redundant value reduction, Strength reduction are carried out so that there might be more performances improvement. After

employing these techniques there is a 5X speed up of the CWT code.

D.3 Oral cancer

A research work is being done on biopsy images of oral cancer and as squamous cell carcinoma (SCC) is more prevalent the same is being studied. 409 more images were added to the existing database. Out of which 90 are images with normal cells and 319 are images with abnormal cells. A total of 94 textural features were extracted using histogram and GLCM approaches. For selecting significant features, two methods were employed, namely the t-test and the Principal component analysis (PCA), which is an efficient statistical data compression technique used for identifying a smaller number of uncorrelated variables. Using SVM classifier, we achieved 89.7% accuracy for data set generated by applying t-test and 100% accuracy for the PCA generated data set as revealed in Table 1.

Table 1 : Values of sensitivity, precision, recall and overall classification accuracy for the extracted texture

Feature Extraction Methods	Sources	Sensitivity	Precision	Recall	Accuracy
Histogram & GLCM	Feature set generated after applying t-test	0.94%	0.86%	0.94%	89.7
	Feature set generated after applying PCA	100%	100%	100%	100%

D.4 Breast cancer

Here two studies have been concluded this year. First a study was done to design of a method to extract breast border from Mammogram images. The steps involved :

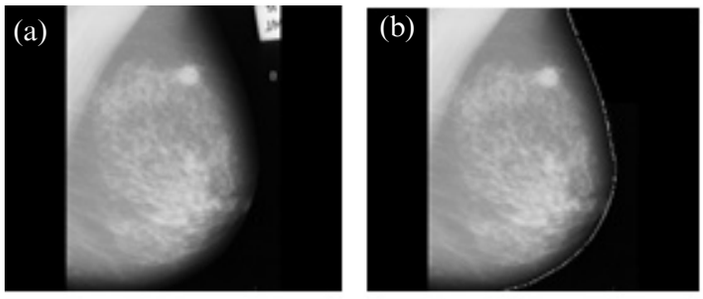


Fig. 7 : (a) Original Mammogram mdb202 (b) Mammogram with Extracted breast border.

Global threshold -> Morphological closing operation -> morphological erosion -> Erosion -> subtraction

The breast border extraction method is applied to 322 images of mini MIAS dataset. Out of the 322 images, proposed method detected boundaries correctly in case of 318 images. However partially correct boundaries detected in case of 4 images due to presence of some artifacts. The results are obtained based on the visual inspection of a trained radiologist. Fig 7 shows the result of successful breast

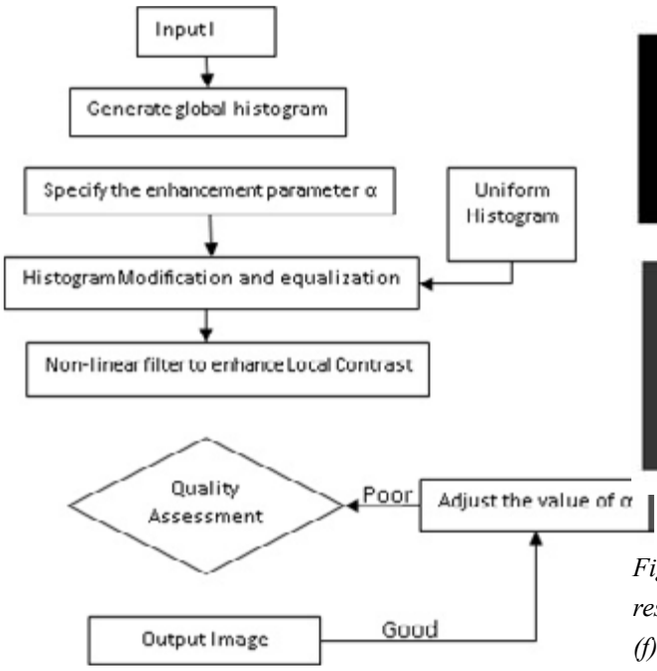


Fig. 8 : Flowchart of proposed Contrast Enhancement Method.

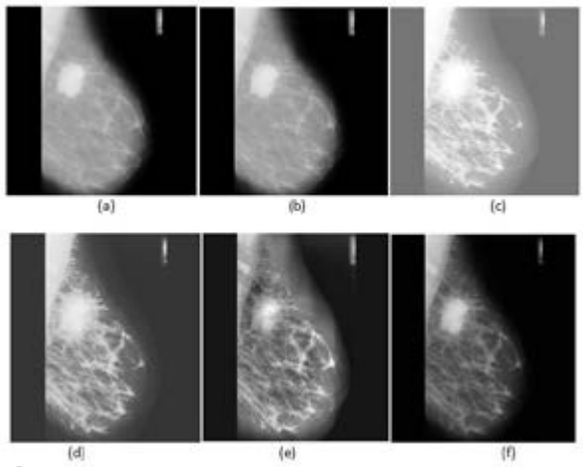


Fig. 9 : (a) Original image mdb184 (b) result of US (c) result of HE (d) result of BBHE (e) result of CLAHE (f) result of the proposed method.

border extraction for the image mdb28.

Another study was done to design of a contrast enhancement method to enhance low quality mammogram images. Mammogram images often come with low contrast making further analysis difficult. In this study a contrast enhancement method (Fig 8) is applied to enhance the mammogram images considering both local and global features. The enhanced mammogram image with different approaches is presented in Fig 9. From the figure it is clear that the proposed method performs much better enhancement than Histogram Equalization (HE), Brightness Preserving Bi Histogram Equalization (BBHE), Contrast Limited Adaptive Histogram Equalization (CLAHE) and Unsharp Masking (US). The performance matrices of Enhancement Measure (EME), Absolute Mean Brightness Error (AMBE), Peek Signal to Noise Ration (PSNR) and Discrete Entropy (H) are calculated.

D.5 Brain cancer

According to medical centers at the region medulloblastoma is the most common malignant tumor in children accounting for 18% of all brain tumors and 80% of all childhood tumors. It can be highly aggressive with a mortality rate of 100%. Our broad perspective is to detect the characteristics of the biopsy samples on grading, type of the tumor, its subtype and study any correlation with genetic variance. We are also studying to formulate a new grading system for this purpose. We have designed a classifier to distinguish between normal and abnormal cells of childhood medulloblastoma at smear level based on morphology properties of cells at cellular level with 90% accuracy. The classifier is built with 1771 individual ground truth nuclei feature set.

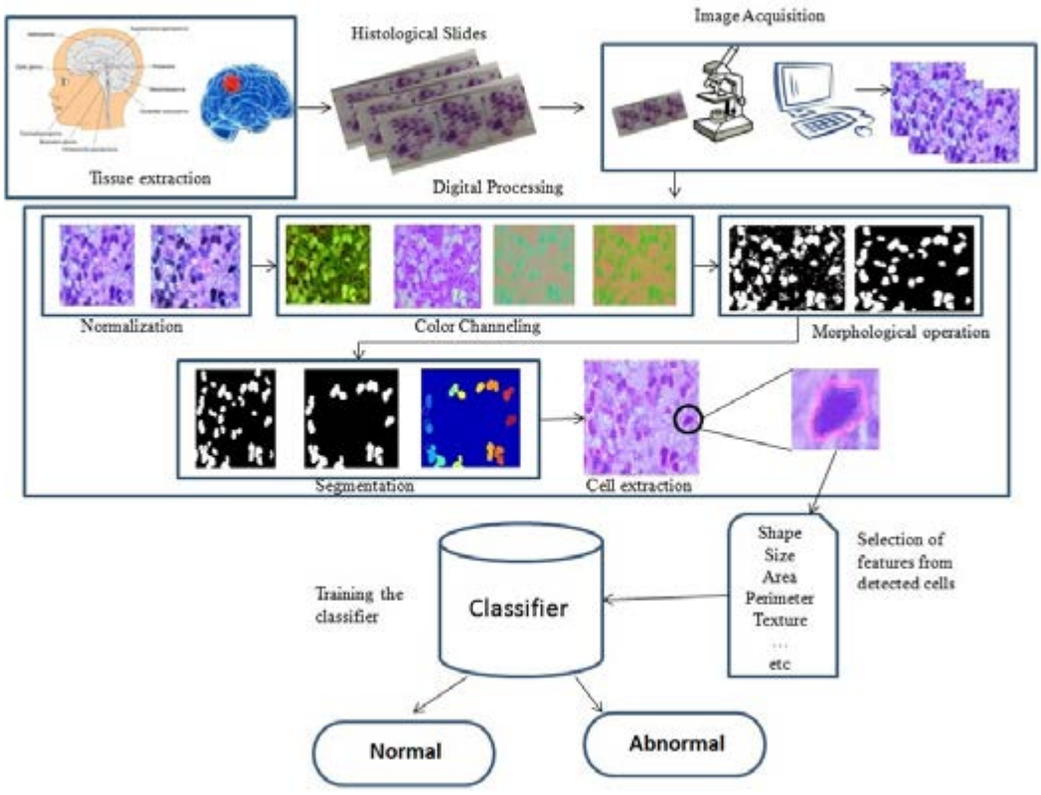


Fig 10 : Block diagram of the decision support system to classify between normal and abnormal cells of childhood medulloblastoma.

Since the classifier is based on ground truth therefore it is a trusted model. Further a working prototype GUI was created and tested with novel samples that was correctly able to classify between normal and abnormal samples by the classifier. We can also visualize the deviation of abnormal cells with respect to the normal cells by a graph plot (Fig 10).

D.6 Epdemiology of breast cancer

Another way of tackling the disease is the study and analysis of its pattern, causes and effects in defined populations. It is the essence of public health policy making. A study on Estimating Risk of Breast cancer at different ages applying survival Techniques have the objectives (i) To estimate the Cumulative risk of having breast cancer from the present age of a group of women up to age 70 and (ii) To find out the probability of breast cancer occurrences between the early menarche and late menarche group of female population. Present study reveal that with respect to the value of the shape parameter estimated from observations of our study, cumulative hazard of the women belonging to 35 to 50 years is higher than the early and late aged women. Further when we implemented the cumulative hazard function for different values of shape parameter; the cumulative hazard plot with shape parameters 0.5, 1 and 10 shows that cumulative risk for early aged women are greater than the late aged women; but when the value is increased from 10, the

opposite trend is observed, viz. the cumulative hazard for late aged women gradually increase from the early age women.

From the second part of the study it is found that probability of disease occurrence in the early menarche group is higher than the late menarche group. And the median age of the disease occurrence among the early menarche group is 52 years and for late menarche it is 54 years.

Extramural projects

Ongoing projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
On the development of an automated image analysis system for detection of cervical pre-cancerous and cancer lesions using liquid cytology based pap smear images.	DBT, Govt. of India; Rs. 50.93 Lakhs; 2016-2019; **Dr. Lipi B. Mahanta**	1. To design & develop a Decision Support Software for detection of cervical pre-cancerous & cancerous lesions. 2. To assess the impact of some risk factors (socio-economic, environmental, lifestyle, medical history, diet, anthropometry and hematology) of the patients. 3. To evaluate human papillomavirus (HPV) DNA testing as an alternative screening method.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
K. Bora, N. Rajbongshi, L. B. Mahanta, P. Sharma, D. Dutta.	Assessing the awareness level of breast and cervical cancer: a cross-sectional study in northeast India	Int J Med Sci Public Health. Online First: SCOPEMED doi:10.5455/ijmsph.2016.28012016409		April/ 2016
L. B. Mahanta, K. K. Das, S. Dhar	A queuing model for dealing with patients with severe disease	Electronic Journal of Applied Statistical Analysis ; DOI: 10.1285/i20705948v9n2p362	Vol. 09, Issue 02; 362-370	October/ 2016
N. Rajbongshi, D. C. Nath and L. B. Mahanta	Exploring Age Distribution Pattern of Female Breast Cancer Patients in Assam, India Using Gamma Probability Distribution Model	Journal of Applied Sciences DOI: 10.3923/jas.2016.496.503	Vol.16 (11): 496-503	2016
K. Bora, M. Chowdhury, L. B. Mahanta, M. Kumar Kundu, A. K. Das	Automated classification of Pap smear images to detect cervical dysplasia	Computer Methods and Programs in Biomedicine http://dx.doi.org/10.1016/j.cmpb.2016.10.001	138 ; 31–47	2017
S. Dhar, K. K. Das and L. B. Mahanta	An infinite server queueing model with varying arrival and departures rates for healthcare system	Int. Journal of Pure and Appl. Math	Vol 113 No. 5, 583-593	2017
G. Choudhury. and M. Deka	A batch arrival unreliable server delaying repair queue with two phases of service and Bernoulli vacation schedule under randomized vacation policy	International Journal of Services and Ope-rations Management	Vol 24 No.1, 33-72	2016
A. Mahanta , H. K. Sarmah and G. Choudhury	Mandelbort Set, Mesmerizing Fractal with Integer Dimension	International Journal of Applied Mathe-matics and Statistical Sciences	Vol 6 No.1, 2-18	2016
G. Choudhury and C. R. Kalita	A batch arrival unreliable queue with two type of general heterogeneous service and delayed repair under repeated service policy,	International Journal of Operational Research	Vol 13 No.3, 121-151	2016
T. K. Dutta and P. Prajapati	Period Doubling Bifurcation and its related Results on Rossler Nonlinear Three Dimensional System	International Journal of Advanced Scientific and Technical Research,	Volume 1, Issue 7	2017

No. of publications in conference proceedings: 2 (Two)

No. of contributory papers presented in national and regional conferences: 1 (One)

No. of Conferences/Workshops/Meetings attended by the staff and students of MCS: 13 (Thirteen)

Lectures delivered at other institutes

Dr T.K. Dutta delivered 3 lectures on ‘Metric Spaces’ in the Refresher Courses in Mathematical and Physical Sciences in Manipur University during 21st -22nd March 2017

Biodiversity and Ecosystem Research

1st Row (left to right): Wahengbam Romi (DST INSPIRE Faculty), Mojibur R. Khan (Associate Professor-I), Suresh Deka (Professor), N. C. Talukdar (Professor), Dipali Devi (Associate Professor II), Arundhuti Devi (Associate Professor-I), Soumyadeep Nandi (Ramalingaswami Fellow), Debajit thakur (Associate Professor-I).

2nd Row (left to right): Suravi Kalita (SRF), Chingakham Juliya Devi (CSIR-JRF), Tamali Sinha (CSIRJRF), Rabiya Sultana (JRF-MANF), Madhurankhi Goswami (JRF), Monalisa Kalita (JRF), Mehzabin Ali (Project Assistant), Anurupa Goswami (JRF), Sujata Deka (JRF), Tulsi Kumari Joishy (JRF, DST INSPIRE).

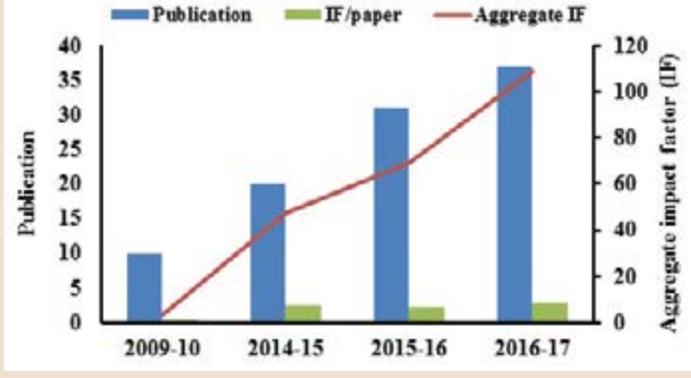
3rd Row (left to right): Suparna Sen (JRF), Anuska Khasnobish (Research Assistant), Atlanta Borah (JRF), Manashi Das (SRF), Gitumoni Devi (CSIR-SRF), Madhusmita Dehingia (SRF), Rupshikha Patowary (SRF), Priyanka Sarkar (JRF), Bhuwan Bhaskar (JRF).

4th Row (left to right): Yogesh B. Chaudhari (CSIR –SRF), Atanu Adak (Research Associate), Debyayan Deb (JRF), Kautuvmani Patowary (SRF), Anupam Bhattacharya (Research Associate), Shantanu Das (JRF), Simang Champramary (Research Assistant), Khanindra Sharma (JRF).

Absent in photograph: Hemen Deka (DST-SERB, Young Scientist), Nandana Bhraradwaj (DBT- Bio Care Women Scientist), Rupamoni Thakur (SERB-NPDF), Sailendrea Gayari (SERB-NPDF), Asim K. Dutta (SERB-NPDF), Supriyo Sen (DBT-RA), Sushmita Gupta (DBT-Women Scientist), Rictika Das (DSTDISHA, Women Scientist), Garima Raj (JRF), Ranjita Das (JRF-RGNF), Juri Saikia (JRF-RGNF), Kamal Das (Research Associate), Robinson S. Jose (Research Associate), Jintu Dutta (SRF), Priyanka Sharma (SRF), Monikankana Kalita (SRF), Rashmi Rekha Barua (JRF), Jilmil Baruah (JRF), Mihirjyoti Pathak (SRF), Gitartha Kaushik (SRF).

Summary

Scientist (Core): 6 (M: 4, F: 2)
Scientist (National fellows): 2
Ramalingaswmi fellow: 1 (M)
DST INSPIRE faculty: 1 (M)
NPDF/ BioCARe/RA: 7 (M: 5, F: 2)
JRF/SRF: 35 (M: 12, F: 23)
IASST alumni's placement:
Ministry of Environment and Forest - 2
Ministry of Power - 1
Regional Medical Research Centre (Dibrugarh) - 1
Referred Journal Publication: 37
Cumulative Impact factor: 108.934
Ph.D. awarded: 6
Invited scientific/chief guest/guest of honour lectures: 22 (national) & 2 (international)
Conference presentation awards: 4
International visits/short term training/conferences with national/international support: 4
Scientific manpower joined IASST from other national organizations: 4
Technology developed: 3
Startup grant: 1(BIRAC)



The program includes a wide array of research opportunities in the domain of sericulture/seribiotechnology inclusive of diversity of silkworm moth, effect of anthropogenic activity in ecosystem and environment on health of microorganism and higher organism within it, restoration of disturbed/polluted ecosystem. Other areas of research under BER are understanding range of diversity of bacteria in crop seeds and its role in different crop development stages, role of genetics, diet and geography on human gut microbiome and its health and Microbial prospecting for alternate energy.

A. Seri-biotechnology

A.1 Effect of pesticides exposure on silkworm: Tea plantation and chemical input intensive agriculture pocket of Assam receives high annual dose of pesticides to control insect pest. By means of wind drift, the silkworms of households near such pockets suffer as non-target of pesticide. Earlier we reported the negative impact of commonly used pesticides chlorpyrifos and cypermethrin on nutritional physiology, enzymatic activity, genotoxicity and commercial characters and yield reduction of Eri silkworm. In present study, we investigated mechanism of action of pesticide using Eri silkworm hemocytes. After 24 hours of exposure to chlorpyrifos and cypermethrin, activation of caspase and annexin affinity was observed in hemolypmph samples. The numbers of live cells were significantly higher in control group in comparison to pesticide exposed groups. However, in chlorpyrifos and cypermethrin exposed groups significantly higher caspase activated and apoptotic cells were observed compared to the control group. In order to confirm apoptosis in hemocytes exposed to pesticides annexin V assay was also performed. In control group significantly less numbers of apoptotic cells were detected compared to both chlorpyrifos and cypermethrin exposed groups. The result of this study might be useful in formulating pesticide application dose and strategy by keeping in view the productivity loss of sericulture industry from pesticides sprayed in teas plantation.

A.2 Phagocytosis activity of Muga silkworm hemocytes as an immune response against pathogenic bacteria: In previous study, *B. thuringiensis*, *P. aeruginosa* and *S. aureus* were detected as pathogenic bacterial strains associated in gut of Flacherie diseased Muga silkworm. In this study, immune response of silkworm against these pathogenic strains was evaluated by in vivo and in vitro phagocytosis assay. In in vivo experiment, silkworms were injected with 104 CFU/ml of pathogenic strains separately followed by injection with a diluted latex bead solution after 24 hours. A non-pathogenic E. coli (ATCC 25922) strain was used as control in both the experiment. Phagocytic activity as revealed by bright green color fluorescence inside the hemocytes was observed in all treatment but the phagocytosis activity of the treated groups; *B. thuringiensis*, *P. aeruginosa* and *S. aureus* was significantly higher than that in controls. Phase contrast images confirmed the phagocytosis in hemocytes of each control and treated batch (Fig.1). Similarly, in *in vitro* assay control group showed less phagocytosis activity but phagocytic

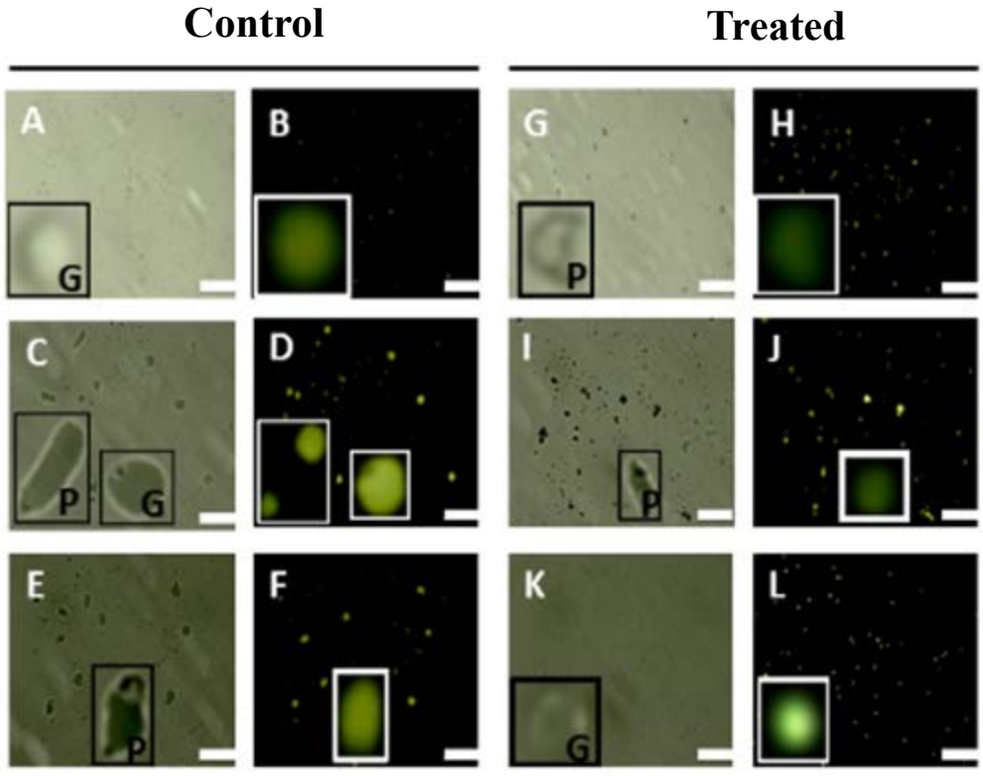


Fig. 1: Phagocytic activity of hemocytes after injection of microsphere beads in control, saline injected, E. coli infected positive control, B. thuringiensis infected, P. aeruginosa infected and S. aureus infected group respectively (Phase contrast A, C, E, G, I, K and fluorescent B, D, F, H, J, L).

activity of granulocytes and plasmatocytes of treated groups was significantly higher than that in control, and among treated groups activity in the *S. aureus* treatment was not statistically significant.

A.3 Muga silk fibroin based scaffolds for cartilage repair in rabbits: Due to limited repair capacity of articular cartilage, it is essential to develop tissue-engineered cartilage for patients suffering from joint disease and trauma. Herein, we have fabricated Muga silkworm, Antheraea assamensis silk fibroin scaffolds and evaluated its potential application in cartilage repair. In order to mimic the natural extracellular matrix (ECM) of cartilage, the scaffold had an adequate pore size, porosity, and mechanical properties. Furthermore, silk fibroin scaffolds were biocompatible and had a tunable degradation rate. In the cartilage tissue repair of rabbit, gross observation, Micro-CT and histology observation showed better chondrocyte morphology, integration, continuous subchondral bone, and much thicker newly formed cartilage compared with Bombyx mori scaffold group and control group (Fig. 2). Our results show that the Muga silkworm based porous silk fibroin scaffolds might be potential alternative biomaterial in articular cartilage tissue engineering.

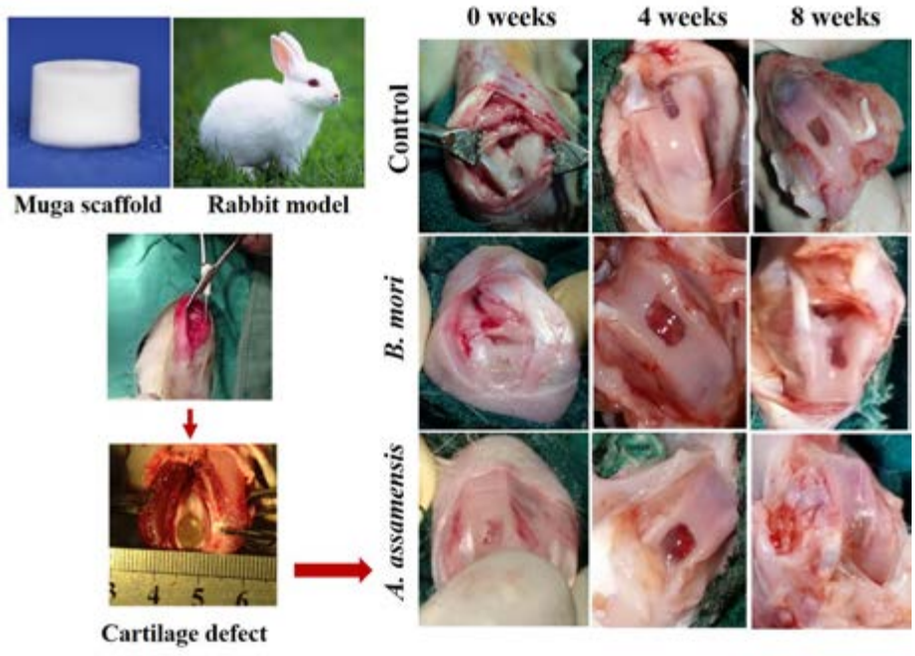


Fig. 2: Gross observation pictographs of the knee joint in different groups showing cartilage repair using Antheraea assamensis and Bombyx mori silk fibroin scaffolds after 4 and 8 weeks of implantation.

B. Microbial diversity and interaction in ecosystem

B.1 Bacterial diversity inside cereal, legume and oil seed: Both micro-and macro organisms interact and influence each other in the ecosystem where they occur. Research to generate fundamental knowledge on this area is important to improve function and health of individual organism and ecosystem. In this research, our focus is to understand diversity of bacteria, inside cereal, legume and oil yielding plant seed, how they migrate inside plant and move from one generation to the next and how microbial community is shaped inside seed of a plant grown in particular season in natural environment.

Preliminary research data indicated that every surface sterilized seed of a crop does not contain culturable bacteria (only 40-60% of rice seeds; 10% green gram seeds; and 5-10% of tomato seed contain culturable bacteria except Toria where 100% seeds contained culturable endophyte). However, SEM study and metagenome sequence data suggested occurrence of bacteria in every surface sterilised rice seed (SSRS). The seed endophytic bacteria were also detected in 5 days old seedling roots and shoot of rice, green gram and mustard (Fig. 3.). NGS generated data on 16s RNA gene amplified genomic DNA of SSRS, germinated rice seeds and 15 day old in-vitro raised rice seedlings suggested that plant growth stage might select and control proliferation of seed endophytic bacterial community.

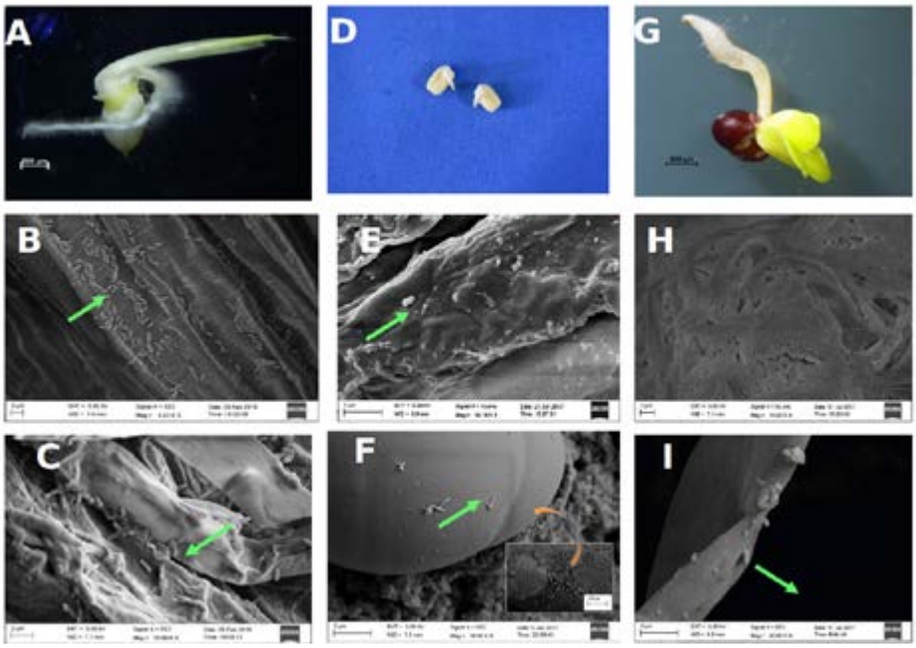


Fig. 3: (A) Germinated surface sterilized rice seed (GSSRS). SEM image of interior of (B) plumule and (C) radicle of GSSRS. (D) Germinated surface sterilized green gram seed (GSSGGS). SEM image of interior of (E) plumule and (F) radicle of GSSGGS. (G) Germinated surface sterilized mustard seed (GSSMS). SEM image of interior of (H) plumule and (I) radicle of GSSMS. Arrows indicates the presence of bacteria.

B.2 Bacterial diversity in rice seeds from across four rice agroecosystem: In another experiment, NGS of 16sRNA gene amplified DNA of seeds of rice grown in four agro-ecosystem [2-3 m Standing Water Field (SWF), rice known as deep water rice [(landrace kekao bao), 30 cm SWF HYV Ranjit and local Joha, upland (no SWF) rice variety "Ido"] showed occurrence of bacteria which are representative of 3 phylla, 11 genera and 16 distinct species. Bacteria in genus Pantoea was found in seeds of all the six rice variety/landraces studied and from among different varieties/landraces, highest number of endophytic bacteria (belonging to seven genera) were isolated from inside of sterilised seeds of Joha rice. This result suggested occurrence of highest diversity of bacteria in scented rice seed.

B.3 Microbial diversity in Jhum agroecosystems: Bacterial population and diversity in a vegetated soil near a plant root is shaped differently by the influence of rhizosphere compared to bulk soil away from the root surface. This was also observed in 3 different types of crops of slash and burn agricultural ecosystems of north-east India. In general, cfu of bacteria was found to be statistically more in very strongly adhered soil of crop roots of cropping phase of 5 years duration compared to that of 20 years duration Jhum cycle.

Five year Jhum cycle field soils are less fertile and under much stressed than that of 20 years Jhum cycle. Our results suggest that in stress environment of five years Jhum field, the crop roots exert selective influence to attract bacteria and promote their proliferation for its adaptive

and performance advantage (Fig. 4).

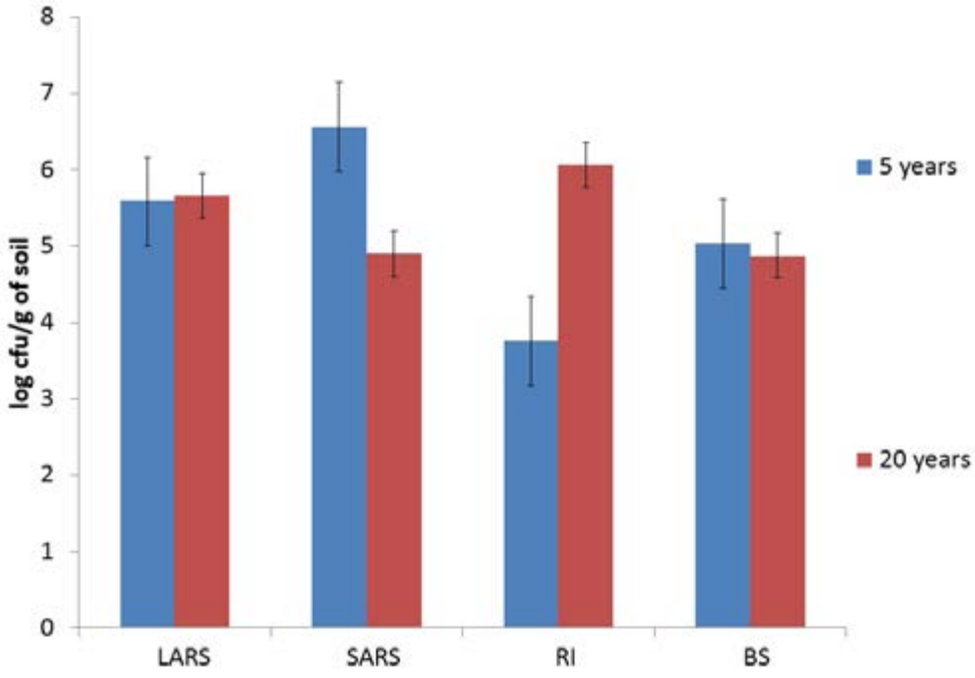


Fig. 4. Bacterial population in Jensen agar medium (N2 fixing bacteria) by plating serial dilution of bulk soil (BS), loosely adhered rhizosphere soil (LARS), strongly adhered rhizosphere soil (SARS) and surface sterilized root interior (RI) of rice crop in 5 & 20 years Jhum cycle field.

B.4 Streptomyces sp. TT-3 as biocontrol agent against Tea fungal diseases: In our continued search for novel microbial metabolites having agricultural and pharmaceutical potential, a large number of actinobacterial isolates were obtained as pure culture from commercial tea rhizosphere soil samples and screened for the extracellular antifungal metabolites production. This has resulted in isolation of a mesophilic actinobacterial strain designated as TT-3. The

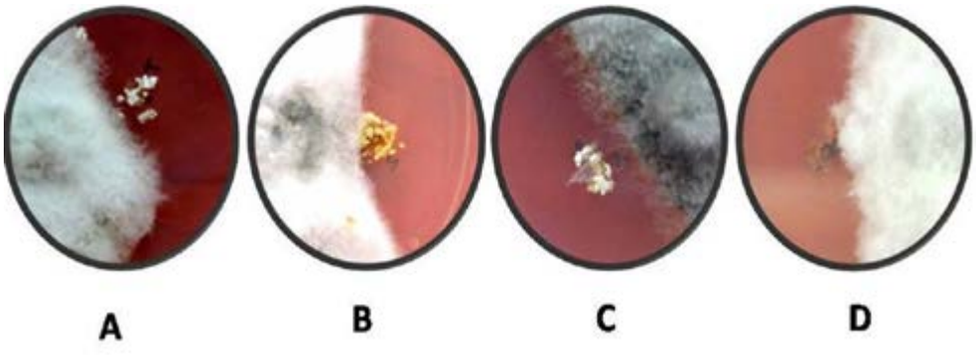


Fig. 5: Streptomyces lydicus strain TT3 showing antagonistic activity in duel culture against the fungal pathogens (A) P. theae, (B) C. gloeosporioides, (C) N. sphaerica and (D) R. solani.

strain is a Gram-positive filamentous bacterium with rugose spore surface which exhibited a broad range of antifungal activity against phytopathogens (Fig.5 and Fig.6). Based on phenotypic and molecular characteristics, the strain was identified as *Streptomyces lydicus* (Gene bank accession KT892738) which shares 99.4% sequence similarity with *Streptomyces lydicus* NBRC13058 (Gene bank acc. NR_112352).

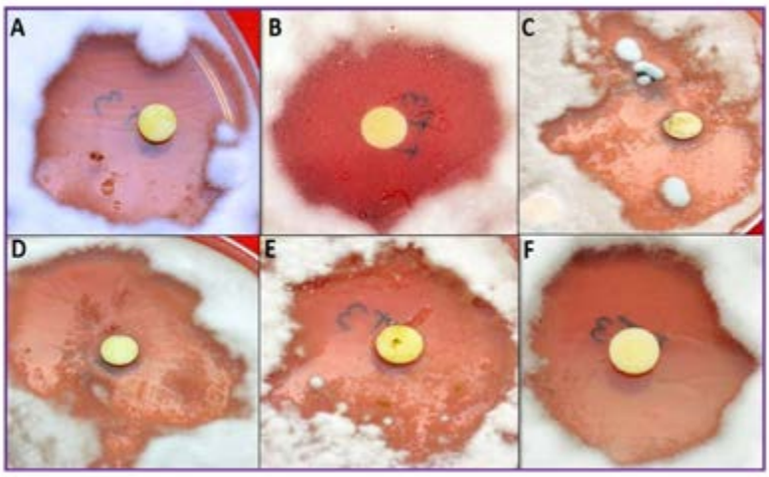


Fig.6: The antagonistic activity of ethyl acetate extract of TT3 against Tea fungal pathogens (A) C. gloeosporioides, (B) N. sphaerica, (C) G. cingulate, (D) E. vexans, (E) R. solani, and (F) P. theae.

C. Understanding the role of human gut microbiota on health

In our continuous effort to understand the role of microbes of the human gut on the health, relation of gut bacteria with fecal metabolites was studied in the tribal populations of Assam. Among the total fecal metabolites, short chain fatty acids (SCFA) are of major importance as they play important role in maintaining the gut health. SCFAs are the products of microbial metabolisms in our gut. Among the SCFAs, acetic acid was the core and the major metabolite of the tribal populations. This study hints towards links between metabolite signatures with specific bacterial genera (Fig. 7). In our previous study, the gut bacterial profiles of healthy ethnic groups of India was revealed and results of the current study will help in predicting such gut bacterial profiles in an individual based on their fecal metabolite signatures.

D. Human Microbiome as a Therapeutic Target for Improving Women Health

The conceptual framework with which this project research activity was initiated from later part of 2016-17 in IASST is presented in this write-up. Menopause is one of the major increasing global health problems of reproductive-age women. Globally, 1.1 billion women is expected to reach menopause by 2025, while India alone will have 103 million women with menopause by

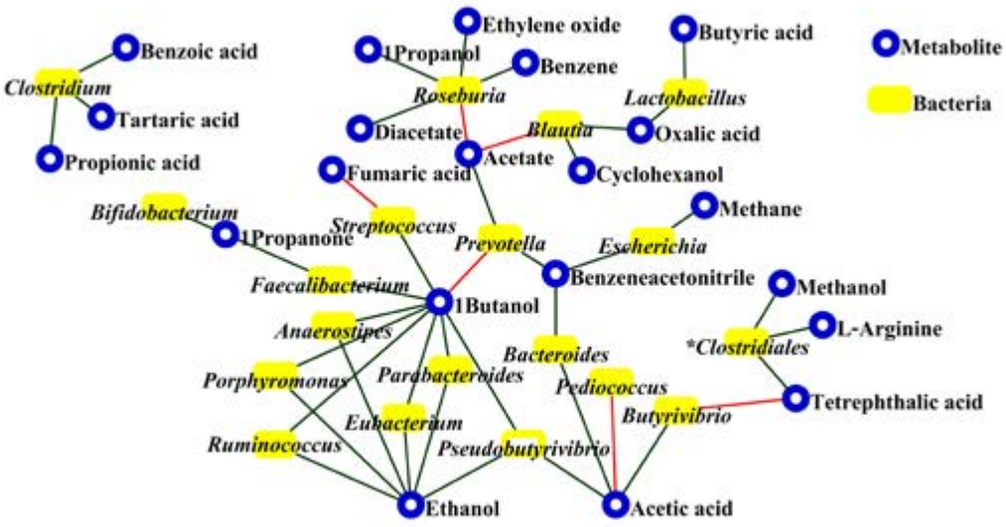


Fig. 7: Networks depicting the correlations of gut bacteria with fecal metabolites. Edges represent the correlation (Green: positive and red: negative).

2026. Premature natural menopause (PNM) is defined as menopause occurring naturally at the early reproductive age before 40 years due to failure of ovaries to produce normal level of ovarian hormone, a gynecological condition known as primary ovarian insufficiency. Surprisingly, the number of Indian women suffering from PNM is alarmingly high (11.6%) and they reach menopause at the age as early as 30 years. PNM significantly impacts psychological and physiological health among reproductive-age women and severely affects quality of life, as it decreases fertility and increases risk of mortality, and serious morbidity. PNM is largely idiopathic, but it is associated with inherited genetic factors, autoimmune diseases, socio-economic status, nutrition, caste/tribe and geographical region among others. There is lack of adequate specific biomarkers for accurate early prediction and risk assessment of PNM. Hormone therapy remains as the most effective primary treatment, but it suffers from contraindications. Non-hormonal therapeutic interventions for effective management of symptoms and prevention of chronic conditions in menopausal women have not been well investigated and hence there are critical gaps in knowledge.

It is well documented that perturbations in composition (dysbiosis) and metabolic activities (gene expression and metabolite production) of human microbiome are linked with impaired microbiota and metabolomic profile that are implicated with disease states. Alterations in the indigenous gut and vaginal microbiota in women impact susceptibility to adverse clinical outcomes such as preterm birth, bacterial vaginosis, infertility, pelvic inflammatory disease, and gynecologic cancers. Despite the critical role of human microbiota in women health, little is known about the association of women microbiota and microbial-derived metabolites in the onset and pathogenesis of PNM. Taking into consideration that hormonal changes in women

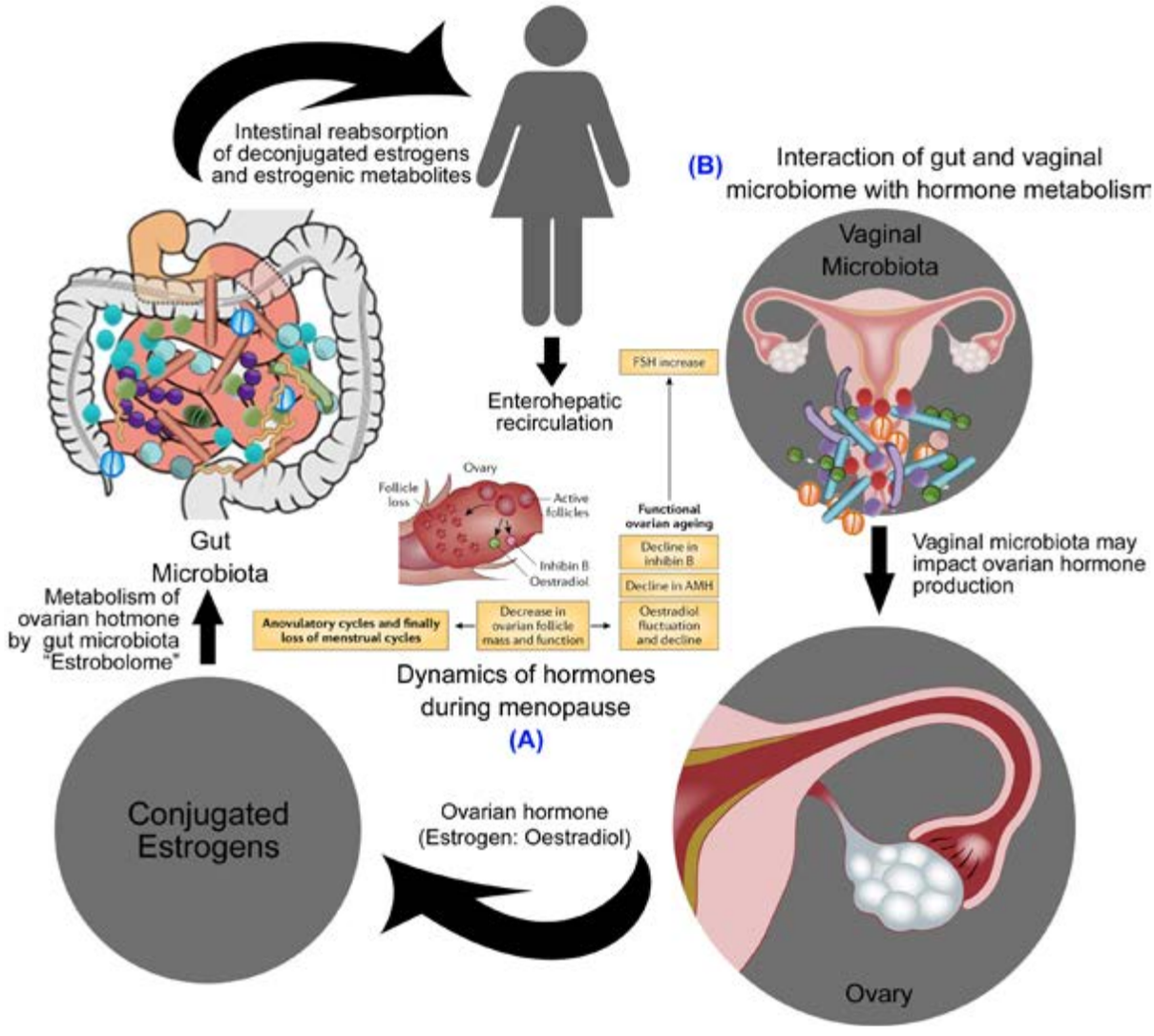


Fig.8 : Schematic diagram highlighting (A) dynamics of hormonal changes during menopause and (B) potential interaction of human gut and vaginal microbiome with ovarian hormone metabolism.

are associated with significant changes in vaginal microbiota, similar variation in vaginal microbiome might be expected to accompany PNM as well. Nevertheless, the burden of ovarian hormone insufficiency in reproductive-age women may reflect in part the metabolic functioning of the gut microbiota. A certain set of gut microbiota, known as estrobolome, regulates ovarian function and homeostasis of ovarian hormone metabolism by modulating the enterohepatic recirculation of estrogens through its estrogen-metabolizing function. Imbalance among this microbiota in reproductive-age women may consequently influence their susceptibility to development of PNM (Fig.8).

The present study hypothesizes that temporal and spatial variation in the microbiome of

reproductive-age women correlate with the onset and pathogenesis of PNM. We are adopting multiomics approach combined with reverse microbial culturomics to elucidate the role of gut and vaginal microbiome and microbial-derived metabolites in the onset and pathogenesis of PNM in Indian women, assess their variation between individuals of different ethnicity, socio-economic strata, diet and nutritional status, and devise a model for prediction of PNM. Collaborations with gynecologists from two leading medical institutions of North East India viz. Guwahati Medical College and Hospital (GMCH), Guwahati, Assam and Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Imphal, Manipur have been established, which will be further extended to other medicals institutions of the region. The recruitment of target patients of 30-40 years and age-matched healthy control individuals, followed by collection of blood, urine, vaginal and fecal samples in four different time points are in progress.

E. Locally prepared distilled alcoholic liquor (Chulai) and plasma metabolite profile of the tea tribes of Assam

India has one of the largest tribal populations of the world of which the tea-tribes form a major ethnic group in Assam. They consume a form of distilled alcoholic liquor from fermented jaggery (Chulai), whose chemical composition and health effects are unknown. A study was conducted to compare the blood biochemical parameters among the drinkers and non-drinkers of Chulai. Apart from the ethanol content (11-16% v/v), a GC-MS based study on untargeted metabolite profiling revealed that aliphatic hydrocarbons (67%), esters (16%) and higher alcohols (5%) are primary constituents of Chulai. Liver biomarkers (GGT, SGOT and SGPT) were significantly elevated in the Chulai drinkers ($p \leq 0.007$) compared to the non-drinkers. The drinkers and non-drinkers of Chulai had different blood plasma metabolite profiles ($R = 0.13$; $p = 0.01$) (Fig. 9). The altered metabolites are involved in carbohydrate and amino acid metabolisms. Correlation network analysis indicated that plasma metabolites, viz. 1,3 butanediol, 2,3 butanediol and glutamine can serve as blood biomarkers of Chulai consumption (Fig. 10).

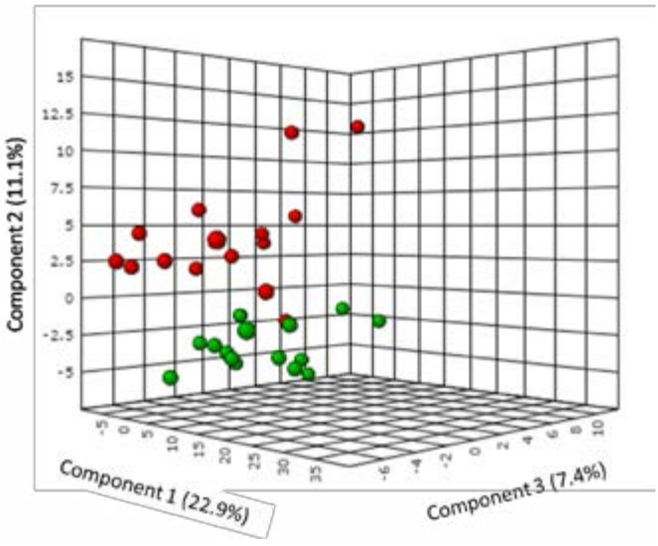


Fig. 9: Principal Component Analysis (PCA) with the data on plasma metabolites of the drinkers and non-drinking of Chulai (Red balls: drinkers; green balls: non-drinker).

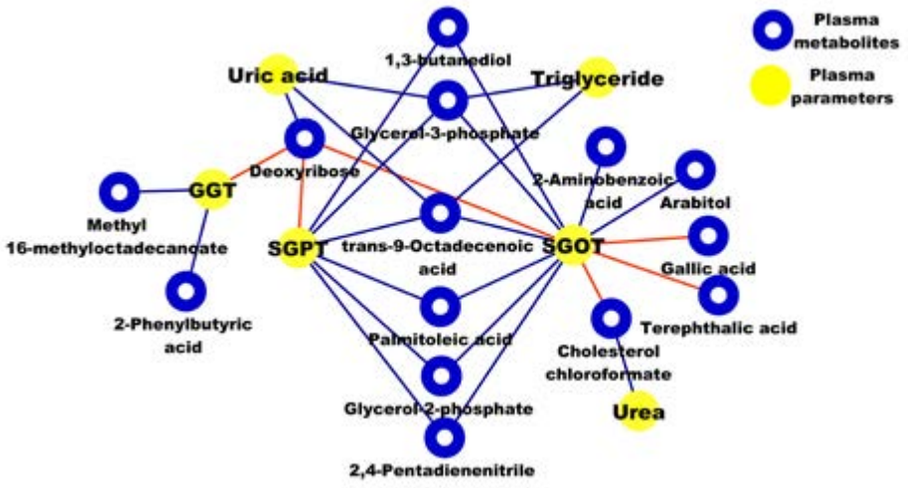


Fig. 10: Networks depicting the correlations of the plasma biochemical parameters with the metabolites which are significantly altered in the Chulai drinkers. Edges represent the correlation (Green: positive and red: negative).

F. Correlation study of different determinant of gene regulatior

Our group focuses on the 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 the development or improvement of efficient computational methods to manage and investigate these data has become highly essential. Such frameworks are essential to conduct studies to address different fundamental biological phenomena. Using the above mentioned analytical tool we are currently studying the correlation of determinants of gene regulators during different developmental stages of an organism. Enormous amount of experimental data related to different model organism for different time point are also available. These data can be exploited to understand the phenomenon.

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 (TFs), 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. The focus of the study is to characterize the interplay among these regulators by exploiting massive amount of experimental data. These data are investigated at different time point of developmental stages. Number of computational algorithms are employed to investigate the interactions of TFs, Polycomb complexes and other epigenetic regulators. To achieve a wholistic understanding of the mechanism of interaction at different developmental stages, different databases, such as, protein expression; protein-protein interaction; genome wide mapping of different TFs and epigenetic regulators (ChIP-seq and ChIP-chip); and binding site profiles of different DNA binding proteins from databases like Jaspar and TRANSFAC are integrated. Essentially, this approach would give us the wholistic interactions among these regulators.

With this approach number of novel TF-TF interactions with respect to the epigenetic regulators like histone modifications were identified in human and Drosophila. Further the research is extended to integrate the other regulators to understand the orchestrated fashion of gene expression during the developmental stages.

G. Prospecting bacteria and their biosurfactant/bioflocculant for enhanced bioremediation of hydrocarbon polluted ecosystem (HPE) and reclamation of formation water

G1. Biosurfactant for HPE bioremediation: Research at IASST on hydrocarbon polluted ecosystem surrounding oil field exploration sites covers a range of topic such as (i) isolation and screening of HC degrading bacteria (HCDB) (ii) bioremediation of polluted soil using consortia of efficient bacterial strains and (iii) characterization and production of biosurfactant from HCGB and has generated interesting result in the field of remediation of soil ecosystem and control of fungal pathogen of crop. Currently, we have been carrying out experiment to augment, breakdown and reduce load of total poly aromatic hydrocarbon (TPH) in contaminated soil by application of biosurfactant and compare its effectiveness with chemical surfactant namely sodium dodecyl sulfate (SDS).

Degradation of TPH due to application of rhamnolipid biosurfactant @ 1.5g/L was found to be 86.1% and 80.5 % in two soils containing 6800 ppm and 8500 ppm TPH, respectively. Application of SDS resulted in 70.8% and 68.1% TPH from the contaminated soil. GC MSMS based analysis showed presence of indene, chamazulene, naphthalene, phenanthrene, anthracene, fluorene, floranthene, benz(b)fluorene and benz(d)anthracene as component of TPH and rhamnolipid treatment eliminated 3 PAH namely floranthene, benz(b)fluorene, and benz(d) anthracene completely within six months and the remaining PAHs were depleted up to 50-80%, within the same period. The efficient degradation of PAH due to application of the biosurfactant was attributed to enhance heterotrophic bacteria. (Fig. 11)

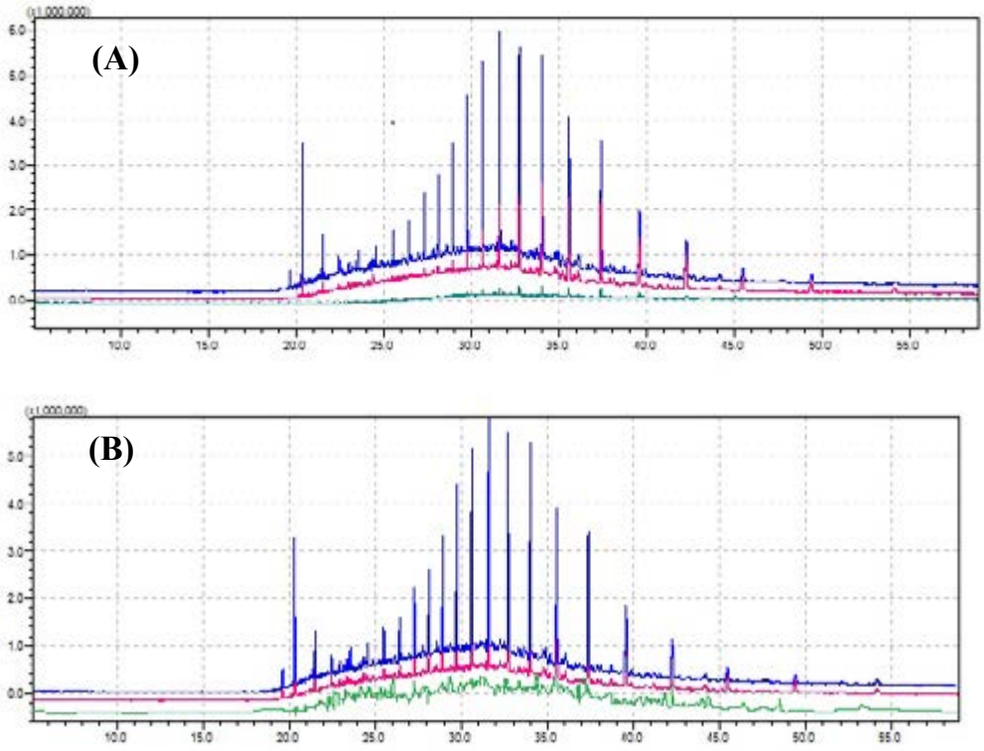


Fig. 11: Comparison of GC-MS Chromatograms obtained during analysis of the (A) 6800 ppm and (B) 8500 ppm hydrocarbon contaminated soil sample. Here, colour 'Blue' indicates control, 'Red' indicates the positive control i.e. SDS treated soil, and 'Green' indicates the biosurfactant treated soil.

G2. A novel polymeric bioflocculant of bacterial origin and its application in removal of heavy metals from formation water: The bacterium, *P. aeruginosa* strain IASST201 shows better ability to flocculate in presence of a single aliphatic hydrocarbon supplemented in bacterial broth culture rather than in a complex carbon source supplemented broth. The GC/MS analyses indicated degradation of *n*-hexadecane by 83.44% in the bacterial broth and the bioflocculating activity to be 87.80%. N-tridecane-1-ol, 2-hexadecanol, n-hexadecanoic acid, and 1-hexadecanol were detected in the bacterial broth which was evident from breakdown of *n*-hexadecane. Generally, biofloculating activity of bacteria is using complex mixture of aliphatic and aromatic hydrocarbons in crude petroleum oil. But this study results shows a single and simple (less complex) hydrocarbon could also be utilized by a specific bacterium. In our earlier study, only 77% of crude petroleum could be degraded by the bacteria in complex mixture of nutrients composed of petroleum hydrocarbons, both long chain aliphatics and polyaromatics. This was due to more energy spent by bacterium in converting the complex substrate to a digestible one.

Contact angle measurement of the culture broth during *n*-hexadecane degradation has revealed some interesting results with respect to alkane biodegradation during the production of extracellular metabolites. Alcohols and acids end of the molecule formed during the

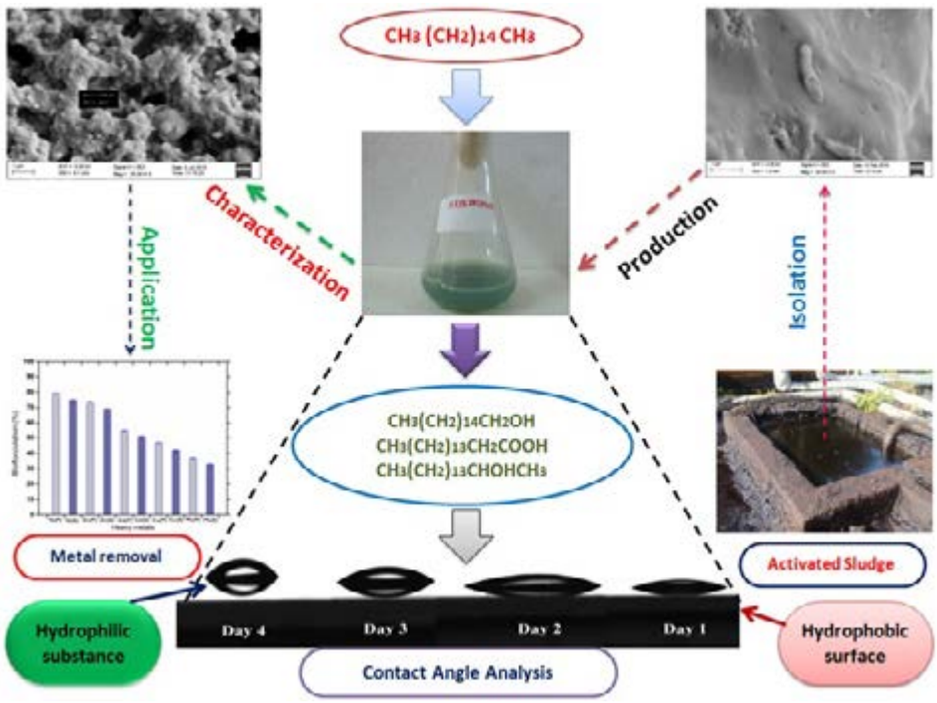


Fig. 12: A schematic representation of practical application of bioflocculant synthesized by a bacterium isolated from hazardous environment and its "greener" action toward bioremediation observed through novel analytical

biodegradation of *n*-hexadecane in the culture medium were polar and hydrophilic due to the hydroxyl end of the molecules and the carbon chain of the molecule is nonpolar and hydrophobic. With increase in carbon chain length, the molecule thus becomes increasingly nonpolar and less soluble in water. The increase in bioflocculant production in the medium throughout the growth period was likely to be accompanied by a natural increase in the hydrophilicity of the whole mass (Fig.12). As the moisture free glass surface is hydrophobic by nature, *n*-hexadecane droplet has the minimum CA on it. The other interesting phenomena is that this subject bioflocculant was able to flocculate the heavy metal in a pattern of $Ni^{2+} > Zn^{2+} > Cd^{2+} > Cu^{2+} > Pb^{2+}$.

H. Benzene, Toluene, Xylene (BTX) levels in air of oil exploration area and its impact on muga silk rearing

BTX levels of atmosphere were studied in six Muga (*Antheraea assama*, also known as Golden silk) plantation sites. The average BTX concentration for pre-monsoon and post-monsoon season at six sampling sites is shown in Table 1. along with some meteorological parameters studied during the monitoring periods. BTX concentrations were found to be in the range of

Table 1. Seasonal variation of BTX

Sampling Site	Pre-monsoon average BTX conc. (µg/m³)			Post-monsoon average BTX conc. (µg/m³)		
	Benzene	Toluene	m-xylene	Benzene	Toluene	m-xylene
Site 1	55.25	58.5	30	73.77	69.5	51.5
Site 2	34.25	58.75	69.5	45.5	66.75	72.25
Site 3	42.25	72.25	20.78	59.25	89.5	44
Site 4	58.07	53.75	15	68.25	58.25	32.25
Site 5	42.25	36.75	40	51.75	55.25	59.5
Site 6	49.5	52.75	56.74	62.25	67.25	68.5
Seasons	**Average Temperature (°C)**		**Average relative humidity (%)**		**Average wind speed (km/h)**	
Pre-monsoon	28.68		67.5		1.5	
Post-monsoon	18.91		89.87		0	

119-162.5 µg/m³ during pre-monsoon and 158.75-198 µg/m³ during post-monsoon period. However, benzene (mean concentration ranging from 34.25 µg /m³ to 73.77 µg/m³) and toluene (36.75–89.5 µg/m³) were found to be higher when compared to the different regions of world.

Of the three BTX compounds, benzene is the most toxic. Most toxicity data is available for airborne exposure to BTX, as this is the most common route of exposure to these volatile compounds. BTXs have considerably long half-life in environment making them persistent in ecosystem. Long-term exposure of Antheraea assama larvae to low concentrations of xylene cause harmful effects on the excretory system (with oral exposure) or on the nervous system (with inhalation exposure) which finally lead to larvae death. Continuous exposure of A. assama to toxic and non-toxic pollutants like hydrocarbons including BTX in the atmosphere is now a serious threat to A. assama culture both in terms of quality and quantity.

I. Microbial prospecting for alternate energy

I1. Bioethanol production from luxuriant vegetation biomass of sub-tropical North East India: Potential of six lignocellulosic biomass (LCB) sources namely sugarcane bagasse (SB), cassava aerial parts (CS), ficus fruits (FF), rice straw and sawdust for bioethanol production (Fig. 13) were evaluated in terms of concentration of glucose, xylose, source of carbon for fermentation and inhibitors of ethanol production such as lactic acid, hydroxyl methyl furfural and furfural. Hydrothermal treatment of the LCB resulted in enhanced saccarification efficiency over the untreated LCB. Two fungal strains *Fusarium oxysporum* HG19 (*GenBank Accession* KR920738) and *Trichoderma koningiopsis* LL28 (*GenBank Accession* KR920726) shared considerable level of β-glucosidase, endoglucanase, endoxylanase and β-xylosidase activity and in consolidated bioprocessing (CPB), HG19 could produce 4.85g/l bioethanol from hydrothermally treated sugarcane bagasse within 7th days of incubation with conversion efficiency of 24% at 0.24g

ethanol/g glucose concentration.

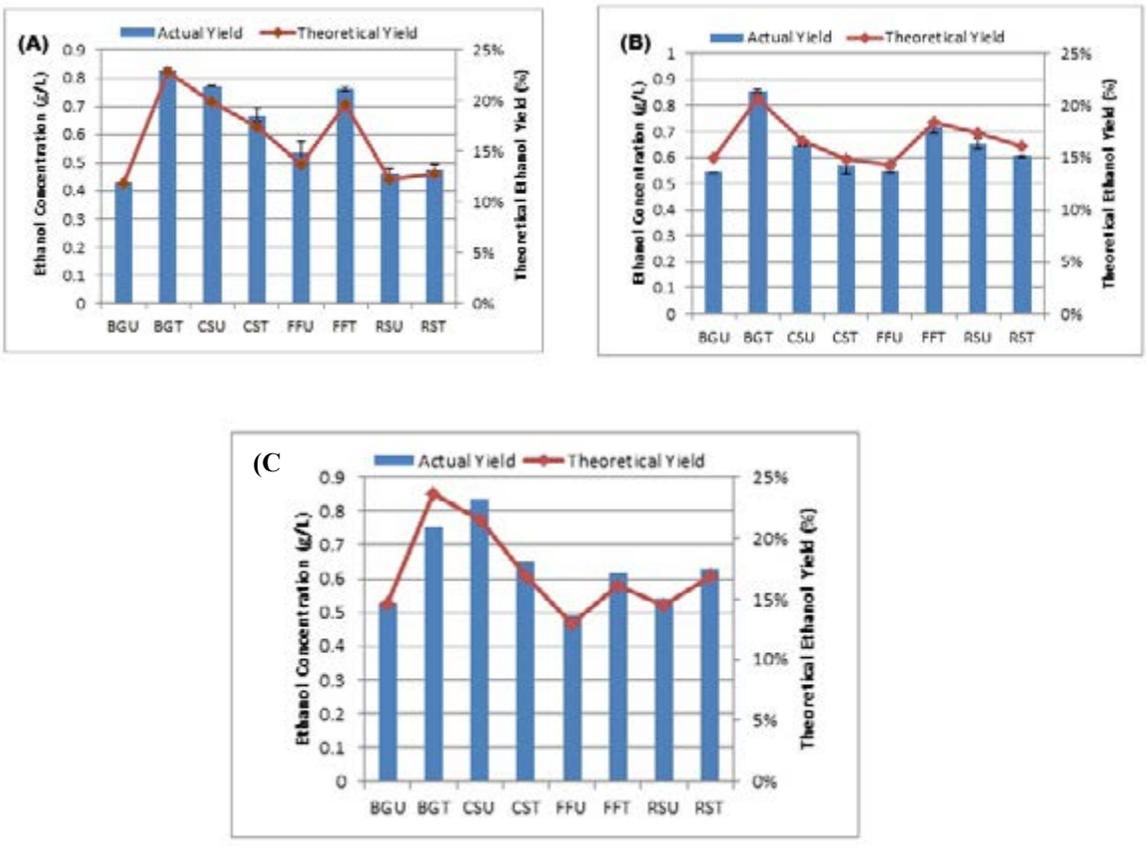


Fig. 13. Fermentation of selected lignocellulosic substrates for bioethanol production and estimated at three intervals (A) 96 hrs, (B) 120 hrs and (C) 144 hrs. BGU: untreated sugarcane bagasse, BGT: hydrothermally treated sugarcane bagasse, CSU: untreated cassava aerial parts, CST: hydrothermally treated cassava aerial parts, FFU: untreated ficus fruits, FFT: hydrothermally treated ficus fruits, RSU: untreated rice straw and RST: hydrothermally treated rice straw. (Bar indicates ± Standard Deviation).

I2. Consolidated bioprocessing for cellulosic bioethanol production: A cost effective process to convert plant biomass to fermentable sugars is an urgent requirement for bioethanol production. Use of microorganisms for simultaneous conversion of biomass to fermentable sugars and to ethanol in a process known as consolidated bioprocessing (CBP) has drawn attention. No natural microorganism possesses all the properties of lignocellulose utilization and ethanol production desired for CBP. A novel bacterium *Enterococcus faecalis* CDB2, isolated from a compost sample from Garbhanga forest (Guwahati, Assam) has shown promise for use in CBP (Fig. 14).

I3. Effect of substrate on the electricity generation in a double chambered microbial fuel cell: Microbial fuel cells (MFCs) use bacterial metabolism to convert chemical energy in organic

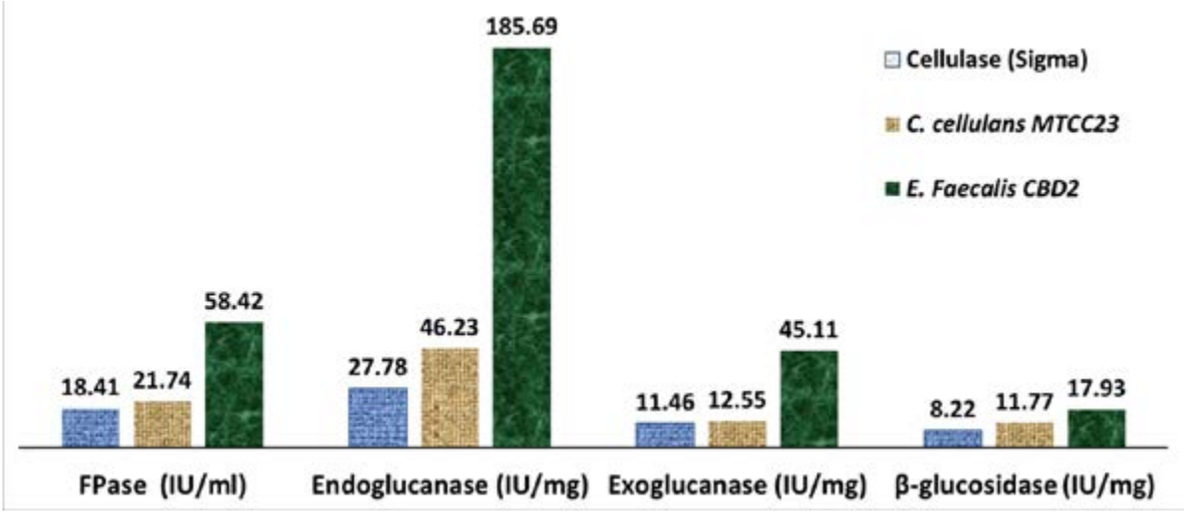


Fig. 14. Activities of various cellulolytic enzymes produced by Enterococcus faecalis CDB2.

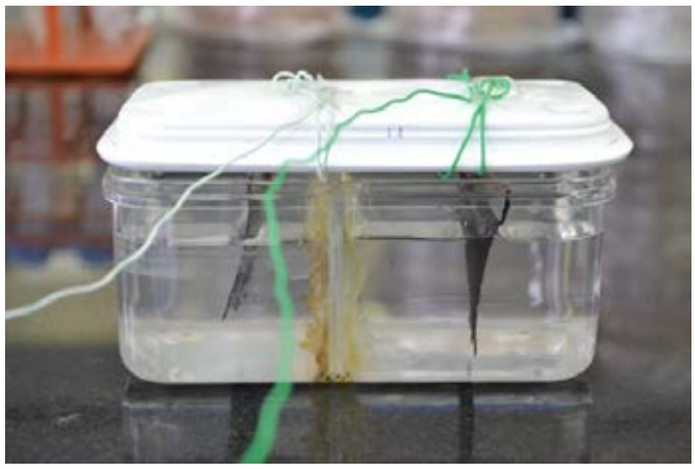


Fig. 15. Photograph of the double chambered MFC

matter to electrical energy from a wide range of organic substrates. In our continuous effort to develop an efficient microbial fuel cell, it was found that the use of glycerol as the carbon source increases the voltage and current output. (Fig. 15)

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. N. C. Talukdar**	A total of 817 bacterial isolates obtained from 4 microsites of rhizospheres of 8 hill rice, 2 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.
Biosurfactant Enhanced Bioremediation of PAHs Contaminated Soil of Oil Field Situated at upper Assam	DBT, Govt. of India; Rs 24.84 lakhs; 2013-2016; **Dr. Suresh Deka**	An efficient biosurfactant producing bacterial strain SR17 was isolated from hydrocarbon contaminated soil samples, which is identified as Pseudomonas aeruginosa (NCBI No. KR2304). The biosurfactant produced by the bacterial strain was characterized as rhamnolipid consisting of both di and mono- rhamnolipid. over six months, in the contaminated soil the degradation of hydrocarbon was found to be 86.1%. This level of degradation was achieved at 1.5 g/l concentration of biosurfactant application. The population of heterotrophic microflora was found to be more in the hydrocarbon contaminated soil samples, where biosurfactant was added.
Exploration of microbial resources of north-east India: Generation of metagenomic DNA bank, construction of metagenomic libraries and screening for gene of interest	DBT, Govt. of India; Rs 77 lakhs; 2011-2016; **Dr. Mojibur Khan**	A metagenomic DNA bank of 132 representative environmental samples covering North East India has been developed. The fosmid library of 6 compost samples was constructed and approx. 4.95 × 107 clones were obtained. Metagenomic libraries were screened and total 167 cellulase positive clones were isolated. The metagenomic DNA inserts of best 4 clones were sequenced and 6 ORF having homology with glycosyl hydrolase family proteins were obtained. 1 ORF (pET28a-GHC1) was overexpressed in pET28a expression system and showed CMCase activity, higher than commercial cellulase and reference strain.

Ongoing projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
Impact assessment of Jhuming on native plants and soil microbiota and restoration of sustainable Jhum agro-ecosystem in Northeat India	DBT, Govt. of India; Entire project fund of Rs. 542.14 lakhs (IASST component of Rs 57.62 lakhs; 2012 to 2016; **Dr. N. C. Talukdar**	Jhum agro-ecosystem prevails in about 65% land areas of North East india which is constituted by hills and mountains 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.
DBT's Scented Rice Program for the NE- "Microbial roles in yield management of scented rice of North East India."	DBT, Govt. of India; As a group- Rs 221.22 lakhs (IASST component of Rs.36.84 lakh; 2016 to 2019; **Dr. N. C. Talukdar**	Determination of the endophytic bacterial diversity inside aromatic rice seeds by culture and molecular techniques. Determination of succession of the endophytic bacterial community and their proliferation during different stages of growth of aromatic rice seedling Determination of metabolite diversity in the endophytic bacterial (EB) cultures, tissue culture generated scented rice plants (TCGSRP) and in EB inoculated TCGSRP.

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
Application of Glycolipid Biosurfactant for General Welfare of Economically Important Crops with special reference to Management of Phytopathogenic Fungi	DBT, Govt. of India; Rs. 25.93 lakhs; 2017-2020; **Dr. Suresh Deka**	This research will help to develop a biopesticide from Glycolipid Biosurfactant (particularly Rhamnolipid) against plant pathogenic fungi of Capsicum chinense (Bhut jolokia) and Zea mays (Maize). The main fungal diseases of Capsicum chinense are die-back disease caused by Colletotricum gleosporoides, stem rot and wilt caused by Sclerotinia sclerotiorum and leaf spot caused by Corynespora cassicola Similarly, the main fungal diseases of Zea mays are maydis blight (Bipolaris maydis), charcoal rot (Macrophomina phaseolina) and banded leaf & sheath blight (Rhizoctonia solani sasakii). The rhamnolipid biosurfactant produced by certain bacterial strains will be tested against these plant pathogenic fungi to develop formulations of biopesticide to control the diseases.
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; 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).
Exploration and conservation of microbial resources prevalent in protected forest ecosystems and tea rhizosphere soil of Assam.	DBT, Govt. of India; Rs 27.10 lakhs; 2017-2020; **Dr. Debajit Thakur**	Aim of this research is to explore Tea rhizosphere associated microbial strains for growth promotion and fungal disease control. Thus the data and information generated would help to develop Plant Growth Promoting (PGP) microbial strains database and inventory as an important document for the development of microbial bioformulation for plant growth promotion and disease control. Antimicrobial metabolites producing microorganisms (especially Actinobacteria) will be preserved and a database will be created. The database would help for future development of clinically/ pharmaceutically important drug molecule/s.
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. 133.14 lakhs; 2016 -2019; **Dr. Mojibur R. Khan**	This study will reveal the effect dairy products and rice beer on gut bacterial profile and health of individuals. The probable outcomes will be a) Components of dairy products and rice beer influencing the gut bacterial profile, b) Gut bacteria responsive to the components of dairy products and rice beer, c) the microbial metabolites that are formed in response to altered gut bacterial profile and d) Probable effect of the microbial metabolites on health.

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
North - East origin silk based 3-D co-culture model for cartilage tissue repair	DBT, Govt. of India; Rs. 34.96 Lakhs, 2013-2017; **Dr. Nandana Bhardwaj**	In this work, we aim for the development of co-culture model for the cartilage repair using three dimensional (3D) silk fibroin scaffolds of North-East origin (especially Muga silk). This developed 3D co-culture model are expected to mimic the initial point of contact between a tissue-engineered cartilage construct populated with chondrocytes and mesenchymal stem cells and host upon implantation. The cell-cell interactions and modulation of hypertrophy and chondrogenesis along with change in phenotypic responses under physiological conditions will provide an idea about the co-culture tissue modeling based strategies for cartilage tissue repair and regeneration
Correlation study of different determinant of gene regulatior.	DBT, Govt. of India; Rs. 88 lakhs; 2015-2019; **Dr. Soumyadeep Nandi**	Aim of the study to understand the correlation of different determinant of gene regulators like transcription factors, histone modification, polycomb complexes, etc. during the process of development of an organism.
Human Microbiome as a Therapeutic Target for Improving Women Health: Role of Vaginal and Gut Microbiota in the Onset and Pathogenesis of Premature Natural Menopause	DST, Govt. of India; Rs. 35 lakhs; 2016-2021; **Dr. Wahengbam Romi**	This study hypothesizes that temporal and spatial variation in the microbiome of reproductive-age (30 – 40 years) women correlate with the onset and pathogenesis of premature natural menopause (PNM). We are adopting multiomics approach combined with reverse microbial culturomics to elucidate the role of gut and vaginal microbiome and microbial-derived metabolites in the onset and pathogenesis of PNM in Indian women, assess their variation between individuals of different ethnicity, socio-economic strata, diet and nutritional status, and devise a model for prediction of PNM.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
B. Louis , S. D. Waikhom , R. C. Jose, S. Goyari, P. K. Bhardwaj , N. C. Talukdar , P. Roy	Cochliobolus Lunatus down-regulates proteome at late stage of colonization and transiently alters StNPR1 expression in Solanum tuberosum L.	Arch Microbiol	199 (2)/ 237-246	September/2016
R. C. Jose, S. Goyari, B. Louis, S. D. Waikhom, P. J. Handique, N. C. Talukdar	Investigation on the biotrophic interaction of Ustilago esculenta on Zizania latifolia found in the Indo-Burma biodiversity hotspot	Microbial Pathogenesis	98/6-15	September/2016
Y. Sheikh, B.C. Maibam, N.C. Talukdar, D. C. Deka, J. C. Borah	In vitro and in vivo anti-diabetic and hepatoprotective effects of edible pods of Parkia roxburghii and quantification of the active constituent by HPLC-PDA	Journal of Ethnopharmacology	191/21-28	September/2016
B. Gurung, P. K. Bhardwaj, N. C. Talukdar	Subtractive transcriptome analysis of leaf and rhizome reveals differentially expressed transcripts in Panax sokpayensis	Functional & Integrative genomics	16 & 6/619-639	November/2016
S. D. Sanasam N. C. Talukdar	Quality compost production from municipality biowaste in Mix with Rice Straw, Cow Dung, and Earthworm Eisenia fetida	Compost Science & Utilization	Page:1-11	January/2017

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
E. Thokchom, D. Thakuria, M. C. kalita, C. K. Sharma, N. C. Talukdar	Root colonization by host-specific rhizobacteria alters indigenous root endophyte and rhizosphere soil bacterial communities and promotes the growth of mandarin orange.	European Journal of Soil Biology	79/48-56	March/2017
S. Sen, M. Dehingia, N. C. Talukdar, M. Khan	Chemometric analysis reveals links in the formation of fragrant bio-molecules during agarwood (Aquilaria malaccensis) and fungal interactions	Scientific Reports	7: doi: 10.1038/ srep44406	March/ 2017
J. Farha Hussain and S. Bordoloi	Breeding tubercles in scales of male Barilius bendelisis (Hamilton, 1807) identified as sexual dimorphic character	Current Science	110(6): 985-986 ISSN 0011-3891	2016
J. F. Hussain, M.K. Das, G. Kaushik & S. Bordoloi	Length weight relationships of five species collected from one torrential river Basistha in Assam, India	Journal of Applied Ichthyology	32 (1)137-138	2016
G. Kaushik, and S. Bordoloi	Ichthyofauna in Ranganadi River in Lakhimpur, Assam, India.	Checklist	12(2): 1871	2016
G. Kaushik, and S. Bordoloi	Ultrasurface structure of oromandibular area in a hill stream teleost Glyptothorax trilineatus Blyth 1860	Acta Zoologica (Stockholm)	00:1-8	2016
G. Devi, A. Devi, K. G. Bhattacharyya	Oil exploration activities: Assessment of hazardous impacts on ‘golden silk’ cultivation	Environmental Monitoring and Assessment	189 (2)/1-14	February/2017
M. Pathak, H.K. Sarma, K. G. Bhattacharyya, S. Subudhi, V. Bisht, B. Lal, A. Devi	Characterization of a novel polymeric bioflocculant produced from bacterial utilization of n-hexadecane and its application in removal of heavy metals	Frontiers in Microbiology	8/1-15	February/2017
C. Kalita , M. Ganguly , A. Devi	Evaluation of Antioxidant Capacity and Antimicrobial Properties of Ethnic Bambuseae species and Identification of the Active Components	International Journal of Pharmaceutical & Biological Archives	7(1)/61-71	2016
S. Baruah, A. Devi, K. G. Bhattacharyya, A. Sarma	Developing a biosorbent from Aegle Marmelos leaves for removal of methylene blue from water	Environmental Science and Technology	DOI 10.1007/ s13762-016-1150-9	2016
K. Patowary, S. Deka, R. Patowary, M. C. Kalita	Development of an efficient bacterial consortium for remediation of hydrocarbons from contaminated sites	Frontiers in Microbiology	7:1092. doi: 10.3389/ fmicb.2016.01092	July/ 2016
S. N. Borah, D. Goswami, H. K. Sarma, S.S. Cameotra S. Deka	Rhamnolipid produced by Pseudomonas aeruginosa SS14 causes complete suppression of wilt by Fusarium oxysporum f. sp. pisi in Pisum sativum	Frontiers in Microbiology	7:1505. doi: 10.3389/ fmicb.2016.01505	September/2016
R. Patowary, K. Patowary, M. C. Kalita S. Deka	Utilization of paneer whey waste for cost effective production of rhamnolipid biosurfactant	Appl Biochem Biotechnol	180 (3) 383–399	October/ 2016

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
R. Patowary, K. Patowary, A. Devi, M. C. Kalita, S. Deka	Uptake of Total Petroleum Hydrocarbon (TPH) and Polycyclic Aromatic Hydrocarbons (PAHs) by Oryza sativa L. Grown in Soil Contaminated with Crude Oil.	Bull Environ Contam Toxicol	98:120–126	November /2016
K. Patowary, R. Patowary, M. C. Kalita,S. Deka	Characterization of Biosurfactant produced during degradation of hydrocarbons using crude oil as sole source of carbon	Frontiers in Microbiology	8:279. doi: 10.3389/ fmicb.2017.00279	February/ 2017
N. Bhardwaj, D. Chouhan, B. B. Mandal	Tissue engineered skin and wound healing: current strategies and future directions.	Current Pharmaceutical Design	DOI: 10.2174/138 16128236661705 26094606	February/2017
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 Material Chemistry Part B	4:3670-3684	April/2016
S. Chakravarty, N. Bhardwaj, B. B. Mandal, N. S. Sarma	Silk Fibroin-carbon nanoparticle composite scaffolds: a cost Effective supramolecular 'Turn Off' chemiresistor for nitro aromatic explosive vapors.	Journal of Material Chemistry Part C	4: 8920-8929.	August/2016
P. Jadi, N. Bhardwaj, B. B. Mandal	Cross-linked silk sericin-gelatin 2D and 3D matrices for prospective tissue engineering applications.	RSC advances	6: 105125-105136.	October/2016
Y. P. Singh, N. Bhardwaj, B. B. Mandal	Potential of agarose/silk fibroin blended hydrogel for in vitro cartilage tissue engineering.	ACS Applied Materials & Interfaces	8: 21236–21249	July/2016
S. K. Singh, BK Bhunia, N. Bhardwaj, S. Gilotra, B. B. Mandal	Reloadable Silk-Hydrogel Hybrid Scaffolds for Sustained and Targeted Delivery of Molecules.	Molecular Pharmaceutics	13:4066-4081.	October/2016
P. Gupta, M. Kumar, N. Bhardwaj, J. P. Kumar, C. S. Krishnamurthy, S. K. Nandi, B. B. Mandal	Mimicking form and function of native small diameter vascular conduits using mulberry and non-mulberry patterned silk films.	ACS Applied Materials & Interfaces	8: 15874–15888	June/2016
M. Kumar, D. Jain, N. Bhardwaj, P. Gupta, S. K. Nandi, B. B. Mandal	Native honeybee silk membrane: A potential matrix for tissue engineering and regenerative medicine.	RSC Advances	6: 54394 - 54403.	June/2016
P. Gupta, M. Kumar, N. Bhardwaj, J. P. Kumar, C. S. Krishnamurthy, S. K. Nandi, B. B. Mandal	Bioengineered silk vascular grafts for coronary artery bypass surgery.	European Cells and Materials	31: 412.	July/2016
P. Gupta, M. Adhikary, J. Christakiran, M. Kumar, N. Bhardwaj, B. B. Mandal	Biomimetic, osteoconductive non-mulberry silk fiber reinforced tricomposite scaffolds for bone tissue engineering.	ACS Applied Materials & Interfaces	8:30797-30810.	October/2016
M. Adhikary, P. Gupta, M. Kumar, S. Jasmine, N. Bhardwaj, D. Chouhan, B. B. Mandal	Hydroxyapatite-silk fiber-silk fibroin tri-composite scaffolds for bone tissue engineering.	European Cells and Materials	31:18.	June/2016

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
A. K. Saw,S Nandi, B. C. Tripathy	Fuzzy code on RNA secondary structure	International Journal of Pure and Applied Mathematics	114(3)/483-501	2017
S. Keisam, W. Romi, G. Ahmed, K. Jeyaram	Quantifying the biases in metagenome mining for realistic assessment of microbial ecology of naturally fermented foods	Scientific Reports	6:34155/1-12	September/2016
M. Kalita, K. Haloi, D. Devi	Larval Exposure to Chlorpyrifos Affects Nutritional Physiology and Induces Genotoxicity in Silkworm Philosamia ricini (Lepidoptera: Saturniidae)	Frontiers in Physiology	15;7:535	November/2016
Haloi, K., Kalita, M.K., Nath, R. and Devi, D	Characterization and pathogenicity assessment of gut-associated microbes of muga silkworm Antheraea assamensis Helfer (Lepidoptera: Saturniidae).	Journal of invertebrate pathology	138, pp.73-85	July/2016
M. Kalita, D. Devi	Immunomodulatory effect of chlorpyrifos formulation (Pyrifos- 20 EC) on Philosamia ricini (Lepidoptera: Saturniidae)	Journal of Entomology and Zoology Studies	4(6): 26-31	October/ 2016
M. Kalita, K. Haloi, D. Devi	Cypermethrin Formulation (Ustad-10 EC) Induces Genotoxicity via Apoptosis, Affects Nutritional Physiology, and Modulates Immune Response in Silkworm Philosamia ricini (Lepidoptera: Saturniidae)	Journal of Economic Entomology	110 (3): 1010-1024	March/ 2017

Book chapters

1. R. K. Sarma, Ratul Saikia, and N. C. Talukdar (2017) Mitochondrial DNA based molecular markers in Arbuscular Mycorrhizal Fungi (AMF) research. In: Molecular Markers in Mycology. Part of the series Fungal Biology. Springer International Publishing AG, pp 243-250
2. Y.P. Singh, S. Mehrotra, J. P. Kumar, B. K. Bhunia, N. Bhardwaj and B. B. Mandal (2016) Tissue engineering therapies for ocular regeneration. In: Biomaterials & Nanotechnology for Tissue Engineering. Edited by S. Swaminathan, K. Uma Maheswari and S. Anuradha. CRC Press (Taylor and Francis Group), USA, pp.173-197

Others: 2 (Two)

No. of contributory papers presented in international, national and regional conferences: 22 (Twenty two)

No. of Conferences/Workshops/Meetings attended by the staff and students of BER: 42

Contribution to World Database

List of bacterial isolates sequenced and their accession numbers

1. Sample IDs and accession numbers (provided by Garima Raj & Dr. NC Talukdar)
KJ_2(KY486204), KJ_3(KY486205), KJ_5(KY486206), KJ_6(KY486207), KJ_34(KY486218), KJ_35(KY486219), KJ_36(KY927407), KJ_37(KY486220), KJ_38(KY486221), KJ_40(KY486222), KJ_41(KY486223), IDO_14(KY486209), IDO_15(KY486210), IDO_d10(KY486232), IDO_d21(KY019246), IDO_d5(KY013009), IDO_d6(KY927404), RN_17(KY486211), RN_d26(KY013011), RN_d3(KY019245), RN_d17(KY013010), FN_10(KY486208), FN_23(KY486212), FN_24(KY486213), FN_48(KY486228), KEK_42(KY486224), KEK_44(KY486225), KEK_45(KY486226), KEK_46(KY927405), KEK_47(KY486227), TKW_27(KY927408), TKW_28(KY486214), TKW_29(KY927406), TKW_31(KY486215), TKW_32(KY486216), TKW_33(KY486217), TKW_51(KY486229), TKW_52(KY486230), TKW_53(KY486231), TKW_56(KY019244)

2. GenBank accession number(s) of Arbuscular mycorrhizal fungi collected from Nagaland (Chanki village) Jhum field (provided by Manashi Das): MF185109, MF185110, MF185111, MF185112, MF185113, MF185114, MF185115, MF185116, MF185117, MF185118, and MF185119
3. NCBI GenBank Accessions KU600016 and KX774514 of yeasts (by Ms S. Sen, Mr. S. N. Borah, and Dr. S. Deka)
4. Sample IDs and NCBI accession numbers of fishes of the River Ranganadi (provided by Gitartha Kaushik & Dr. Sabitry Bordoloi)
1-SKY909143, 2KY909144, 3KY909145,4KY909146, 5KY909147, 6KY809879, 8KY823513, 9KY823511, 10KY823513, 11KY809878, 12KY823514, 13KY800366, 14KY800367, 16KY800368, 17KY847868, 18KY847869, 19KY847870, 20KY853030, 21KY853031, 23KY853032, 24KY853033, 25KY867662, 26KY867663, 28KY867664, 30KY867665, 32KY867666, 33KY867667, 35KY867668, 37KY867669, 38KY867670, 43KY867671, 44KY867673, 45KY867674, 50KY867675, 52KY867672, 53KY867676, 54KY867677, 55KY867678, 57KY867679, 64KY867680, 66KY867681, 68KY909148, 69KY909149, 71KY909150, 72KY909151.

Invited scientific talks

Dr. N. C. Talukdar delivered the following invited talks-

1. 'Bacterial-bioinput based integrated-nutrient-management for rice-pea-rice cropping system and effective consortia for mandarin orange (Citrus reticulata blanco) orchards of north east India' in the 57th Annual Conference & International Symposium of Association of Microbiologists of India (AMI-2016) held at Gauhati University, Guwahati, Assam during 24th -27th , November, 2016.
2. 'Preparation of successful project proposal in agricultural sciences from reviewer perspectives' in the Workshop on preparation of research project proposal in health care and agricultural sciences organized by Biotechnology Consortia India (NERBPMC) held at Dibrugarh university, Dibrugarh (17.11.2016), Tripura university(24.02.2017) and Manipur University (23.03.2017).
3. 'Ecosystems, anthropogenic interventions and restoration with special reference to agriculture and wetland in natural economic zone' in the fifty fourth laboratory raising day of Defense Research Laboratory Tezpur held at DRL Tezpur, Assam on 21st November, 2016.
4. 'Support of microbial resources of soil in increasing /maintaining productivity and health of agricultural ecosystems' in the Microbial resources to support productivity, adaptation and mitigation and agricultural systems held at Dr. Rajendra Prasad Central Agriculture University, Bihar during 22nd-24th December, 2016.
5. Dr. D. Devi delivered at talk on 'Characterization and pathogenicity assessment of gut associated microbes of Muga silkworm Antheraea assamensis Helfer (Lepidoptera, Saturniidae)' in the XXV International Congress of Entomolgy held at Orlando, Florida, USA during 25th - 30th September, 2016.

Dr. S. Deka delivered the following invited talks-

6. 'Phytoremediation of hydrocarbon contaminated soil with some efficient plant species' in the National Conference on "Recent Advancements in Environmental Research-2016" held at IIT Guwahati during 4th -5th June, 2016.
7. 'Role of biosurfactant producing microbes in sustainable agriculture' in the National Seminar on 'Alternative Approaches in Agriculture for sustainable and Human Health' held at SBMS College Sualkuchi, Assam during 24th -25th June, 2016.
8. 'Application of biosurfactant for general welfare of economically important crops with special reference to management of phytopathogenic fungi' in the International conference on "Beneficial Microbes – 2016" held at Phoenix, USA during 22nd -24th September, 2016.
9. 'Biosurfactant enhanced bioremediation of poly aromatic hydrocarbon from contaminated soil' in the International Symposium on 'Microbes and Biosphere: What's New and What Next' held at Gauhati University, Guwahati, India during 24th -27th November, 2016.
10. 'Rhamnolipid biosurfactant for controlling plant pathogenic fungi' in the National Symposium on "Impact of climate change, Biodiversity and Good Plant Protection Practices for Crop Productivity"' held at Bidhan Chandra Krishi Viswvidylaya, Kalyani, W.B, India during 22nd -23rd December, 2016.
11. Dr. D. Thakur delivered a talk on 'Exploration of culturable microflora associated with commercial Tea plantations in Assam and Darjeeling, India for growth promotion and disease suppression' in the 57th Annual Conference & International Symposium of Association of Microbiologists of India (AMI-2016) held at Gauhati University, Guwahati, Assam during 24th -27th November, 2016.

12. Dr. M. R. Khan delivered a talk on 'The Northeast of India: a microbiologist's paradise' in the 57th Annual Conference & International Symposium of Association of Microbiologists of India (AMI-2016) held at Gauhati University, Guwahati, Assam during 24th -27th November, 2016.

In the capacity of Director, Dr. N. C. Talukdar, Life Science Division delivered the following chief guest/guest of honour lectures, attended advisory meetings and participated as panelist

1. plenary speech in the workshop on 'Innovation in Science -Make in India programme' organized by DST and Administrative staff college of India, Hyderabad on 9th June, 2016.
2. plenary speech in the National Conference on Microbes of North East, MICRON 2016 held at Assam University, Silchar during 29th-30th December, 2016.
3. keynote speech in international conference on global biodiversity, climate change and sustainable development (ICBES 2016) at Rajiv Gandhi University, Rono Hills, Doimukh on 16th October, 2016.
4. the Dr. P. K. Goswami memorial lecture on 'Traditional knowledge based drug discovery with special reference to metabolic syndrome Diabetes mellitus and Indo-Burma biodiversity hotspot' Organized by the Dept. of Biochemistry, Gauhati Medical College on the occasion of Death Anniversary of Late Dr. P. K. Goswami, Founder Head, Dept. of Biochemistry and Former Director, IASST on 16th February, 2017.
5. talk at All India Radio Station, Chandmari from 8:30 pm to 9:00 pm on 11th March, 2017 on the topic, 'Guwahati Biotech Park- promoting entrepreneurship in the field of Biotechnology and related areas and catalyzing industrial growth'.
6. chief guest in the Orientation programme of Institute of Science and Technology, Gauhati University on 24th September, 2016.
7. chief guest in the meeting of the All India People Science movement for the year at Pragjyotish college campus, Guwahati, Assam on 7th November, 2016.
8. chief guest in the meeting of the All India People Science movement for the year at Pragjyotish college campus, Guwahati, Assam on 7th November, 2016.
9. chief guest in the valedictory function of National workshop on Phylogeny in biogeography at USTM, Meghalaya on 22nd January, 2017.
10. chief guest in the workshop on capacity building in grant writing skills and effective management of intellectual property rights (IPR) in biotechnology by universities and research institutions in the north east region, sponsored by Department of biotechnology, Govt. of India, New Delhi in college of Veterinary Science, Khanapara, Guwahati on 28th December, 2016.
11. chief guest in the inaugural function of the UGC sponsored course 'Recent development in Nano Sciences and Nanotechnology' in Gauhati University on 25th March, 2017.
12. guest of Honour in the Seminar on 'Entrepreneurial opportunities in Biotechnology' at IIE, Basistha Chariali sponsored by SERB, DST in association with IIE, Guwahati. Organised by GBP (Guwahati Biotech Park) on 10th March, 2017.
13. chief guest in the inaugural function of 'Nano Science and Nano Technology' in Gauhati University on 22nd March, 2017.
14. 'Presented the "Teachers' Day Oration" on Sept. 5, 2016 in Bhupen Hazarika Auditorium of Indian Institute of Technology Guwahati'.

Attended the following meetings as member-

14. the first SAC meeting of Chemical Ecology project between NE and Bangalore scientist held at NCBS, Banglore on 14th September, 2016.
15. the SAC meeting of Toklai Tea Research Association held in TRA office, Kolkata on 19th September, 2016.
16. the CCSU Research Advisory Council meeting of senior members. To scrutinize and approve the list of Ph. D. supervisors from different institutions at CCSU, Guwahati on 10th September, 2016.

Panelists in the following meetings

1. the Brainstorming session on National Mission on Bioeconomy, Shillong, Meghalaya held at NEHU,Shillong, Meghalaya on 24th September, 2016.
2. the NKN Regional workshop on Knowledge and awareness sharing held at NEHU, Shillong, Meghalaya on 19th October, 2016.

Evaluations and examination of the-

1. thesis entitled, 'Optimization of vermi-technology to transform municipality solid waste generated under Tezpur Municipality into valuable soil conditioner' by Ms Banashree Sahariah of Tezpur University.
2. the project, 'Proteomics study of aromatic hydrocarbons degradation enzymes of some selected bacterial strains prospecting strategies for environmental bioremediation' for ONGC-CPBT of MBBT of Tezpur University.

Dr. S. Deka has been nominated as (i) honorary life member of Asian PGRP Society of Sustainable Agriculture. Auburn, Alabama, USA, (ii) fellow of Botanical Society of Assam, (iii) life member of DNA society of India, Kolkata and (iv) a life member of Indian Society of Translational Research, JNU, New Delhi.

Awards

1. Dr. S. Sen, RA was awarded BIRAC (DBT) Biotech Ignition Grant for commercialization of technology on aroma production by fermentation of agarwood.
2. Mr. Yogesh Chaudhari, SRF was awarded Bioenergy-Awards for Cutting Edge Research (B-ACER) by the Indo-U.S. Science and Technology Forum (IUSSTF) to undertake a part of his PhD research in the National Renewable Energy Laboratory, Colorado-80401, USA with Dr. Stephen R. Decker.
3. Dr. R. Thakur, N-PDF received Best poster award in the 57th Annual conference of Association of Microbiologists of India (AMI) held in Gauhati University, Guwahati during 24th – 27th November, 2016.
4. Ms M. Dehingia received best poster award in the 57th Annual conference of Association of Microbiologists of India (AMI) held in Gauhati University, Guwahati during 24th – 27th November, 2016.
5. Mr. Y. Chaudhari, SRF received best poster award at the research conclave held in IIT, Guwahati during 16th- 19th March, 2017.
6. Dr. N. Bhardwaj received best poster award in the International Conference of Young Researchers on Advanced Materials (IUMRS-ICYRAM 2016) held in Indian Institute of Science, Bangalore, India during 11th -15th December, 2016.

Other activities

Visits to national/international institutes/laboratories

Mr. Robinson C. Jose visited EMBL, Heidelberg, Germany for conference on 'Proteomics in cell biology and disease mechanisms' during 14th -17th September, 2016.

Traditional Knowledge based Drug Development and Delivery

1st Row (left to right): Suman Kumar Samanta (RA), Rajlakshmi Devi (Associate Prof.-I), Rosy Mondal (DST INSPIRE Faculty).

2nd Row (left to right): Ankita Hazarika (SRF), Himadri Kalita (SRF), Momita Das (JRF), Paramita Choudhury (JRF), Aditi Kaushik (SRF), Bhaswati Kashyap (Technical Assistant), Krishna Nayani Dutta (SRF).

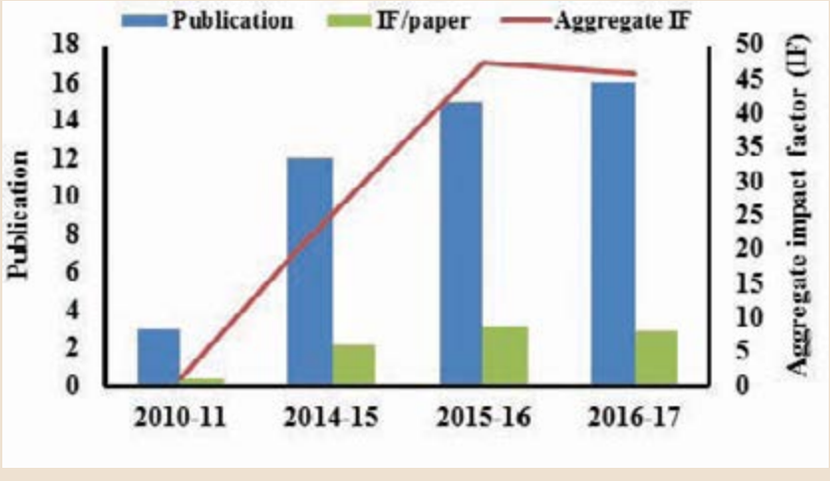
3rd Row (left to right): Prashanta Kumar Dev (JRF), Elan Charan (SRF), Manish Kumar (Temporary guest JRF), Bhaskarjyoti Gogoi (RA), Raghuram Kandimalla (RA), Sagar Ramrao Barge (SRF).

Absent in photograph: N. C. Talukdar (Professor), Udeshna Bayan (JRF), Bhaswati Choudhury (SRF), Simanta Bhardwaj (Technical).

Summary

Scientist (Core): 2 (M:1, F: 1)
Scientist (National fellows): 2
Ramanujan fellow: 1(M)
DST INSPIRE faculty: 1(F)
JRF/SRF: 12 (M: 06, F: 06)
Referred Journal Publication: 16
Cumulative Impact factor: 45.962

PhD awarded: 1
Invited scientific/chief guest/guest of honour lectures: 4 (national) & 1 (international)
International visits/short term training/conferences with national/international support: 3
Technology developed: 1



Research focus of the traditional knowledge based drug discovery programme is validation of selected folklore herbal plants/formulation against diabetes and other metabolic syndrome. Past research in the institute has validated claims of local healers on therapeutic effect of herbs and formulation on diabetes and cardiovascular condition. While continuing this effort, our recent focus has been integration of knowledge of experimental biology, natural and synthetic product chemistry, pharmacology and analytical chemistry, biochemistry and computational biology with validated traditional knowledge for meeting final goal of therapeutic product for cure and prevention of metabolic syndrome. Under this program, few other researches of value in medical applications are also carried out.

A. Bioactive fraction of *Annona reticulata* bark (or) *Ziziphus jujuba* root bark along with insulin attenuates painful diabetic neuropathy through inhibiting NF-κB inflammatory cascade

This research found the neuroprotective ability of bioactive fractions of *Annona reticulata* bark (ARB) and *Ziziphus jujuba* root bark (ZJ) along with insulin in treatment of diabetic neuropathy (Fig.1). Extraction with different solvents of increasing polarity ARB and ZJ followed by bioactive guided fractionation of extracts and their test against H_2O_2 induced toxicity in SHSY5Y neuroblastoma cell lines and DRG neuronal cells yielded interesting result. Methanol extract of ARB and ZJ (ARBME & ZJME) and their water fractions (ARBWF & ZJWF) exhibited significant neuroprotection against H_2O_2 induced toxicity in SHSY5Y cells and DRG neuronal cells. Both the active fractions were tested against streptozotocin (55 mg/kg i.p.) induced diabetic neuropathy in male Wistar rats. Body weight changes, blood glucose levels and pain threshold through hot plate, tail immersion, cold plate and Randall-Sillitto methods were measured throughout the study at weekly interval. At the completion of the drug treatment period, all the animals were sacrificed to measure the sciatic nerve lipid peroxidation, antioxidative enzyme levels (SOD, catalase and GSH) and cytokine levels (IL-1β, IL-6, IL-10, TNF-α, iNOS & NFκB) through ELISA and western blotting analysis. It was found that ARBME, ZJME, ARBWF & ZJWF along with insulin potentially attenuate the thermal, mechanical hyperalgesia and cold allodynia in diabetic neuropathic rats, where insulin treatment alone failed to diminish the same. Reduction of sciatic nerve oxidative stress, NF-κB and iNOS mediated inflammatory cascade and normalization of abnormal cytokine release were the possible mechanism of action in neuroprotective ability. It is further shown that the neuroprotective ability of ARB and ZJ against painful diabetic neuropathy helps in inhibiting oxidative stress and NF-κB inflammatory cascade.

B. Dual delivery of chloramphenicol and essential oil by poly-ε-caprolactone-pluronic nanocapsules to treat MRSA-Candida co-infected chronic burn wounds

Methicillin-resistant *Staphylococcus aureus* (MRSA) and Candida co-infections in the context of

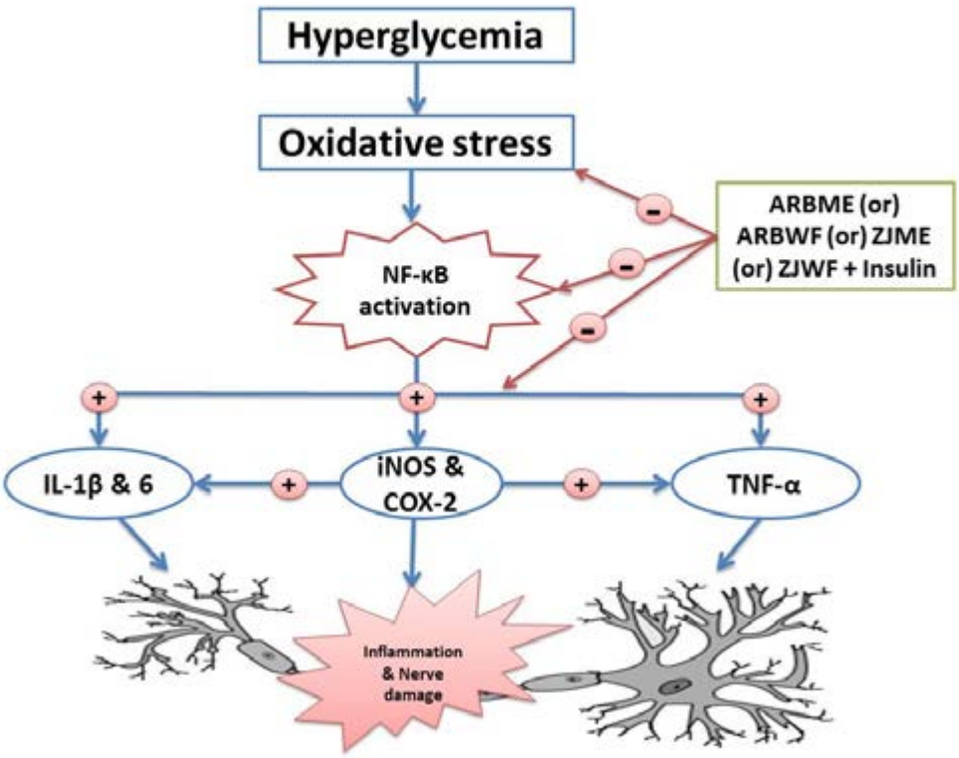


Fig. 1: Possible mechanism of action of A. reticulata and Z. jujuba plant fraction against diabetic neuropathy

burn wounds, leads to morbidity and mortality. Eradication of such difficult-to-treat and complex infection needs concomitant effective topical administration of antibiotic-antifungal cocktail. Application of broad-spectrum antibiotic chloramphenicol (CAM) has been hindered owing to its hydrophobicity, poor dermal penetration, rapid degradation and toxicity issues. But, due to its lesser uses in past, CAM continue to be active against a majority of currently predominant resistant bacterial strains. Essential oil of Cymbopogon flexuous is reported to possesses strong, broad spectrum antimicrobial property which also acts as a synergistic enhancer when used in combination with antibiotics. However, due to its highly volatile nature and instability in free form, the topical administration has not been possible. Keeping this in mind, we co-encapsulated CAM with lemongrass essential oil in PCL-pluronic composite nanocapsules (CAM-LEO-PCL-P NCs) and successful in overcoming the limitations in drug administration and achieved a significant reduction in cytotoxicity than that of free counterparts with increased therapeutic index. CAM-LEO-PCL-P NCs exhibited significantly enhanced in vitro antimicrobial activity against 22 microbial pathogens including ten clinical MRSA isolates and three Candida species. This therapeutic nanocapsule was able to penetrate into burn wounds and demonstrated pronounced wound healing ability against MRSA-Candida co-infected burn wounds of mice by significant reduction of pathogen burden. It also helps in increased cellular proliferation and collagen synthesis in the wounded area with the reduction of inflammatory cytokines. We propose CAM-LEO-PCL-P NCs as a potential candidate to treat chronic wound infections (Fig. 2).

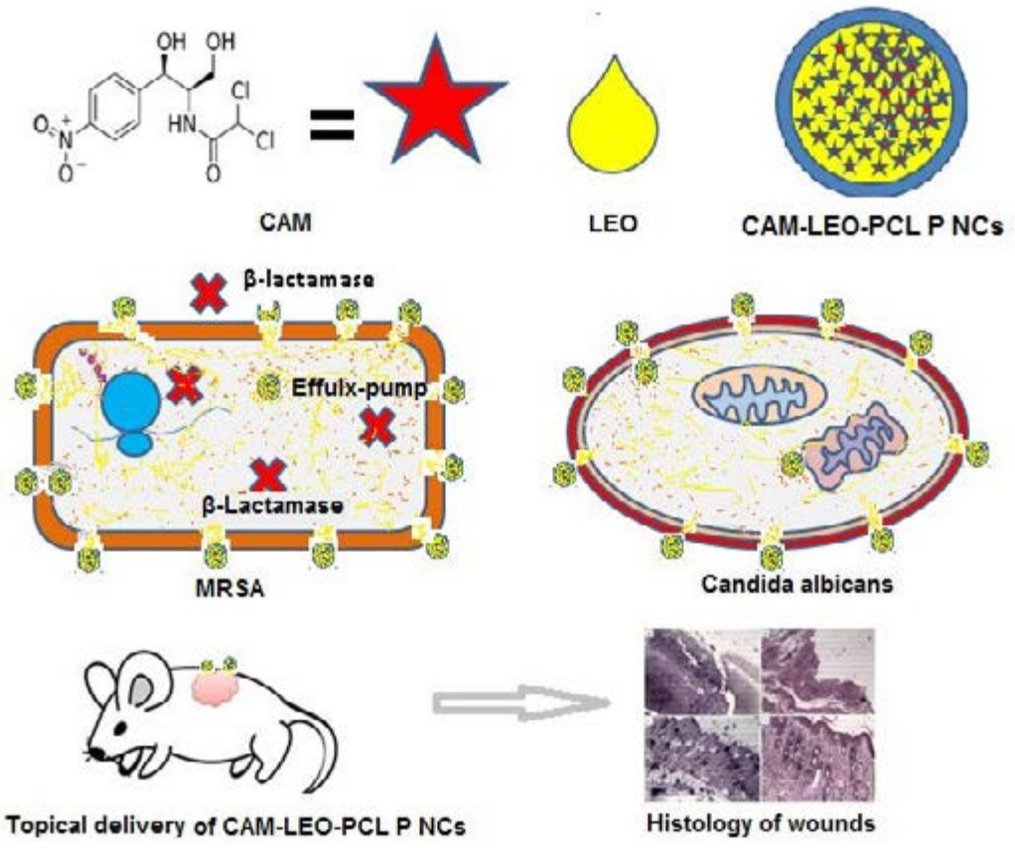


Fig. 2: Schematic representation of hybrid nanocapsule to treat chronic microbial infections on wounds

C. Modification of dietary fat ameliorates metabolic syndrome

The global burden of metabolic syndrome and its consequences are alarmingly rising. However, most of these burdens are preventable since they are primarily due to suboptimal lifestyle, including excessive calorie intake and unbalanced diet. It is of major public health importance to identify and target dietary interventions which can contribute to the prevention of metabolic syndrome. A significant role has been attributed to the quality, rather than the quantity of dietary fat in the development and progression of cardio-metabolic complications. It has been reported that metabolic syndrome associated lipid and lipoprotein metabolism abnormalities are inherent to lipogenesis and lipolysis in the liver and white adipose tissue (WAT). Also, it is accepted that dietary saturated fatty acids (SFA) are detrimental to health and a high intake of SFA, particularly Palmitic acid (C16:0) and Stearic acid (C18:0) is positively associated with increased levels of blood cholesterol and high cardiovascular mortality rate. Hence, our main focus was to determine the responses in tissue SFA profiles of metabolic syndrome-induced rats upon making a dietary intervention by replacement of HCHF diet with a standard rodent diet. In order to determine the effect of this dietary intervention, we have investigated SFA profiles in WAT, liver

and feces with special reference to the highly deleterious SFAs, palmitic acid (C16:0) and stearic acid (C18:0) (Fig. 3). Our study concludes that prolonged consumption of HCHF-diet leads to increased SFA accumulation in liver and WAT, decreased SFA during metabolic syndrome, which is prominently reversed upon sub-chronic withdrawal of the HCHF-diet. This can contribute to the better understanding of the metabolic fate of dietary SFA during metabolic syndrome and may apply to the potential reversion of its complications by simple approach of nutritional modification.

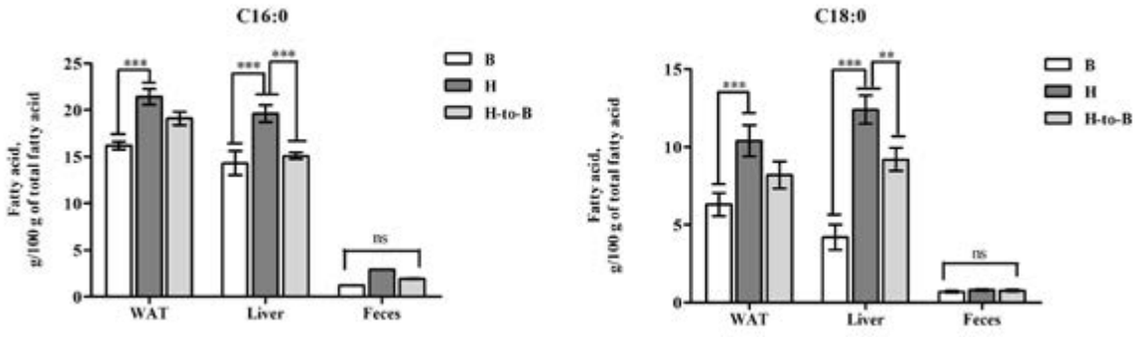


Fig. 3: Changes in saturated fatty acid profile (C16:0, Palmitic acid; C18:0, Stearic acid) in white adipose tissue (WAT), liver, and feces of experimental rats. Group B- Basal diet fed rats, Group H- High-carbohydrate high-fat (HCHF) diet induced metabolic syndrome (MetS) in rats, and Group H-to-B- MetS induced rats subjected to dietary intervention.

D. Integrating herbal medicine of NER with contemporary approaches to develop therapeutic strategies for metabolic syndrome

Several traditional knowledge based herbs and herbal formulation used by different tribes of north east India have been experimented and ethyl acetate extract were found to reduce α-amylase and α-glucoside activity in-vitro and also blood sugar level in HSHF diet induced mouse in pre-clinical trials. Following this results, currently our research is focussed on study of the efficacy of these herbal medicines against metabolic syndrome such as diabetes in an integrated manner involving experimental biology, synthetic and natural product chemistry, pharmacology and Analytical chemistry, biochemistry and mathematical and computational biology. Five plants namely Dillenia indica, Costus speciosus, Premna herbacea, Lagerstroemia speciosa, Mimusops elengi initially and their extracts showed significant antioxidant activity (DPPH assay) invitro with highest activity recorded in ethyl acetate extract (EC50 216.07µg) of Dactylicapnos scandens.

E. Cell free nucleic acid as an non-invasive biomarker in early assessment of head and neck squamous cell carcinoma

Cancer is associated with mutated genes, and analysis of tumour-linked genetic alterations is increasingly used for diagnostic, prognostic and treatment purposes. The genetic profile of solid

tumours is currently obtained from surgical or biopsy specimens to diagnose and manage disease for 1,000 years. Information acquired from a single biopsy provides a spatially and temporally limited snap-shot of a tumour and might fail to reflect its heterogeneity, as a result, highlights the difficulty of dictating a therapeutic course of action which is likely to underestimate the complexity of the genomic landscape of the tumour. There are many difficulties in obtaining a tissue biopsy—including the discomfort suffered by the patient, inherent clinical risks to the patient, potential surgical complications and economic considerations—meaning that multiple or serial biopsies are often impractical. In addition, some tumours are not accessible for biopsy, the procedure itself might increase the risk of the cancer 'seeding' to other sites, and the procedure might not be recommended for patients receiving antiangiogenic treatment. Considering these limitations on the use of single biopsies, new ways have evolved to observe tumour genetics and tumour dynamics. One of the current development is cell free nucleic acid (cfNA-DNA, mRNA and microRNA) in plasma also known as a 'liquid biopsy', which would be useful for numerous diagnostic applications and would avoid the need for tumour tissue biopsies as it delivers the possibility of taking repeated blood samples, consequently allowing the changes in cfNA to be traced during the natural course of the cancer treatment (Fig. 4).

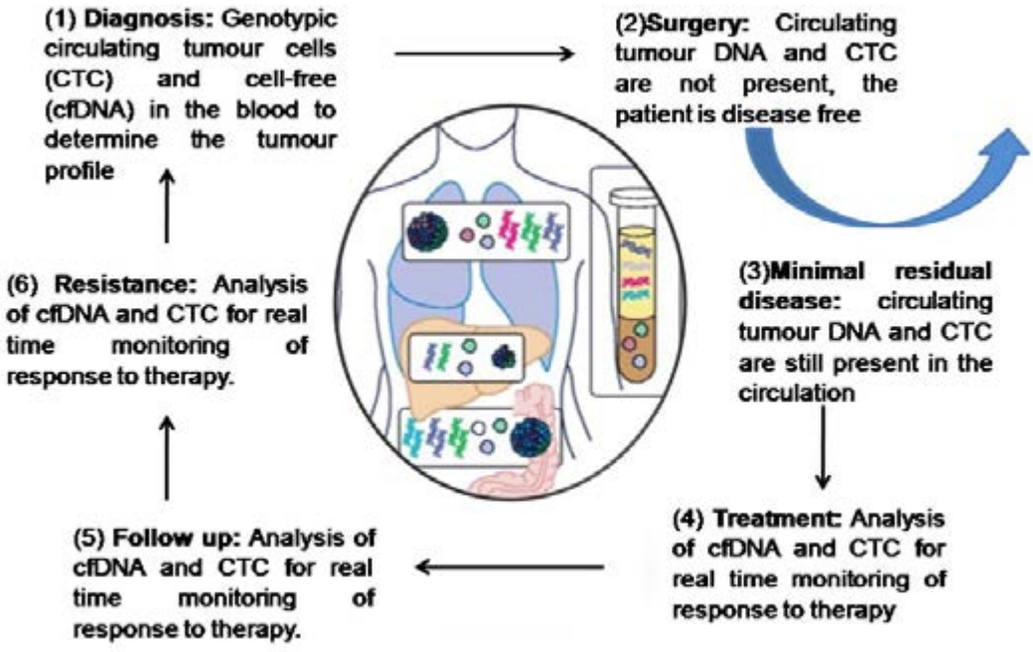


Fig. 4: Schematic representations of cell free DNA as diagnosis, prognosis, and follow-up cancer testing in plasma of cancer patients.

We are working on cell free DNA (cfDNA) using the most prevalent cancer in Northeast India i.e. Head and neck squamous cell carcinoma (HNSCC) using cfDNA as noninvasive biomarker in

early cancer diagnosis. Some preliminary experimental results are highlighted here. At the initial stage of standardization of cfDNA isolation, BCT Streck™ tubes (Streck Inc., Omaha, NE, USA) were used. The cfDNA isolation was carried using QIAamp circulating nucleic acid kit. The quantification of isolated cfDNA samples was done using qubit fluorometer 3.0 showing 1.2 ng/µl ± 0.15 concentration, prior to downstream application. We further, compared the copy number of cfnDNA and cfmtDNA in plasma (Fig.5a and 5b). The level of cfnDNA in the HNSCC group was higher in comparison with the healthy control group (5451.66 vs. 1650.9). Similarly, cfnDNA determination, was found to be higher in comparison to healthy control group. (29103476.15 vs. 9189312.54) (Fig.5c and Table. 1). The diagnostic utility of the study was accessed using ROC (Receiver Operating Characteristic) curve analysis to determine optimal cut-off point for cfnDNA and cfmtDNA (Fig. 5d).

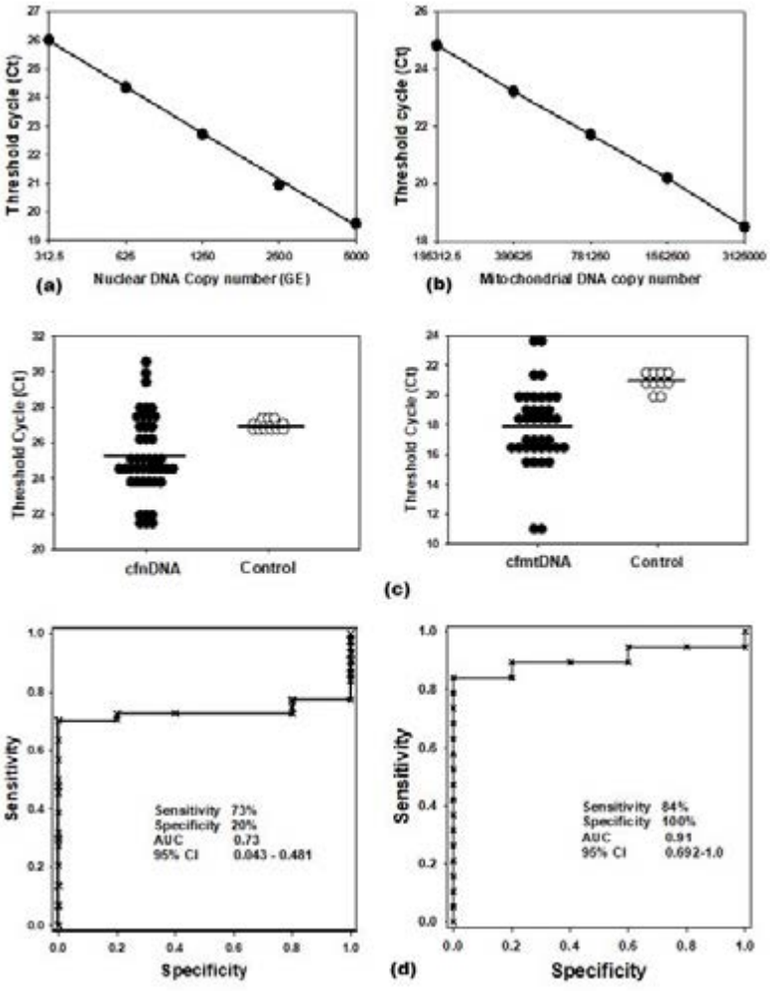


Fig.5: Simulation of real-time PCR kinetics for amplifying a) cfnDNA (GAPDH) and b) cfmtDNA (D-loop) on serial dilutions. Levels of cfDNA copy number as determined by qPCR. Scatter dot plots of the levels of the C) nuclear GAPDH and mitochondrial D-loop (C-tract) in head and neck cancer patients (HNSCC, n=50) and normal control subjects (Control, n=50). The lines in the scatter dot plots denote the medians. The cf nuclear and mitochondrial DNA copy numbers were higher in HNSCC patients compared to those in controls (d) ROC curve comparison in the diagnosis of HNSCC versus healthy controls using cfnDNA and cfmtDNA copy number. For the nuclear GAPDH AUC is 0.73; and mitochondrial D-loop (C-tract) mtDNA AUC is 0.91.

Further, the application of cfDNA is highly innovative in both concept and approach. While detection of specific, known mutations associated with tumors has been demonstrated in cfDNA, 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 will permit targeted re-sequencing libraries to be generated from small amounts of fragmented cfDNA.

Table 1: Copy number of plasma cfnDNA and cfmtDNA in HNSCC cases and controls; expressed as median.

Group	Total number	Age (mean ± S.D.)	Median cfnDNA(GE/ml)	Median cfmtDNA (GE/ml)
HNSCC	50	54 ± 6	5451.66	29103476.15
Control	50	52 ± 2	1650.9	9189312.54

Extramural projects

Completed projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Achievement
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**	In this project we had fractionated some bioactive fractions from Garcinia pedunculata (GP) and Garcinia morella fruits. Further we had isolated and characterized some biomolecules from those active fractions which were further tested both in in vitro and in vivo condition. The cytotoxicity of the fractions/molecules were tested against L929 (mouse fibroblast cell) cell line and it was found that GP has more effective cytotoxicity activity. Reconfirmation of the activity of those molecules were done in animal model after developing metabolic syndrome and compared with a positive control. Thus, it was found that these isolated compounds and extracts from GP have diverse pharmacological properties such as antifungal, cytotoxic, antioxidant, antiobesity and antilipidemic effects.

Ongoing projects

Title of the project	Funding Agency; Total fund; Period; PI/ Coordinator	Goal
Integrating herbal medicine of NER with contemporary approaches to develop therapeutic strategies for metabolic syndrome	DBT, Govt. of India; Entire project fund is Rs 2455.793 lakhs (IASST component of Rs 1043.28 lakhs); 2016-2019; **Dr. N. C. Talukdar**	Evaluate select herbal formulations from the NER for efficacy in a diet-induced rat model for metabolic syndrome. Safety assessment Defining the activity-specific molecular fingerprint for the active formulations. Identification, characterization, and validation of the active constituents (or combinations thereof) that act at the level of the individual tissues.
Development and Elucidation of mechanism of action of herbs to treat Diabetic neuropathic pain.	DBT, Govt. of India; Rs 40 Lakhs; 2014-2018; **Dr. Rajlakshmi Devi**	The goal of this study is to find out a multifaceted noval therapy from medicinal plants of North Eastern Region (NER), India to treat diabetes as it becomes an epidemic disease throughout the world.
Chemical profiling of Joha and black rice of Assam for nutritional, nutraceutical parameters and aroma compounds.	DBT, Govt. of India; Rs. 1.02 crore 2016-2019; **Dr. Rajlakshmi Devi**	Isolation and characterization of active biomolecules from different scented rice of Assam and development of formulation with other medicinal plants for treatment of metabolic syndrome.
Cell -free nucleic acids as non -invasive for cancer detection.	DST, Gov. of India: Rs 35 Lakhs; 2015-2020; **Dr. Rosy Mondal**	The research aims to detect the presence and fractions of circulating cell free DNA (cfDNA) in plasma of head and neck cancer patients and to determine the feasibility of deep sequencing approach in cancer detection. It also aims to determine if cfDNA copy number variation can be used to dynamically monitor response to therapy in cancer.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/Year of publication
Sima Kumari, Elancheran R, Rajlakshmi Devi	In vitro and in vivo antioxidant, anti-hyperlipidemic properties and chemical characterization of Centella asiatica (L.) extract.	Frontiers in Pharmacology, Ethnopharmacology	doi:10.3389/ fphar.2016.00400	2016
Meetali Deori, Dipali Devi, Sima Kumari, Ankita Hazarika, Himadri Kalita, Rahul Sarma and Rajlakshmi Devi	Antioxidant effect of sericin in brain and peripheral tissues of oxidative stress induced hypercholesterolemic rats.	Frontiers in Pharmacology, Ethnopharmacology	doi:10.3389/ fphar.2016.00319	2016
Raghuram Kandimalla, Suvakanta Dash, Sanjeeb Kalita, Bhaswati Choudhury, Sandeep Malampati, Kasturi Kalita, Bhupalee Kalita, Rajlakshmi Devi, Jibon Kotoky	Protective effect of bioactivity guided fractions of Ziziphus jujuba Mill. root bark against hepatic injury and chronic inflammation via inhibiting inflammatory markers and oxidative stress.	Frontiers in Pharmacology	doi:10.3389/ fphar.2016.00298	2016
Rahul Sarma, Sima Kumari, Elancheran Ramakrishnan, Meetali Deori, Rajlakshmi Devi	Polyphenol Rich Extract of Garcinia pedunculata Fruit Attenuates the Hyperlipidemia induced by High Fat Diet.	Frontiers in Pharmacology	doi:10.3389/ fphar.2016.00294	2016
Ankita Hazarika, Himadri Kalita, Mohan Chandra Kalita, Rajlakhsmi Devi	Withdrawal from High-Carbohydrate High-saturated-Fat diet changes saturated-fat distribution and improves hepatic Low-Density-Lipoprotein-receptor expression to ameliorate metabolic syndrome in rats	Nutrition	Vol 38. P 95-101	2017
Raghuram Kandimalla, Suvakanta Dash, Sanjeeb Kalita, Bhaswati Choudhury, Sandeep Malampati, Rajlakshmi Devi, Muthiah Ramanathan, N.C. Talukdar, Jibon Kotoky	Bioactive fraction of Annona reticulata bark (or) Ziziphus jujuba root bark along with insulin attenuates painful diabetic neuropathy through inhibiting NF-κB inflammatory cascade	Frontiers in Cellular Neuroscience	doi: 10.3389/ fncel.2017.00073	2017
Sanjeeb Kalita, Raghuram Kandimalla, Banasmita Devi, Bhupalee Kalita, Kasturi Kalita, ManabDeka, Amal Chandra Kataki, Arup Sharma, Jibon Kotoky.	Dual delivery of chloramphenicol and essential oil by poly-ε-caprolactone-pluronic nanocapsules to treat MRSA-Candida co-infected chronic burn wounds.	RSC Advances	3(7), 1749-1758.	2017
Raghuram Kandimalla,Sanjeeb Kalita, Bhaswati Choudhury, Kasturi Kalita, Suvakanta Dash, Jibon Kotoky.	Chemical composition and anti-candidiasis mediated wound healing property of Cymbopogon nardus essential oil on chronic diabetic wounds.	Frontiers in Pharmacology	7:198. doi: 10.3389/ fphar.2016.00198	2016
Raghuram Kandimalla, Sanjeeb Kalita, BikasSaikia, Bhaswati Choudhury, Y.P Singh, Kasturi Kalita, Suvakanta Dash, Jibon Kotoky.	Antioxidant and hepatoprotective potentiality of Randia dumetorum Lam. leaf and bark via inhibition of oxidative stress and inflammatory cytokines.	Frontiers in Pharmacology	7: 205. DOI: 10.3389/ fphar.2016.00205.	2016

Author (s)	Title	Journal name	Volume & Issue no./ page no.	Month/Year of publication
Raghuram Kandimalla, Suvakanta Dash, Sanjeeb Kalita, Bhaswati Choudhury, SandeepMalampati, Kasturi Kalita, Jibon Kotoky.	Bioactive guided fractions of Annona reticulata L. bark: Protection against liver toxicity and inflammation through inhibiting oxidative stress and proinflammatory cytokines.	Frontiers in Pharmacology	7:168. doi: 10.3389/ fphar.2016.00168	2016
Momita Das, Devendra Kumar Patel, Binode Kumar Baruah, Sofia Banu, Arup Kumar Sharma, Jibon Kotoky	Assessment of polycyclic aromatic hydrocarbons and heavy metal pollution in soils of Guwahati city	Current Science	110 (12), 2285-2292	June/2016
K. Saravanan, R. Elancheran, S. Divakar, S. Kabilan and S. Selvanayagam	2-Chloro-N-(4-phenyl-1,3-thia-zol-2-yl)acetamide	IUCrData	DOI: 10.1107/ S2414314616008798	June/2016
K. Saravanan, S. Divakar, R. Elancheran, S. Kabilan and S. Selvanayagam	4-[2-(1,3-Dioxoisoindolin-2-yl)-1,3-thiazol-4-yl]-benzonitrile	IUCrData	DOI: 10.1107/ S2414314616011172	July/2016
V. L. Maruthanila, R. Elancheran, A. B. Kunnumakkara, S. Kabilan and Jibon Kotoky	Recent development of targeted approaches for the treatment of breast cancer	Breast Cancer	24(2):191-219 doi: 10.1007/s12282-016-0732-1	October/2016
Ajaikumar B. Kunnumakkara. Nand K. Roy, Javadi Monisha, Ganesan Padmavathi, Anusmita Das, Sudeshna Gupta, Elancheran Ramakrishnan and Jibon Kotoky	Rapid Biosynthesis of Gold Nanoparticles Using Aqueous-ethanoic Leaf Extract of Heartleaf Moonseed: Characterization and Effect of pH on its Synthesis	Current Nanomaterials	DOI: 10.2174/24054 6150266616120915 3905	January/2017
K. Saravanan, R. Elancheran, S. Divakar, S. Athavan Alias Anand, M. Ramanathan, Jibon Kotoky, N.K. Lokanath and S. Kabilan	Design, synthesis and biological evaluation of 2-(4-phenylthiazol-2-yl) isoindoline-1,3-dione derivatives as anti-prostate cancer agents	Bioorganic & Medicinal Chemistry Letters	Volume 27, Issue 5, Pages 1199–1204 https://doi. org/10.1016/j. bmcl.2017.01.065	March/ 2017

Book chapters: 2 (Two)

No. of publications in conference proceedings: 2 (Two)

No. of contributory papers presented in international, national and regional conferences: 3 (Three)

No. of Conferences/Workshops/Meetings attended by the staff and students of TKDDD: 16 (Sixteen)

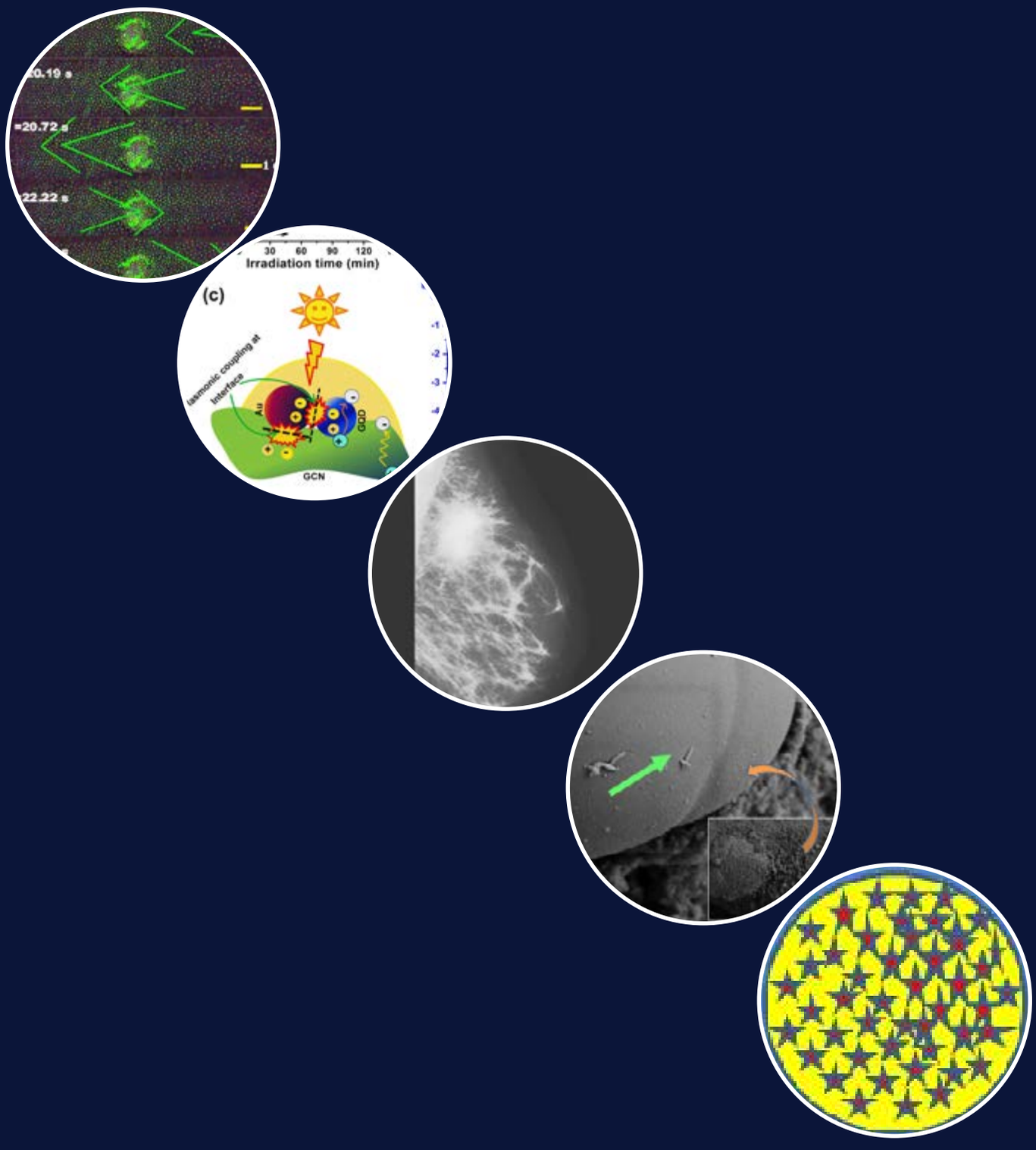
Invited scientific talks

Dr. R. Devi delivered the following invited talks-

1. 'Cell: Structure and function' on National Technology day in the Regional Science Center, Khanapara , Guwahati on 11th May 2016.
2. 'Development of Traditional knowledge based herbal medicine of NER, India' on National Technology day in the Regional Science Center, Khanapara, Guwahati on 8th July 2016.
3. 'Power of Woman' on International Woman day in Pub Kamrup College, Baihata Chariali, Assam on 8th March 2017.

Dr. R. Mondal delivered the following invited talks-

4. 'Association of HPV infection, Xenobiotic gene polymorphism, mitochondrial mutations and tobacco with oral cancer-A study from northeast India' in the conference- EUROGIN 2016 in Salzburg, Austria during 15th -18th June, 2016.
5. 'Genomic on Cancer' in Pub Kamrup College, Guwahati on 20th April, 2017.



Interdisciplinary Research

Silk fibroin based nano-biosensor for the detection of nitroaromatic explosive vapours via impedimetric technique (Advanced Materials Science and Seribiotechnology)

In this work, focus has been shifted from traditionally used substrates like glass and silicon to biopolymer silk fibroin scaffold (SF) as a template for material development, device fabrication and its sensing application towards nitroaromatic explosives detection. The bio-composite material with multilayer of CNPs is prepared via a static adsorption strategy involving a one pot approach. Impedimetric method has been employed for sensing studies as it has many advantages over fluorimetric techniques for onsite applications. The sensor exhibits a resistivity switch upon exposure to the vapours of nitro aromatic compounds like TNP and TNT which is explained in terms of adsorptivity and percolation theory. The sensor exhibits an excellent response time (0 - 3s) and an excellent reversibility. Utilization of low cost precursors, one pot approach for material development and impedimetric sensing technique make the system an ideal choice for achieving the ambitious goal of sustainability. The Bombyx mori (B. mori) Silk used here is a unique material which is known for its strength and lustre and is extensively used in textile industries and as suture material. The raw cocoons are composed of sericin and fibroin protein. Sericin is a group of glycoproteins that cover the surface of fibroin protein, which needs to be removed completely for the preparation of fibroin based materials. The

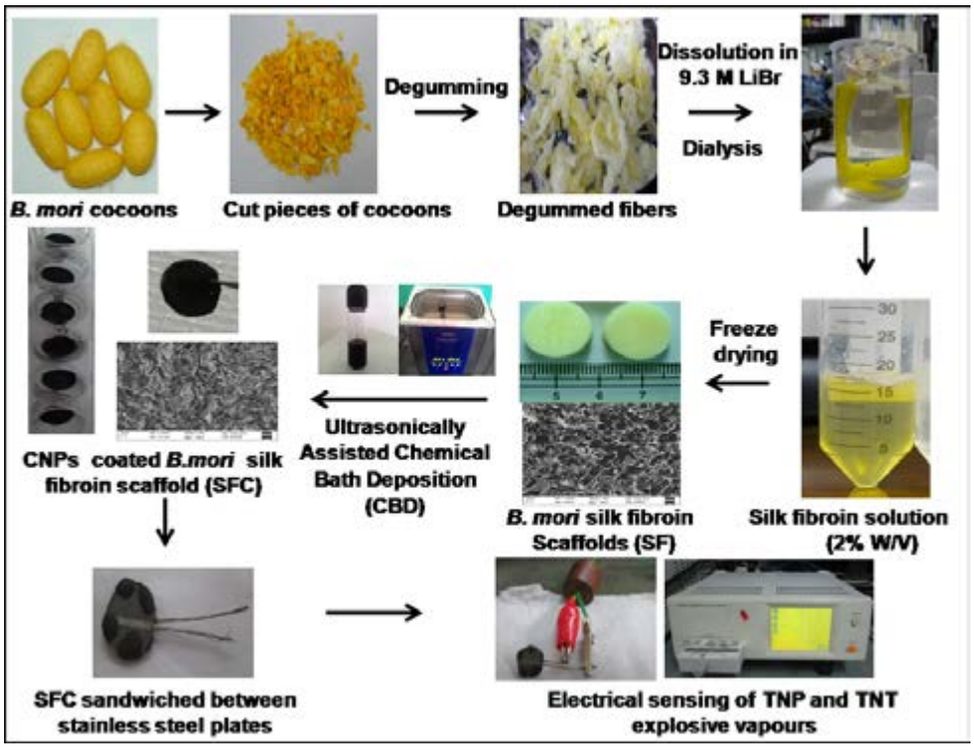


Fig 1 : Scheme represents the biocomposite development for sensing application.

aqueous solution of fibroin protein can be processed into various morphologies for varied applications in sensing and biomedical fields.

Quantum Dot sensor (Plasma and Advanced Materials Science)

A simple, ultrasensitive and rapid cost-effective sensing technique is formulated based on Mercaptosuccinic acid (MSA) capped CdTe/ZnS core/shell (CS) quantum dots (QD) for the detection of toxic Hg(II) in aqueous media. The present system demonstrations a remarkably low detection limit of 1 Pico molar (pM) which is the best-reported work till date. Here, the CdTe/ZnS CS 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. Due to the interaction between CS QDs and the heavy metal ions, the photoluminescence (PL) intensity of QDs quenches via excited state electron transfer mechanism (Fig.2), and is confirmed from cyclic voltammetry and zeta potential. CdTe/ZnS QDs

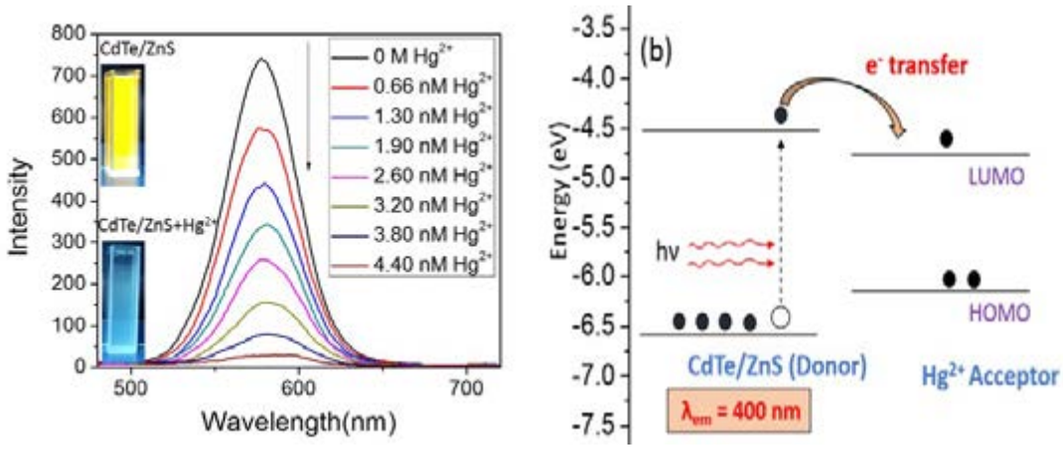


Fig.2 : (a) PL spectra of MSA-coated CdTe/ZnS QDs in presence of different amounts of Hg^{2+} ions (0–4.40 nM). Inset: CdTe/ZnS CS QD before and after titration with Hg^{2+} under UV light. (b) Schematic diagram of the possible mechanism electron transfer mechanism between donor and acceptor pair.

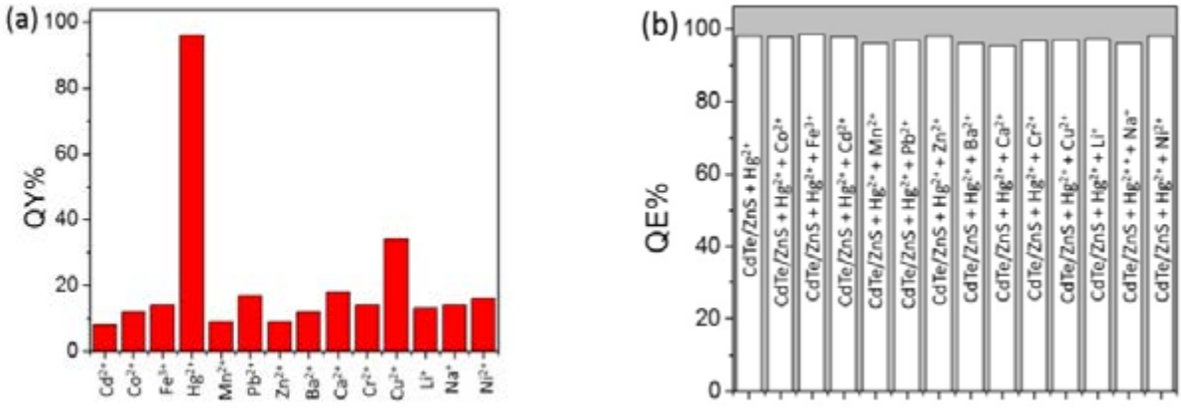


Fig.3 : (a) Fluorescent response of MSA-caped CdTe/ZnS in the presence of a different solution containing a specified metal ion of the same concentration (b) Fluorescent response of MSA-caped CdTe/ZnS towards Hg^{2+} in the presence of other ions of the same concentration.

are found to be highly selective for Hg (II) ions whereas the interference from other toxic metal ions is insignificant. The real time analysis was further carried out with drinking water and tap water solutions and the QDs show remarkably good quenching in these solutions (Fig.3). This is a very simple method for detection of Hg (II) ions in aqueous media and using this method, a prototype low-cost electronic equipment is further designed and fabricated.

Chitosan–Iron Oxide Coated Graphene Oxide Nanocomposite Hydrogel: A Robust and Soft Antimicrobial Biofilm (Advanced Materials Science and Microbiology)

A robust biofilm with antimicrobial properties was fabricated from chitosan–iron oxide coated graphene oxide nanocomposite hydrogel. It was also possible to fabricate films with tunable surface properties such as hydrophobicity simply by varying the loading percentage of GIO nanomaterial in the hydrogel matrix. Fascinatingly, the chitosan–iron oxide coated graphene oxide nanocomposite hydrogel films displayed significant antimicrobial activities against both Gram-positive and Gram-negative bacterial strains, such as methicillin-resistant Staphylococcus aureus, Staphylococcus aureus, and Escherichia coli, and also against the opportunistic dermatophyte Candida albicans. The antimicrobial activities of the films were tested by agar diffusion assay and antimicrobial testing based on direct contact. A comparison of the antimicrobial activity of the chitosan–GIO nanocomposite hydrogel films with those of individual chitosan–graphene oxide and chitosan–iron oxide nanocomposite films demonstrated a higher antimicrobial activity for the former in both types of tests. In vitro hemolysis potentiality tests and MTT assays of the nanocomposite films indicated a noncytotoxic nature of the films, which conveyed the possibility of potential applications of these soft and tough films in biomedical as well as in the food industry.

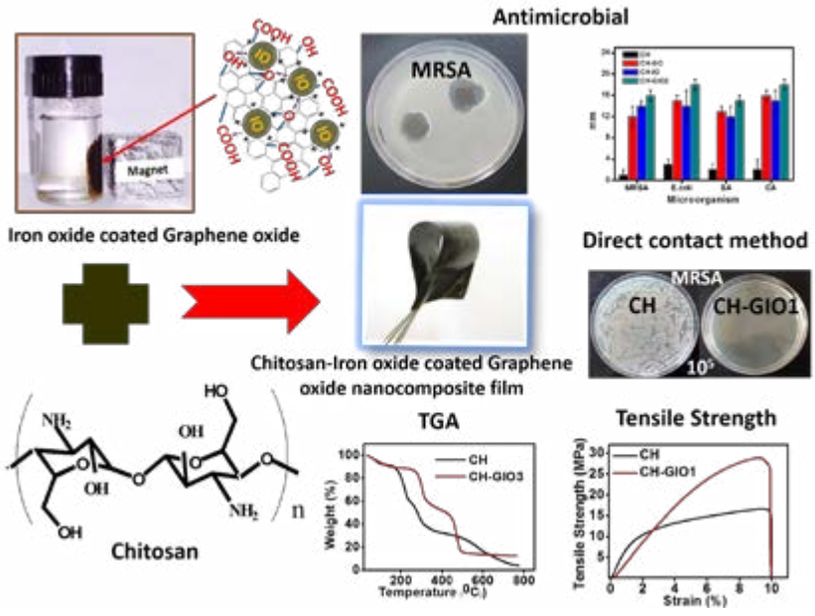


Fig 4 : Chitosan–Iron Oxide Coated Graphene Oxide Nanocomposite Hydrogel based Antimicrobial Biofilm

Fuzzy set and its application (Mathematics and Molecular Biology)

The set whose boundary is not sharp or precise has been studied by the notion of fuzzy set and its logic introduced by L. A. Zadeh in 1965. It is worth mentioning that this notion originated a new theory of uncertainty, distinct from the notion of probability. We have applied the concept of fuzzy theory in studying Phylogenetic analysis of the base sequences in RNA/DNA of cells. We have developed a fuzzy code technique for molecular phylogenetic analysis. Using this novel methodology we have encoded the sequences of 16sRNA and 18sRNA molecule of considered species in phylogenetic trees which folds into

three-dimensional structure termed as secondary structure. We encoded RNA sequence into the fuzzy code and subsequently framed mathematical formulation of RNA secondary structure. Also, we established a relationship between RNA sequence space and their secondary structure. We are now developing new tools for phylogenetic analysis using fuzzy theory. An interesting feature of this tools is that it does not require sequence alignment and termed as Fuzzy integral similarity technique for phylogenetic analysis. It generates phylogenetic tree on the basis of similarity level between two DNA/protein sequence within the collection of sequences for phylogenetic tree construction.

Treatment of Dermatophytic Fungal Infection (Environmental Biotechnology and Drug Design)

Trichophyton rubrum is a drug resistant dermatophytic fungal pathogen of human being and search for new antimycotic drug against this fungus is an important research dimension. Biosurfactants are fast gaining importance as therapeutic molecules owing to their promising antimicrobial activity. Although there are a few reports pertaining to the anti-dermatophytic effect of biosurfactants in-vitro yet, studies to validate those results in-vivo are limited. Therefore, in this research we suggested a potent biosurfactant to invitro and invivo evaluation. Sophorolipid biosurfactant (identified by LCMS) produced by the yeast strain Rhodotorula babjevae YS3 (gene bank accession no. KU600016) was tested for its ability to inhibit the growth of Trichophyton rubrum. In-vitro antifungal activity of the sophorolipid produced by Rhodotorula babjevae YS3 against spores and mycelia of Trichophyton rubrum was investigated and results are presented in Fig.5. Currently, pre-clinical trial in annimal being carried out.

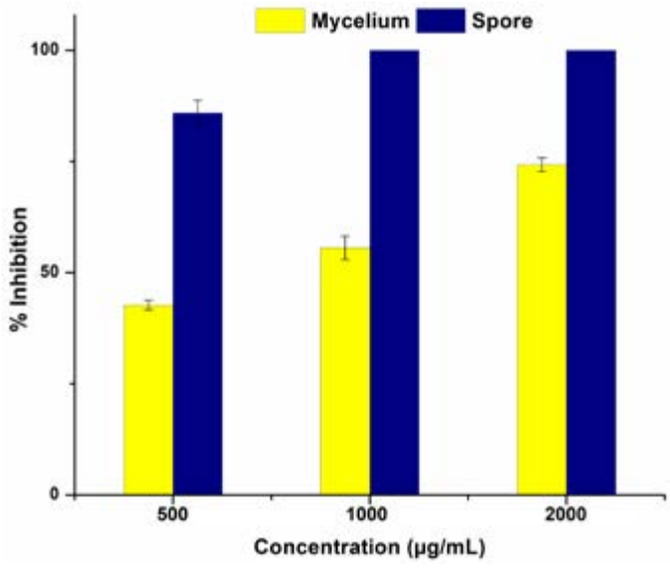


Fig.5: Comparative analysis of the antimycelial and antispore activity of sophorolipid produced by Rhodotorula babjevae YS3 using glucose as carbon substrate against dermatophyte Trichophyton rubrum. Values are mean±SEM.

Publications

In cited journals

Author (s)	Title	Journal name	Volume & Issue no./page no.	Month/Year of publication
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 Material Chemistry Part B	4:3670-3684	April/2016
S. Chakravarty, N. Bhardwaj, B. B. Mandal, N. S. Sarma	Silk Fibroin-carbon nanoparticle composite scaffolds: a cost effective supramolecular 'Turn Off' chemiresistor for nitro aromatic explosive vapors.	Journal of Material Chemistry Part C	4: 8920-8929.	August/2016
A. K. Saw, S Nandi, B. C. Tripathy	Fuzzy code on RNA secondary structure	International Journal of Pure and Applied Mathematics	114(3):483-501	2017
S. Majumdar, G. Krishnatreya, N. Gogoi, D. Thakur, and D. Chowdhury	Carbon dot coated alginate beads as a smart stimuli responsive drug delivery system	ACS Applied Material Interfaces	8:34179-34184	December/2016
A. Konwar, S. Kalita, J. Kotoky, D. Chowdhury	Chitosan-iron oxide coated graphene oxide nanocomposite hydrogel: A robust and soft antimicrobial bio-film.	ACS Applied Material Interfaces	8:20625-20634.	August/2016
S. Majumdar, U. Baruah, G. Majumdar, D.Thakur, D.Chowdhury,	Paper Carbon dots based fluorescence sensor for distinction of organic and inorganic sulphur in analytes	RSC Advances	6:57327	June/2016

Technology Innovation

List of Patents

1. Konwar, R. Kandimalla, S.Kalita, D. Chowdhury (2017) Hybrid Cotton Patch and A method for its Fabrication. Patent application no. 201731001972 A
2. M. Khan, S. Sen and N. C Talukdar (2016) A methods for production of fragrant compounds from resinous chips of Aquilaria malaccensis fermention. Patent Application No. 201633016084 A
3. R. Kandimalla, S. Kalita, B. Choudhury, R. Devi, N. C. Talukdar, M. Ramanathan, S. Dash and J. Kotoky (2016) Poly herbal formulation for treatment of painful diabetic neuropathy. Patent Application No. 201631008543 A
4. S. Kalita, R. Kandimalla, N. C. Talukdar and J. Kotoky (2016) Polymeric nano capsulated delivery system for enhanced antimicrobial activity. Patent Application No. 201631008544 A
5. S. Kalita, R. Kandimalla, K. K. Sharma, N. C. Talukdar and J. Kotoky (2016) Poly herbal formulation for the treatment of dermatophytic infections. Patent Application No. 201631008545 A
6. M. Khan, B. Bhaskar, A. Adak and N. C. Talukdar (2017) A method of production Rice Based Beverage with High Alcohol Content and Method Therefore. Patent Application No. 201731006470
7. A. Hazarika, H. Kalita, S. Kalita, R. Kandimalla, D. Devi and R. Devi (2016) A method for preparing antimicrobial suture biomaterial and antimicrobial suture biomaterial obtained thereby. Patent application no. 201631039602
8. H. Kalita, A. Hazarika, R. Kandimalla, S. Kalita, D. Devi and R. Devi (2016) Antimicrobial suture biomaterial and a method for preparing the same. Patent application no. 201631039604
9. A. Hazarika, H. Kalita, R. Kandimalla, S. Kalita and R. Devi (2016) Cost effective antimicrobial suture biomaterial and a method for preparing the same. Patent application no. 201631039605
10. H. Kalita, A. Hazarika, S. Kalita, R. Kandimalla, D. Devi and R. Devi (2016) Novel antimicrobial suture biomaterial and a method for preparing the same. Patent application no. 201631039603
11. A. Hazarika, R. Devi, N. C. Talukdar and M. C. Kalita (2016) Herbal Formulation for Treatment of Hypercholesterolemia. Patent application no. 201631030051

A. A liquid antifungal biocontrol agent

A liquid antifungal product has been developed and validated in commercial Tea plantations in Namrup district, Udalguri district and Sonitpur district of Assam. Its effectiveness in control of tea diseases such as Black Rot (causal agent, *Corticium* sp.); Red rust (causal agent, *Cephaleuros* sp. in both stem and leaf) and tea pesticide Mealy bug is demonstrated in commercial tea plantations. Currently M/S Green Harvest (India) Bio-tech Pvt. Ltd. (Fig.1) has been producing this product under license agreement with IASST.

Fig. 1: Bio-formulation of Streptomyces sp. *TT-3 as bio-fungicide against Tea fungal pathogens and plant growth promoter.*

B. Development of cost-effective suture biomaterial for stitching surgical wound (application no: 201631039605(pineapple) & 778/KOL/2015 (Ramie))

Natural Ramie and Pineapple fiber (Fig. 2) impregnated with natural hydrogel of Aloe-Vera origin and antimicrobial agents have been found to cause faster wound healing of surgical wound compared to the market available/ commercial silk suture in pre-clinical trial (Fig.3). However, their tensile strength (251 ± 11.5 and 255 ± 10 g/den, respectively) is less than the

commercial silk suture (BMSF). Our current research on determination of surface characteristic of these sutures, enhance their tensile strength in collaboration with Dept. of Textile technology, IIT, New Delhi and testing antigenic effects of the sutures in different model animal in collaboration with the Pathology department of AIIMS, New Delhi.

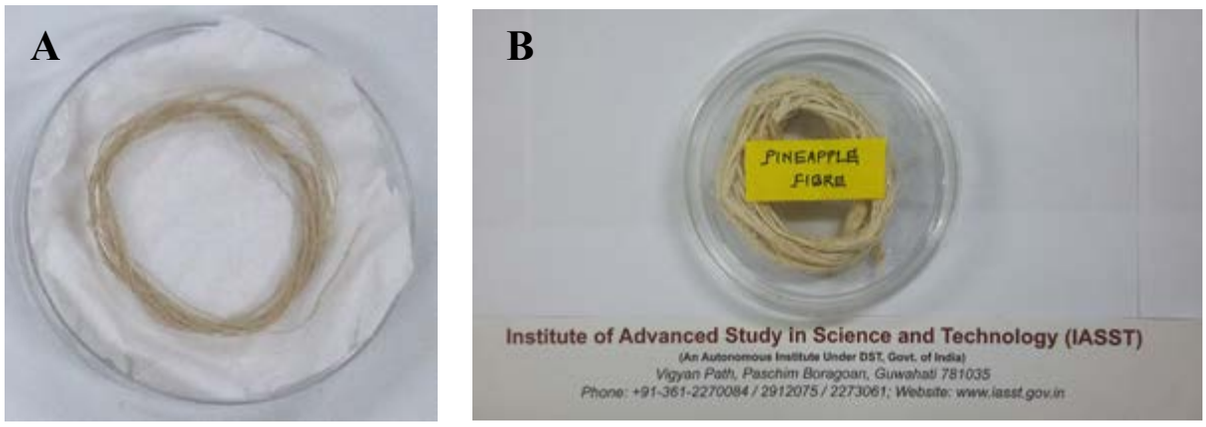


Fig. 2: Natural Ramie (A) and Pineapple fiber (B) as source of cost-effective suture biomaterial for stitching surgical wound.

Fig. 3: Images of surgical wound healing of surgical closures made with Commercial suture, Non-coated and Coated natural fiber based suture at observation time points of Day 0, Day 7 and Day 14 of surgical model in rat.

C. Hybrid Cotton Patch (Patent Application No.201731001972 A, Indian Patent Application Publication Journal Page No. 3213)

A highly absorbent, stable, flexible and compact bio-polymeric hydrogel bounded cotton patch has been fabricated. Hybrid patch does not use loom or other kinds of weaving machines but also makes it possible to get a soft but mechanically robust textile material. Most importantly the polymeric matrix hydrogel part, present over the surface of cotton fibers creates the possibility of loading different kinds of drugs, micro or nanomaterials, different chemicals etc. for numerous applications. With this hydrogel coated cotton patch has been finally developed into bandage material with the minimal number of ingredients viz. graphene oxide and curcumin in it which works on infected wounds.

D. *In vitro* production of fragrant agarwood compounds (Patent application No. 1277/KOL/2014)

An *in vitro* method has been developed for production of fragrant agarwood compounds by treating agarwood callus with a fungus. Fungi isolated from fragrant resin impregnated agarwood of Assam was first screened for their ability to induce production of fragrant compounds in agarwood callus. DBT has funded BIRAC Biotech Ignition Grant (BIG) for commercialization of the technology on aroma production by fermentation of agarwood. The project envisages pre and post proof of concept (POC) of technology for generation of license and/or start-up in line with the start-up India Programme and is underway in IIT-Guwahati. Under the BIRAC-BIG project a pilot scale solid state fermentation based system is being designed for commercial production of high value agarwood oil to cater to the perfume industry and thereby promote agarwood culture in Assam.

E. Formulation from *Cymbopogon nardus* essential oil to treat fungal infected chronic wounds (Indian patent application number: 287/KOL/2015)

A formulation comprised of essential oil from *C. nardus* and olive oil in appropriate proportion has been developed. The formulation inhibits the fungal pathogens (*Candida albicans*, *Candida glabrata*, and *Candida tropicalis*) growth *in vitro* conditions. Further the formulation is effective in inhibiting the growth of fungus on chronic diabetic wounds and fastening the wound healing process in mouse. It also inhibits the inflammatory cytokine levels in mice with chronic diabetic wounds. This invention might promote the market value of *C. nardus* crop which is widely cultivated in North East India. Currently we are in a process of developing the formulation in larger quantity for commercialization.

Supporting staff for technical matter

1st row (Front) L to R: Niranjan Bhagobaty, Dr. Nirab Chandra Adhikary, Juri Pathak, Julie Bordoloi, Subrata Goswami, Dr. Tarini Dev Goswami

2nd row L to R: Manomohan Huzuri, Srikanta Baishya, Madan Chandra Kalita, Subhrojit Sengupta, Nayan Talukdar, Sabin Kalita, Babul Ch. Deka, Bipul Kumar Das, Balabhadra Pathak

3rd row L to R: Gwhwm Basumatary, Kumud Baishya, Krishna Kanta Swargiary, Abinash Nath

ACADEMIC ACTIVITY

Manpower Generation

List of PhD awardees

1. Mr. Bedanta Gogoi was awarded PhD by Gauhati University for his thesis on 'Development of Polymeric Chemosensors from Biological Materials' under the supervision of Dr. N. S. Sarma.
2. Ms Priyanka Dutta was awarded PhD by Gauhati University for her thesis on 'Polymeric Gels and their Nanocomposites: Effect of Metallic and Non-metallic Nanoparticles on the Electrical Conductivity' under the supervision of Dr. N. S. Sarma.
3. Ms Anna Gogoi was awarded PhD by Gauhati University for her thesis on 'Conductivity Studies on Polysalts of 2-Vinylpyridine and its Acrylonitrile Copolymer in Solid State' under the supervision of Dr. N. S. Sarma.
4. Ms Neelam Gogoi was awarded PhD by Gauhati University for her thesis on 'Hybrid Functional Biopolymers as Advanced Nanocomposite for Catalytic Drug Delivery and Sensing Applications' under the supervision of Dr. D. Chowdhury.
5. Mr T. Barman was awarded PhD by Gauhati University for his thesis on 'Study of Discharge and Deposition Characteristics of Glow Discharge Plasma System for Synthesis of Conducting Polymer Films' under the supervision of Dr. A. R. Pal and Prof. J. Chutia.
6. Ms A. A. Hussain was awarded PhD by Gauhati University for her thesis on 'Synthesis of Organic-Inorganic Hybrid Nanocomposites for Optoelectronic Device Applications by Plasma Process' under the supervision of Dr. A. R. Pal.
7. Mr. Dinesh Baruah was awarded PhD by Gauhati University for his thesis on 'Studies on some anti-diabetic plants used by Traditional practitioners of this region' under the supervision of Dr. J. Kotoky.
8. Ms Surabala Devi was awarded PhD by Gauhati University for her thesis on 'Evaluation, characterization and mechanism studies of anticancer compounds from traditional folklore medicines of Manipur' under the supervision of Dr. N. C. Talukdar.
9. Mr Sailendra Goyari was awarded PhD by Gauhati University for his thesis on 'Characterization of cellulose degrading microorganisms and its cellulase enzymes from undisturbed forests soil located at different temperature regimes of north east India' under the supervision of Dr. N. C. Talukdar.
10. Ms Debahuti Goswami was awarded PhD by Gauhati University for her thesis on 'Isolation and characterization of biosurfactants from soil microbes of north east India with special reference to red rot diseases of sugarcane' under the supervision of Dr. S. Deka.
11. Ms Manasee Choudhury was awarded PhD by Gauhati University for her thesis on 'The Golden Hued Muga Silk – studies on degumming, surface modification and pigmentation profile' under the supervision of Dr. D. Devi.
12. Mr Saranga Dutta was awarded PhD by Gauhati University for his thesis on 'De novo Non-mulberry silk as Biomaterial' under the supervision of Dr. D. Devi.
13. Ms Mousumi Saikia was awarded PhD by Gauhati University for her thesis on 'Molecular characterization of some non-mulberry silkworms with special reference to Antheraea assamensis Helfer' under the supervision of Dr. D. Devi.

MSc dissertation

1. Ms N. Das carried out M. Sc. Project (5 months) with Dr. S. Kundu on 'Synthesis and Characterization of Organic Nanoparticles'.
2. Ms S. Gogoi carried out M. Sc. Project (5 months) with Dr. S. Kundu on 'Protein assisted synthesis and characterization of copper nanomaterials'.
3. Ms P. Boro carried out M. Sc. Project (6 months) with Dr. M. B. Sahariah on 'First Principles study of Ni2MnIn Heusler alloy'.
4. Mr. S. J. Deka carried out M. Sc. Project (6 months) with Dr. M. B. Sahariah on 'SnSi nanocrystals of zinc blende structure in a Si matrix'.
5. Mr. Raj Mallik carried out M. Sc. Project (6 months) with Dr. H Bailung on the topic 'Production of Dusty Plasma Using Radio Frequency Discharge at 13.56 MHz and its Characterization'.
6. Mr. Hitesh Boro carried out M. Sc. Project (6 months) with Dr. H Bailung on the topic 'Study of Ion Rich Sheath Characteristics in Laboratory Plasma'.
7. Ms. Archana Mishra carried out M.Sc. dissertation (1 month) with Dr. D. Thakur on the topic 'Application of microbiological and molecular biology techniques towards the screening of biologically active metabolite/s production by microorganisms and their characterization'.
8. Ms. Madhuchanda Sarma carried out M.Sc. dissertation (3 months) with Dr. D. Thakur on the topic 'Production of biologically active metabolite/s by microorganisms and their characterization using molecular techniques'.

9. Ms. Monika Kumari carried out M.Sc. dissertation (1 month) with Dr. D. Thakur on the topic 'In-vitro production of extracellular biologically active metabolite/s by microorganisms and their characterization through molecular techniques'.
10. Ms Satabdi Bhattacharjee carried out summer training (4 months) with Dr. M. R. Khan on the topic 'Probiotic characterization of lactic acid bacteria from rice beer'.

BSc project

1. Mr. A. J. Dutta carried out B.S. Final semester Project (6 months) with Dr. N. S. Sarma on 'Studies on The Synthesis and Development Of Polyvinyl Formaldehyde Conjugates for Gas Sensing Applications'.
2. Ms G. Krishnatreya carried out project (6 months) with Dr. D. Chowdhury on 'Carbon dots coated alginate hydrogel as drug delivery system for mrsa infection inhibition'.
3. Ms Puja Choudhury carried out B.S. final semester project (5 months) with Dr. Nirab C Adhikary on the topic, 'Study the effect of transition material doping on carbon nanotube'.
4. Mr. Pratidutta Sen carried out B.Sc. project (4 months) with Dr. Nirab C Adhikary on 'Study of the electronics and structural properties of titanium and scandium doped single wall carbon nanotube by using DFT'.
5. Ms Rehana Khatoon carried out B.Sc. project (4 months) with Dr. Nirab C Adhikary on 'Computational Modelling of nanostructure'.
6. Ms J. Borkakati carried out B. Sc. Project work (2 months) with Dr. R. Devi on 'Phytochemical screening and in-vitro biological activation of different Clerodendron .
7. Ms R. R. Boro carried out B. Sc. Project work (2 months) with Dr. R. Devi on 'Chemical profiling of Lippia alba'.
8. Ms C. Rajkumari carried out B. Sc. Project work (2 months) with Dr. R. Devi on 'Screening of antimicrobial potential of an herbal formulation'.

Summer training

1. Ms S. Gogoi carried out summer training (2 months) with Dr. N. S. Sarma on 'Synthesis and Characterization of Polyvinyl Alcohol – Coumarin 6 Films for Electrical Properties'.
2. Ms A. D. Choudhury carried out project (3 months) with Dr. D. Chowdhury on 'Preparation and characterization of graphene oxide-bentonite clay hybrid composites'.
3. Mr. Rajnandan Choudhury Das carried out summer training (2 months) with Dr. H. Bailung on the topic 'Horizontal Rotation of Nano Dust Cloud in a Cylindrically Symmetric Unmagnetized Dusty Plasma'.
4. Ms Kasturi Bhattacharjee carried out summer training (2 months) with Dr. N. C. Talukdar on the topic, 'Generating electricity from waste water by using bacteria'.
5. Ms. Mitra Mansi Das and Mr. Rupam Rabha carried out summer training (1 month) with Dr. S. Deka on the topic 'Isolation and screening of efficient hydrocarbon degrading bacteria from oil contaminated soil'.

List of lab members appointed in other national laboratories or abroad

Name of the member	Name of supervisor	Position and current laboratory
Dr. Bedanta Gogoi	Dr. N. S. Sarma	Postdoctoral position in the Weizmann Institute of Science, Israel
Dr. Priyanka Dutta	Dr. N. S. Sarma	NPDF, in the laboratory of Prof. PK Iyer, IITG
Dr. Sudesna Chakravarty	Dr. N. S. Sarma	Research Assistant at the Yonsei University, South Korea
Dr. Neelam Gogoi	Dr. D. Chowdhury	Post-doctoral Fellow, Chinese Academy of Science, URUMQI, China
Dr. Tapan Barman	Dr. A. R. Pal	Postdoctoral Fellow, FCIPT, Institute for Plasma Research, Gandhinagar, India
Dr. Amreen Ara Hussain	Dr. A. R. Pal	National Postdoctoral Fellowship (NPDF), IIT Indore.
Dr. Satyananda Chabungbam	Dr. M. B. Sahariah	Postdoctoral fellow/ Harish-Chandra Research Institute, Allahabad
Mr. Gunenja Gobinda Gohain	Dr. Soumyadeep Nandi	Research Scientist I (NM), Regional Medical Research Centre, Dibrugarh
Dr. Mrinal Kumar Das	Dr. S. C. Bordolai	Zoological Survey of India, Chennai
Ms. Jafrin Farha Hussain	Dr. S. C. Bordoloi	Ministry of Environment and Forest, New Delhi
Ms. Santana Baishya	Dr. S. C. Bordoloi	Ministry of Power, Guwahati

List of lab members who are from other national laboratories and had joined IASST

Name of the member	Name of supervisor	Earlier laboratory
Dr. Wahengbam Romi, Inspire faculty	-	Microbial Repository Centre, Institute of Bioresources and Sustainable Development (IBSD), Imphal, Manipur, India
Mr. Robinson C. Jose, Inspire fellow	Dr. N. C.Talukdar	IBSD
Ms Griha Lakshmi, CSIR-SRF	Dr. N. C. Talukdar	IBSD
Mr.Manish Kumar, JRF	Dr. R. Mondal	Molecular Medicine Laboratory, Department of Biotechnology, Assam University, Silchar
Dr. M. A. Barik	Dr. N. Sen Sarma	Dept of ECE, Tezpur University

Conferences/Seminar/Workshops Organized

Training programme on 'Basic Techniques in Microbiology & Molecular Biology'

The Institutional Biotech Hub of IASST organised a three day exposure training programme on 'Basic Techniques in Microbiology & Molecular Biology' during 25th -27th May, 2016 for school students. Students of standard IX and X from Tetelia High School (Gotanagar, Guwahati), Agdhala Chariali High School (Baihata Chariali, Kamrup) and Sonapur Higher Secondary School (Kamrup) participated and got acquainted with the equipment and techniques used in the research of microbiology and molecular biology.

Workshop for Promoting manufacturing at district level

As a part of Make in India initiative of Govt. of India, a workshop was organised at IASST on 9th June 2016 with a theme of "S & T Innovation for Promoting Manufacturing at District Level". It was organised by Department of Science and Technology in collaboration with Administrative Staff College of India (ASCI), Hyderabad, Centre for Knowledge, Ideas and Development Studies (KnIDS), Delhi in IASST auditorium.

Prof. Gautam Biswas, Director, IITG (left) and Mr Swapnil Barua (IAS), Commissioner, Industry & Commerce, Government of Assam (right), addressing the workshop on S& T Innovation for Promoting Manufacturing at district level.

Workshop on Primary cell culture techniques

A workshop on primary cell culture techniques was organized at IASST from 29th August-31st August 2016. The workshop started with the brief talk on primary cell culture techniques and procedures by Prof. Samir Bhattacharya, Former Director Indian Institute of Chemical Biology, Kolkata. It was followed by demonstration of experimental work on liver and adipose tissue collection from the mice by Prof. Samir Bhattacharya and Dr. Sandip Mukherjee. Experimental setup using the isolated primary cell culture was also demonstrated by western blotting techniques. The participating students acquired preliminary knowledge on the primary cell techniques through this workshop and took part in active discussion with resource persons.

Prof. Samir Bhattacharya demonstrating experimental technique to the participants

4th IASST Colloquium

The fourth edition of IAAST colloquium was held on 27th - 28th October 2016 at institute premises. The primary focus of the program was to give platform to the young research scholars of IASST to improve their presentation skill and express their

creative scientific thoughts. In the program, a few eminent scientists were invited to deliver cutting edge research talks. The inaugural talk was delivered by Prof. Dhiraj Bora, Former Director, Institute of Plasma Research, Gandhinagar on "Fusion and Plasma Science". The other eminent scientists who delivered talk in the IASST colloquium included Prof. Paramvir Singh Ahuja, Former Director General, CSIR, who spoke on "Bioresources and Bioeconomy", Dr. Niranjan Chakraborty, Director, National Institute of Plant Genome Research, Delhi gave a talk on "Understanding plant response to stress: turning knowledge into applications" and Dr. Debasish Borah, Indian Institute of Technology Guwahati, gave a talk titled "The Universe: From the Big Bang to the Present". In the event, post-graduate students and research scholars from different local universities also participated and presented posters on different areas of science and these young researchers were also immensely benefited from the talks of the eminent persons.

In this two days event, there were 10 presentations given in groups by different research groups of IASST on diverse but exciting topics such as Nano-bots: Engines of the future, Skipping Retirement!, Actinobacteria-Weapon against human and plant pathogen. The presentations were judged by a panel of external jury to select the best group. The judges were Prof. B. K. Das, Head, Department of Chemistry, Gauhati University, Dr. Uttam Manna, Department of Chemistry, Indian Institute of Technology, Guwahati, Dr. Debasish Bora, Indian Institute of Technology Guwahati, Prof. Anurup Gohain Barua, Head, Department of Physics, Prof. Utpal Bora, Department of Biosciences & Bioengineering, Indian Institute of Technology, Guwahati. On the first day, the group led by Tonuj Deka and the group led by Achyut Konwar were declared joint winners for the best presentations. On the second day the best presentation award was given to the group led by Bhuvan Bhaskar. The winners were awarded cash prize of ten thousand rupees.

Prof. Dhiraj Bora, Former Director, Institute of Plasma Research, Gandhinagar (left) and Prof. P. S. Ahuja, Former Director General, CSIR delivering talks at 4th IASST colloquium

Workshop on statistical package "R"

"R" is one of the most popular software environment for statistical computing and graphics. This is a free software under GNU project. To take advantage of the package and to improve the analytical skill of the research scholars and scientists in their research activities, IASST conducted two days' workshop on 1st & 2nd of September, 2016. The workshop was conducted by Dr. Alok Srivastava, Assistant Professor, Data Science and Computational Systems Biology at CRRAO Advanced Institute of Mathematics, Statistics and Computer Science, Hyderabad. The workshop was largely carried out at the Bioinformatics Infrastructure Facility, IASST. The purpose of the workshop was to introduce the research scholars the statistical computing environment. The workshop primarily focused on the fundamentals of the package, file handling, graphics and visualization. The workshop was a good success as was evident from the feedback received from the research scholars.

Dr. Alok Srivastava, demonstrating the R-package to the participants

SERB School on Plasma Theory

IASST hosted the SERB school on plasma theory from November 9th – 29th 2016, funded by Department of Science and Technology. The purpose of the school on Plasma Theory is to educate and motivate young researchers of the country carrying out research in the areas of plasma. The curriculum included the introduction to the basic plasma physics, description of varieties of plasmas that exist naturally as well as produced in the laboratories.

The school was inaugurated with a welcome address by Dr. N. C. Talukdar, Director IASST on 9 Nov, 2016. The keynote address was delivered by Prof. M. P. Bora, Head, Department of Physics, Gauhati University. He enlightened the challenges and scope of Plasma research in his talk entitled "Plasma Physics Research – an Overview". A series of lecture was given by various renowned scientists on the different topics related to plasma physics. The school also organized popular lectures and the invited speakers were Prof. P. K. Kaw, Prof. Praveen Kr. Chaddah, and Prof. D. K. Srivastava.

Prof. Predhiman K. Kaw delivering popular talk on Nonlinear Laser Plasma Interactions in the IASST

Plasma production and waves and instabilities detection techniques in DC and RF discharge were demonstrated in the Laboratory sessions in Dusty Plasma Device and Double Plasma Device of IASST

The school also organized an educational tour for the participants that included a half day tour organised to visit the Centre of Plasma Physics (CPP – IPR) campus at Sonapur (Outskirts of Guwahati). Faculty of CPP – IPR demonstrated the ongoing research works in their Laboratories. Besides, site seeing tours on holidays were arranged to important and historic locations in and around Guwahati. The programme ended with a meeting that was attended by Prof. Manoranjan Khan, Member, Program Advisory Committee, Prof. Joyanti Chutia, Former director IASST, Prof. N. C. Talukdar, Director, IASST, Prof. Kartik Patel, BARC Mumbai. After hearing comments from all participants Prof. Khan expressed his happiness on successful completion of the school and thanked all the speakers and the organizers for their dedicated effort.

57th Annual Conference of Association of Microbiologists (AMI) of India and International Symposium on "Microbes and Biosphere What's New and What's Next" during 24th – 27th Nov 2016

The 57th annual conference of Association of Microbiologists of India (AMI) was organised jointly by IASST and the Gauhati University during 24th – 27th Nov 2016 in Gauhati University auditorium and other venues. This was first ever Annual Conference organised by AMI in North-East India in its 57 years history. Dr. N. C. Talukdar, Director, IASST was the chairman and Dr. D. K. Jha, Professor, Dept. of Botany, Gauhati University, was the secretary of the organising committee of the conference. In the conference, an international symposium on the theme "Microbes and Biosphere: What's New and What's Next" was organised for deliberations in six different thematic area. Dr. Merja Iavaara, VTT Technical Research Center , Finland delivered the key note lecture of the inaugural function on the topic "Crystalline rock deep life bio-diversity and geo-biological cycles in crust". The inaugural function of the conference was graced by the Hon'ble Governor of Assam, and the Hon'ble Minister of Science and Technology and Water Resources of Assam, Shri Keshab Mahanta. Altogether one thousand delegates participated in different sessions of the conference. The plenary lectures were delivered by the renowned microbiologists of the country. A special session was organised for the oral presentations by the young microbiologists from different NE Institute/universities on themes relavent to North-east region context. Overall, the conference was highly successful and has contributed to strengthen the future microbiology research in NE part of India.

Inaugural function of the 57th Annual Conference of Association of Microbiologists of India and International Symposium was graced by Hon'ble Governor of Assam, Shri Banwarilal Purohit and Hon'ble Minister of Science and Technology, GoA, Shri Keshab Mahanta.

62nd Annual Technical Session of Assam Science Society

IASST organized 62nd Annual Technical Session of Assam Science Society and National Seminar on "Science and Technology for Human Welfare" on 27th February, 2017. In the inaugural function, distinguished nuclear scientist Professor Anil Kakodkar delivered the keynote talk on "Science education, research and nation building". Prof. Mridul Hazarika, Vice-Chancellor, Gauhati University was the chief-guest for the event. The programme was also graced by Dr. P. C. Neog, President of Assam Science Society and Dr. B. P. Duarah, General Secretary of Assam Science Society. Around 150 participants from academic institutions, universities and colleges participated in this event to discuss, deliberate and propose solutions on various aspects related to the theme for the human welfare. Eight parallel Technical Sessions covering Life Sciences, Physical Sciences, Chemical sciences and Mathematical Sciences were conducted in the morning and afternoon session.

Keynote talk delivered by Prof. Anil Kakodkar and Inauguration of book on the occasion of technical session of Assam Science Society

Workshop on Innovation Management and Product Commercialization

IASST organized a one day workshop on "Innovation Management & Product Commercialization" on March 3rd , 2017. The idea of the workshop is to educate the innovators how to convert their innovations into products so that it can be commercialized. In the workshop a few scientists were invited who have been successful in taking their innovations into products and even have their own start-up companies. The key note address was given by Dr. Amit K. Dinda, Department of Pathology, All India Institute of Medical Sciences, New Delhi who has lot of bio-medical innovations to his credit. Other speakers included Dr. H. C. Das, Director and CEO, Innotech Interventions Pvt. Ltd., Guwahati, Dr. S. Kanagaraj, Department of Mechanical Engineering, IIT Guwahati, Dr. Biman Mandal, Department of Bioscience and Bioengineering, IIT Guwahati. The industry side was represented by Dr. M. Ahmed, Executive Director R&D, Green Harvest (India), Biotech Pvt. Ltd. There was also a session of short presentations by young innovations both in-house innovators from IASST as well as institutes and Universities. Innovators from IIT Guwahati, IASST, Gauhati University, Tezpur University presented their innovation in the workshop.

A group photo of the Innovation Management and Product Commercialization meet with the visiting dignitaries

2nd National Workshop on Medical Image Processing

IASST conducted the 2nd National workshop on Medical Image Processing on 8th and 9th March 2017. IASST has been the first institute in India to provide a platform where scientists and experts working in this area came together with clinicians from hospitals and diagnostic laboratories. The workshop was organised in joint collaboration with Indian Statistical Institute. Kolkata. Prof. Gautam Biswas, Director, IIT Guwahati was the Chief Guest of the Inaugural function and Prof. Atindra Adhikari was the Guest of Honour. Both of them started off the workshop with highly illuminative and motivating lectures. A series of lectures were delivered by a number of well known scientists of the field. The invited speakers were Prof. Nikhil R. Pal, Prof. Bhabatosh Chanda, Dr. Swagatam Das, Dr. Basanta Baishya, Dr. Anup Das and Prof. K.D. Krori.

Prof. Gautam Biswas, Director, IIT Guwahati and Prof. Bhabatosh Chanda delivering lecture at 2nd National Workshop on Medical Image Processing

Northeastern Regional Conference and exhibition

Institutional Biotech Hub, Gauhati University in collaboration with IASST, IIT Guwahati, USTM Meghalaya and NEBA organized a three day Northeastern Regional Conference and Exhibition on "Promotion and Protection of Traditional Health Care Remedy" at Gauhati University from 24th – 26th March, 2017. The conference cum exhibition was an attempt to bring researchers and traditional medicinal practitioners of NE India in one platform to pave out the road map for future conservation of traditional medicinal practices and research arising out of such sources of medicines.

Basics of Bioinformatics and way to Multiple applications

Bioinformatics Infrastructure facility (BIF) of IASST organized one –day hands on workshop on "Basics of Bioinformatics and way to Multiple applications" on 29th March 2017 at its premises. The workshop aimed to provide in depth knowledge of various bioinformatics tools/techniques in biological data analysis to the undergraduate college students of North-eastern region. 25 participants from Nalbari college, Pub Kamrup college, Pragjyotish college, Pandu college, actively took part in the workshop. Dr. Probodh Borah, Coordinator of BIF Centre of NER & Prof. College of Veterinary Science, Guwahati underlined the importance of bioinformatics studies in biological data analysis. Sri Saurov Mahanta, NIELIT, Guwahati, Assam emphasized on biological databases and its importance. Dr.Soumyadeep Nandi, IASST, majorly focused on the basics of computational biology & how it helped the researchers in their field. The hands on training was conducted by Nabajyoti Goswami, College of Veterinary Science & Anupam Bhattacharya, IASST. Participants were exposed to sequence analysis, BLAST, phylogenetics study, protein structure analysis during the hands on session.

Exhibition Attended

Innovation Festival

Regional Science Centre, Khanapara, Guwahati organised its 3rd Innovation Festival in its premises on 11th and 12th February 2017 in collaboration with National Innovation Foundation, India. Shri Krishna Kumar Dwivedi, Commissioner and Secretary, Dept. of Science & Technology and Information Technology, Govt. of Assam was present as the Chief Guest and inaugurated the Innovation Festival. IASST participated by displaying exhibits on outcome of its research activities in the exhibition along with the technologies and innovations developed at the institute.

Shri Krishna Kumar Dwivedi, Commissioner and Secretary, Dept. of Science & Technology and Information Technology, Govt. of Assam delivered inaugural speech of the Innovation Festival.

Students of IASST exhibiting IASST's research themes.

Signing of Memorandum of Understandings

IASST signed Memorandum of Understanding (MoU) with several institutions for research collaborations. On 7th of May, 2016, three MoUs were signed. The first tripartite MoU was signed among Drug Discovery Research Center (DDRC), Delhi, Revelations Biotech Pvt Ltd., Hyderabad and IASST. The second MoU was signed with Assam Down Town University and the third MoU was signed between IASST and Cotton University. Subsequently, IASST signed MoUs with Rajiv Gandhi University, Arunachal Pradesh on 20th of July 2016, Toklai Tea Research Institute, TRA on 4th Feb 2017 and InfoTech Interventions Pvt. Ltd on 6th of Feb 2017.

MoU among DDRC, Revelations Biotech Pvt Ltd and IASST

MoU between Cotton University and IASST

MoU between Down Town University and IASST

Formation of Scientific Society

Meeting of selected office bearer of the Indian Society of Translational Research with North East researchers in IASST

A meeting was held at the conference hall of IASST, on 05/12/2016 to discuss on the formation of a unit of Indian Society of Translation Research (ISTR) in the Northeastern part of India. Dr. N.C. Talukdar, Director, IASST welcomed all the members present in the meeting. Academician and researchers from Tezpur University, Guwahti University, IITG and NEH took part in the meeting and after detail deliberation it was unanimously decided to open the North East India chapter of ISTR with its office in IASST. Prof. G. Kundu, Secretary of ISTR appraised the objective of ISTR and informed that it is a registered society having four local chapters spread across the country. The purpose of the meeting was to open up another new chapter of ISTR for Eastern part of the country. Ten life members and thirty one student members present in the meeting joined to constitute the ISTR unit for North-East India.

Meeting on formation of a unit Indian Society of Translation Research (ISTR) in the Northeastern part of India

Meetings of IASST

Brainstorming meeting on Multi Drug Resistant Tuberculosis (MDRT) in India: Genomics Driven Intervention

A Brainstorming Meeting was organised at IASST by Department of Biotechnology, Govt. of India on "Multi Drug Resistant Tuberculosis in North Eastern Region of India", during 19-20th August 2016. More than 30 experts from different scientific institutions and DBT officials participated in this meeting. The main purpose was to generate ideas for formulation of a mega research project for addressing the complexity of MDRT and developing therapeutic strategy.

Dr. T. Madhan Mohan, Advisor, DBT (left) and Prof. Partha P Majumder, National Institute of Biomedical Genomics (right) addressing the audience in the brainstorming meet.

Ninth meeting of the Governing Council of IASST

The ninth meeting of the governing council of the IASST was held on 11th November 2016, in the Technology Bhavan of Department of Science and Technology (DST), New Delhi under the chairmanship of Prof. Ashutosh Sharma, Secretary, DST.

Meeting of the Governing Council of IASST

Meeting of Animal Ethics Committee

The Institutional Animal Ethics Committee (IAEC) meeting was held on 23rd January 2017 at IASST. The members present in the meeting were Dr. N. C. Talukdar, IASST, Dr. Pritam Mohan, CPCSEA, Dr. Sashanka Sekhar Dutta, CPCSEA, Dr. P. Chattopadhyay, Dr. S.Tamuli, Dr. Smriti Rekha Dutta, Dr. D. Devi, Dr. R.Devi and Dr. D. Thakur. In the meeting it was decided that each and every experiment should follow standard operating procedure (SOP) set up by IAEC, IASST. All the members visited the animal house facility of IASST and appraised that the house is quite small as compared to demand of the experiment. Dr. N. C. Talukdar appraised that a new animal house will be constructed within 10-12 months time with all modern facility. After thorough discussion and scrutinization of the project proposal related to animal experiment, different projects were approved in the meeting.

Meeting on Institutional Animal Ethics Committee held at IASST

Programme on "Hydrocarbon Vision 2030: Opportunities for R&D institutes and entrepreneurs of NE India"

IASST in association with Innotech Interventions Pvt Ltd (Innotech) organized a one day workshop entitled "Hydrocarbon Vision 2030: Opportunities for R&D institutes and entrepreneurs of NE India" on 6th February, 2017. Sri H.C.Das, CEO, Innotech explained the objectives of the workshop followed by welcome address of Dr.N.C.Talukdar, Director, IASST. Key note address by was given by Dr R.K. Vij, Asset Manager, ONGC, Sibsagar on "Hydrocarbon Vision 2030: Opportunities for R&D institutes and entrepreneurs of NE India" He discussed at length the requirement of new technologies for enhancement of production by the industry in the coming decades. The presentation of Dr P M Sarma, CTO, Innotech was on "Research opportunities in Petroleum microbiology".The last speaker Mr R Puri, CEO, MICGAS, USA and Vice President, Innotech Global operation spoke on "Industry academia relationship in US and global opportunities for Indian research institutes" and enthralled the audience in his innovative way which was followed by active participation of the audience.

Signing of MoU between IASST and INNOTECH; and H.C.Das, CEO, INNOTECH welcoming the gathering

Meeting with DNA Society of India

IASST held a meeting on 13th February 2017 with DNA Society of India (DSI) to organize a symposium entitled "Importance of DNA fingerprinting, cataloging and utilization of the bioresources of the North-East India." The tentative date proposed for the conference was 12th – 13th April 2017. The symposium was decided to organized jointly by Cotton University and IASST. Delegates from Cotton University and DSI were present in the meeting.

Programme on interactive meet with college Principals

IASST organized an interactive meet of College Principals & Faculties of Govt. Colleges on 17th February 2017 at its own campus. The objective of the meeting was to discuss suitable areas of research collaboration between individual colleges and the IASST faculties. Forty-five participants comprising college principals and faculties from different colleges participated in the meeting. The inaugural Speech was delivered by Prof. Kulendu Pathak, Former Vice Chancellor, Dibrugarh University, Assam. The participants spoke about their area of research interest and current teaching curriculum. The research program heads of IASST highlighted research programs being carried out in the Institute.

Interactive meet of college Principals at IASST

Visit of distinguished scientists from other institutes

Date	Photo	Name of the visitor and Affiliation	Title of the talk
21/4/2016		**Dr. Jnanjyoti Sarmah** Vice-Principal (i/c), R.G. Baruah College, Guwahati and Karyakarta of Vivekananda Kendra Institute of Culture.	Yoga and Meditation for Stress Management.
25/04/2016		**Prof. Samir Bhattacharya** Former Director, CSIR-IICB, Kolkata and Emeritus Professor, School of Life Science, Visva-Bharati, Santiniketan	Lipid links inflammation, insulin resistance and type 2 diabetes
29/04/2016		**Dr. B. G Unni** Registrar, Assam Down Town University, Guwahati, Assam	Laboratory visit and interaction with students, IASST
24/06/2016		**Prof. Sandeep Kumar** Professor of Raman Research Institute, Bangalore	Supramolecular nanocomposites as advanced materials for opto-electronics.
28/06/2016		**Dr. Govind Gujar** DBT Visiting Research Professor, IASST , Former HoD of Entomology, IARI, New Delhi	A story of Bt transgenic cole crops-our experiences
19/08/2016		**Dr. Tapan Saikia** Medical Oncologist Prince Aly Khan Hospital, Mumbai	Mathematics of cancer: the causes and progression
20/10/2016		**Dr. Magnus Larkspore Liden** Department of Organismal Biology, Systematic Biology Uppasala University, Sweden	Eastern Himalayan Biodiversity
05/12/2016		**Dr. Bidyut B Chaudhuri** INAE distinguished Professor, Indian Statistical Institute, Kolkata	Automatic processing of strike- outs in handwritten text images

Date	Photo	Name of the visitor and Affiliation	Title of the talk
05/12/2016		**Dr. Gopal Kundu** Scientist-G & Professor, National Center for Cell Sciences, Pune	Therapeutic potential of oncogenic and angiogenic genes in cancer and cancer stem cells
13/01/2017		**Dr. C P Thakur** Chairman, COPLOT, New Delhi	Parliamentary team visit New Delhi
18/01/2017		**Dr. Partha P. Parui** Jadavpur University	Bio-thiols detection: Application in living species
03/02/2017		**Mr. S. Francis** Sr. AO, Public Financial Management System (P.F.M.S.), Ministry of Finance, New Delhi	Public Financial Management System
10/02/2017		**Dr. G. Suresh Kumar** Chief Scientist, CSIR- Indian Institute of Chemical Biology	Drug-nucleic acid interaction on medicinal alkaloids
20/02/2017		**Dr. Kishore Kumar Das** Department of Statistics, Gauhati University	Able's binomial generalization via Urn modelling
23/01/17		**Dr. Satish Kumar** Centre for Cellular & Molecular Biology, Hyderabad	Indian Livestock Genetic Resources: Role of Genomics Research in Conservation and Utilization of Bio-diversity
28/03/2017		**Prof. Malaya Ananda Dutta** Department of Computer Science and Engineering, Indian Institute of Information Technology, Guwahati	Some hard problems in computer applications

Popular Talk/ Lecture delivered by the in-house speakers

Date	Name of the Speaker	Title of the talk
16/12/2016	**Dr. Sagar Sharma** (DST-INSPIRE Faculty, IASST) & **Dr. Biswajit Choudhury** (DST-INSPIRE Faculty, IASST)	Organic Semiconductor Materials & 2D carbon based Plasmonic Photocatalysis
19/12/2016	**Dr. Soumyadeep Nandi** (Ramalingaswami Fellow, IASST)	How we are committed?
20/12/2016	**Dr. Wahengbam Romi** (DST-INSPIRE Faculty, IASST) & **Dr. Rupamoni Thakur** (NPDF, IASST)	Hunt for the Invisible Soldiers & Dietary Factors: A Major Regulator of the Human Gut Microbiota

Experience shared by the in-house staff after their visit to training programmes

Date	Name of the Speaker	Title of the talk
29/08/2016	**Dr. Diganta Goswami** (Registrar, IASST)	Competencies of strategic leadership and change management
10/01/2017	**Dr. Neelotpal Sen Sarma** (Assoc. Professor II, IASST) & **Dr. Debajit Thakur** (Assoc. Professor I, IASST)	Sharing our experience under a training program "Values Driven Leadership" held at Administrative Staff College of India, Bella Vista, Hyderabad.

IASST'S SCIENTIFIC SOCIAL RESPONSIBILITY

Technology Outreach

Adoption of ST village and rural technology intervention

Two ST villages viz. Bakrapara and Kallapra situated at Rani Block, Kamrup District of Assam and 24 kilometers from IASST campus were chosen and their scoio-economic status analysed through standard questioner driven survey prior to technology intervention.

Total no. of household and individuals were 85 and 396, respectively of Kallapara and 87 and 380, respectively of Bakarapara. The respective sex ratio in both the villages was 47(M):53(F) with 76% literacy rate in Kallapara and 52(M):48(F) with 85% literacy rate in Bakarapara. The estimated income of >50% households ranged from Rs.20,000-80,000 annually. Household with agricultural land holding finds it hard to grow the crop as wild elephants damage their crop fields regularly. About 26% of house-holds carry out farming on rental land. As a part of their culture, 60% of their households in both the villages produce local wine for own consumption and generating an additional income. The allied activities, the inhabitants of both the villages, interested and carry out in order of preference are pig farming, goat farming and handloom and these activities meet a part of their livelihood requirement.

Overall analysis of survey generated data revealed that the villages were poor and living below poverty line. The objective of the adoption was to improve the economic condition by providing inputs and knowhow support in phase manner to selected households. These rural technologies are standardized in IASST.

Mushroom production

Sixteen households showed interest at the end of an awareness generating and hands on training programme conducted for 20 male and females during December 8-9, 2016 in Mushroom Demonstration Unit of IASST. Quality mushroom spawn and high-density polybags were provided along with spot technical support to the first batch growers. The individual household harvested 5 to 10 kg mushroom over a period of 3 months and earn money from Rs. 300/ to 500/- per batch besides their own utilization. Seeing the success, more villagers showed interest and 2nd batch of production is underway. (Fig. 1 & 2)

Fig. 1: Participants from Bakarapara and Kollapara villages near the low-cost mushroom production unit of IASST after their practical session on mushroom production training held during December 8-9, 2016.

Fig. 2: IASST stuff observing the luxuriant growth of mushroom in one of the beneficiary at Bakrapara village

Eri silk rearing

A total of ten households participated. Disease free eggs and seeds of castor were provided by the IASST. Three batches of production helped the growers earn money by selling (i) cocoon (ii) raw silk and (iii) larvae and pupa as an edible protein source. On an average, each family earned Rs. 4,000 to 5,000 per year from eri silk rearing. (Fig. 3)

Fig. 3: A woman beneficiary observes her lot of eri-larvae at 3rd instar, feeding on castor plant leave.

High-value rice cultivation

3 kg of high-value black rice seed collected from Manipur was supplied by IASST to Mr. Basanta Daimari of Kallapara village for cultivation. The seedling of rice was transplanted on 23/08/2016 and harvested on 27/11/2016. A total of 55 kg rice was produced from the 3kg of the seed. This year, 20 kg of rice seed was procured from Mr. Daimary by IASST and distributed 4 kg to each of 5 farmers of both the villages. (Fig. 4)

Fig. 4: Transplantation of black rice seedling at Kollapra village of Rani Block of Kamrup District of Assam.

Empowerment of ST/SC people through rearing and utilization of Eri silk worm, *Samia ricini* Donovan in two Districts of Assam

The outreach program on eri rearing and spinning has been continued at two places of two districts as reported earlier. Twenty beneficiaries are working in this project. They produced 1,25,000 of green cocoons during the year @ of 50 kgs /person. A user friendly spinning machine has been distributed to the farmers last year. They spun the eri cocoons themselves and earned more as shown below-

1 kg cut cocoon contains 2500 number of green cocoons

50 kg cut cocoons x2500=125000 green cocoons

1 kg cut cocoons=700 gm fiber

50 kg cut cocoon=35000gm fiber=35kg fiber

1 kg fiber =Rs 2400

35 kg fiber=Rs 82,000.

On an average Rs 82,000/- of income/person/year was generated from this venture of IASST in two tribal village.

Outreach program in Jhum field of Nangpoh, Meghalaya-

A bacterial consortia (Enterobacter hormaechei RCE-1, Enterobacter asburiae RCE-2, Enterobacter ludwigii RCE-5 and Klebsiella pneumoniae RCE-7) developed through 3 years of field trial was found to enhance yield of rice grown in Jhum fields of Nagaland, Mizoram and Karbi Anglong, Assam and this consortia was also inoculated in a local ginger landrace (Purlum) and cultivated in 10 year Jhum field of Nongpoh, Meghalaya. Ginger rhizome yield increased due to inoculation by 21% compared to uninoculated control. (Fig. 5)

Fig. 5: Demonstration plots set up in Pahamsyiem village, Nongpoh, Meghalaya during March, 2016. Mixing of biofertilizer with Ginger rhizome (A) (left). View of ginger crops (B) in the control (without biofertilizer-right) and with biofertilizer-left in the month of August, 2016. Please note that biofertilizer applied plot plants are healthier than control plants

Academic Outreach

School Outreach Program

IASST scientists are 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. These lectures are followed up by a daylong exposures visit of selected students to IASST laboratories. This has been a very effective venture in generating genuine interest of students in science. During 2016-2017, 16 scientists of IASST delivered 96 hours of lectures covering physics, chemistry and biology. In these classes, the IASST scientists connect a particular topic of school text with their laboratory research. Consequently, it is expected that students are able to link their text science topics with the results of works of scientists in laboratories and it is likely that this approach will motivate students towards career science. Some of the school visited by IASST scientists include Sonapur H. S. School, Sonapur, Agdala High School, Agdala, Dora Kohara High School, Changsari.

IASST scientist teaching in high school in the outskirt of Guwahati

Exposure visit of students of schools and colleges of NorthEast India

During the year, the institute hosted 14 batches of student visitors from schools and colleges of northeast India. During the visits, the students could see and experience the range of research activities in the institute and its infrastructure facilities. The bioresource conservation hub and the diverse plantation in the institute's green campus were appreciated by the students and were very inspirational for them. The details of visit is listed below:

Date of visit	Name of the Institute	No. of visitors			Department visited
		Teacher	Students	Total	
04/04/2016	B.N. College, Dhubri, Assam B.Sc. 4th Sem. (Dept. of Botany)	2	33	35	Life Science Division
06/04/2016	B. Borooah College, Guwahati, Assam B.Sc. 4th Sem. (Dept. of Botany)	4	19	23	Life Science Division
02/05/2016	Tetelia High School, Guwahati, Assam 10th Class Students	03	36	39	Life Sciences Division and Physical Sciences Division
3/5/2016	Handique Girls College, Guwahati, Assam B.Sc. 4th Sem. (Dept. of Zoology)	02	15	17	Life Science Division
10/05/2016	Class IX students of the Govt. schools of state of Manipur as Science awareness cum excursion programme sponsored by DST, Govt. of Manipur	05	40	45	Life Sciences Division and Physical Sciences Division
22/6/2016	Bajali College, Pathsala, Barpeta PG Students, (Dept. of Zoology)	02	18	20	Life Science Division
15/7/2016	St. Edmund's College, Shillong, Meghalaya B.Sc. 6th Sem.(Dept. of Botany)	02	7	09	Life Science Division
9/9/2016	B. P. Chaliha College, Nagarbera, Kamrup B.Sc 6th Sem. (Dept. of Zoology)	01	05	06	Life Science Division
28/11/2016	Assam Don Bosco University, Sonapur, Guwahati PG Students (Dept. of Biotechnology)	02	15	17	Life Science Division
16/12/2016	Cotton University, Guwahati, Assam, PG Students (Department Biotechnology, CCSU	02	09	11	Life Science Division
19/12/2016	Simen Chapari College, Dhemaji, Assam B.Sc. 6th Sem. (Dept. of Zoology)	02	49	51	Life Science Division
9/2/2017	Haflong College, Haflong, Assam B.Sc. 5th Sem. (Dept. of Physics)	02	10	12	Physical Sciences Division
22/2/2017	College of Veterinary Science, Khanapara, Guwahati	02	06	08	Life Science Division
15/3/2017	Nalbari College, Nalbari, Assam B.Sc. 5th Sem.	02	10	12	Life Science Division


Visit of Students from B.N. College, Dhubri (left) and students from Biotechnology Department, CCSU (right)


Visit of Students from B.P. Chaliha College, Nagarbera (left) and from the State of Manipur (right)

BEHIND RESEARCH AND DEVELOPMENT

IASST COMMITTEES

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Prof. Ashutosh Sharma
Secretary,
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
Joint Secretary and Financial Advisor
Department of Science &Technology
Government of India, New Delhi

Ms. K.K. Dwivedi, IAS
Commissioner& Secretary,
Science & Technology Department
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

Members

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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

FINANCE COMMITTEE

Chairperson

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

Members

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

Dr. Praveer Asthana
Adviser/Scientist-G
Head, AI Division
Department of Science &Technology,
Govt. of India, New Delhi

Prof. B. C. Tripathy
IASST, Guwahati

Mr. Uttam Ch. Das
Registrar
IIT Guwahati

Member-Secretary:

Mr. Pradyut Borkataki
FAO, IASST, Guwahati

BUILDING WORKS COMMITTEE

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

Chief Vigilance Officer:
Dr. B. K. Shukla
DST, New Delhi

Vigilance Officer:
Dr. Neelotpal Sensarma, IASST

Public Information Officer:
Dr. Diganta Goswami, IASST

Nodal Officer, Public Grievance:
Dr. Sumita Kumari Sharma, IASST

INSTITUTIONAL MANPOWER

Dr. N. C. Talukdar	Director
Divisional Research supporting staff	
Physical Sciences Division (PSD)	
Dr. Nirab Chandra Adhikary	Technical Officer –B
Gautomi Gogoi,	Project Assistant
Krishna Kanta Swargiary	Technician
Bipul Kumar Das	Multi-Tasking Staff
Babul Ch. Deka	Multi-Tasking Staff
Life Sciences Division (LSD)	
RMES Section	
Manomohan Huzuri	Technical Assistant
Mehjabin Ali	Project Assistant
Prakash Ch. Kachari	Consultant-SC/ST
Madan Chandra Kalita	Multi-Tasking Staff
Srikanta Baishya	Multi-Tasking Staff
BCSS Section	
Juri Pathak	Technical Officer-A
Julie Bordoloi	Technical Assistant-II
Subrata Goswami	Technical Assistant
Simang Champramary	Project Assistant.
Bhaswati Kashyap	Technical Assistant
Simanta Bharadwaj	Technical Assistant
Arup Jyoti Deka	Account Assistant.
Bikash Jyoti Das	Animal Keeper
Abinash Nath	Animal Keeper
Gwhwm Basumatary	Animal Keeper
Tarun Talukdar	Multi-Tasking Staff
Bolin Das	Multi-Tasking Staff
Sabin Kalita	Multi-Tasking Staff
Haren Medhi	Multi-Tasking Staff
Centre for Computational and Numerical Studies (CCNS) Division	
Balabhadra Pathak	Multi-Tasking Staff
Knowledge Resource Centre	
Dr. Tarini Dev Goswami	Assistant Librarian and i/c KRC
Kumud Baishya	Assistant
Subhrajit.Sengupta	Professional Assistant
Sarala Deka	MTS
Administration, Accounts and Engineering	
Dr. Diganta Goswami	Registrar
Pradyut Borkataki,	Finance & Accounts Officer
Bipul Goswami	Estate Management Engineer (EME)
Niranjan Bhagobaty	Technical officer-B and i/c Academic Cell

Rajesh Sharma	Public Relation Officer (PRO)
Prabodh Kr. Deka	Section Officer
Suresh Ch. Sarma	Section Officer
Lelin Gogoi	PS to Director
Rabin Ch. Kalita	Superintendent
Ramen Mahanta .	Superintendent
Saraswati Bora	Superintendent
Dwijendra Ch. Deka	Superintendent
Jayanta Borthakur	Network & System Administrator
Nayan Talukdar	Technical Officer (Instrumentation)
Dr. Anup Kr. Nath	Technical Co-ordinator
Dr. Anil Kumar	Technical Co-ordinator
Montu Deka	Junior Engineer (Civil)
Md. Mohammed	Junior Engineer (Civil)
Pabitra Deori	Junior Engineer (Elect.)
Diganta Das	Assistant
Gora Gupta	Assistant
Prabhat Ch. Barma	Assistant
Munindra Singh	Technical Assistant
Ksh. Sharmina Devi	Receptionist
Pinky Taye	Assistant
Kalpana Bala Das	Assistant
Hemanta Sarma	Assistant
Milan Jyoti Das	Innovator
Nimai Hazam	Driver
Phatik Baishya	Driver
Lakshmi Kanta Soud	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
Consultant	
Dr. D. K. Hore	Consultant (Botany)
Prof. Nalin Kr. Mohan	Consultant (Horticulture)
Prof. T.K. Dutta	Consultant (Mathematics)
Dr. Aswini Bezbaruah	Consultant Medical Officer
Pradip Kr. Chakravarty	Consultant (Audit)
Gautam Kr. Medhi	Consultant (Instrument and Elect. Management)

R & D Facilities at IASST

Central Instrumentation Facility

Central Instrumentation Facility (CIF) of IASST includes sophisticated equipments mainly to cater to the need of researchers of IASST. The institute also ensures access to their facility on payment basis for the researchers of other scientific organizations and universities. During 2016-17, Confocal Microscope, Flow Cytometer, BD FACS Melody Multi-Colour Analyzer cum High speed Cell Sorter; Langendroff System with PowerLab Data Acquisition system, Extracellular Flux Analyzer are added to the existing list of major instruments. Scanning Electron Microscope, Carl Zeiss, Σigma VP; X-Ray Diffractometer, Bruker, D8-Advance; FT-IR, Bruker, Vector 22; Gel Permeation Chromatography (GPC), Waters 2414; Differential Scanning Calorimetry (DSC), Perkin Elmer DSC 6000; 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, LC-MS-MS, GC-MS-MS, Plant tissue culture and walk-in room plant growth chamber are available at CIF.

Confocal Microscope

BD FACS Melody Multi-Colour Analyzer cum High speed Cell Sorter

Bioinformatics Infrastructure Facility (BIF)

Bioinformatics Infrastructure Facility (BIF) at Institute of Advanced study in Science and Technology was established in the year of 2011-2012 with the funding support from the Department of Biotechnology (DBT), Government of India. The functions of the centre include acquisition, creation and development of databases, organization of workshops and seminars in the field of bioinformatics. BIF includes a high end workstation which is extensively used by the researchers from inside and outside IASST. In this facility, workshops/hands on training were organized during the year. Recently, the centre has launched a website (www.bifiasst.ac.in) which feature latest research activities, upcoming seminars/workshops in the field of bioinformatics/biotechnology.

The hardware facilities of the BIF include HP high end server, HP Desktop PCs, HP laserjet CM1415fn color MFP, Linux Enterprise Edition, MS office 2010 and the commercial softwares facilities are LeadIT FlexX, Blast2Go pro, Origin Pro, MATLAB along with open access softwares for biological data analysis.

Institutional Biotech Hub

A biotech hub was set up in the institute in 2012 with the financial support from Department of Biotechnology (DBT), Govt. of India to foster development of biotechnology in the institute and also to train and enhance skill of basic techniques of microbiology and molecular biology in undergraduate and postgraduate students of other institutes. The IBH has been organising training on regular basis and also arranging exposure visits for students of local schools during which students avail the opportunity to acquaint with techniques and equipment required for biotechnology research work. During the years 2016-17, 55 participated in three days exposure training from 25th -27th May, 2016.

Class IX and X students of local schools are engaged in practical experiment based biotechnology science learning in the Biotech Hub of IASST.

Medicinal Plant Conservatory (MPC)

MPC of IASST has been maintaining- medicinal herbs and medicinal shrubs and trees in its campus. Several of these medicinal plants are investigated for their potential in the treatment of metabolic syndrome such as diabetes and cancer based on traditional knowledge. Bioactivity guided fractionation and evaluation of bioactive principles of some of these herbs under traditional knowledge based drug discovery programme are carried out with ease by having them in the MPC. The MPC also maintains several medicinal herbs and plants of common use in general health care practice as folklore medicine, particularly for institute scientist, students and other visitor to the institute. An inventory book contains a detailed photographic and descriptive record of available plants. Some of the important medicinal plants of the collection in MPC are Ambellica officinalis, Citrus grandis, Citrus morella, Clerodendrum colebrookianum, Clerodendrum philippinum, Terminalia chebula, Vincarosea, Eugenia jambolana, Punica granatum, Ocimum sanctum, Cuinamomum tamala, Murrya koenigii, Piper longum, Rauwalfia tetraphylla, Terminalia arjuna, Musa balbisiana, Tinospora cordifolia, Alpinia galangal, Stevia etc.

Animal House Facility (AHF)

A mini AHF is maintained in the institute which houses experimental albino rat, mouse and rabbit and this cater to the need of scientists of traditional knowledge based drug discovery programme of IASST and also the scientist of Tezpur University, Assam Auyrvedic College, IIT Guwahati. In view of the increasing requirements of space in AHF for both scientist of IASST and other institute, construction of a state of the art new AHF of 8000 sq. ft. has been initiated during 2016-17. Currently different species of laboratory animals available in AHF are Albino rats (Wistar), Albino mice (Swiss), Guinea pigs (Duncan Hartley) and Rabbits (New Zealand white) which are maintained and used as per guidelines of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) Government of India, and Animal Welfare Division and guidance of the institute CPCSEA committee.

Central Computational and Numerical Laboratory

The current CCNL facility under mathematical and computational programme of IASST include 20 all-in-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 high end softwares installed in the PCs are MATLAB-r2012A (in 6 PCs), Quantum Espresso and VSP (Vienna Ab Initio Simulation Package). This facility is available for research scholars and scientists of both IASST and other institutes of the region. This facility enables computational and numerical solutions in the domain of Image processing & Pattern recognition of Medical images, Stochastic processes, Topology, ab initio electronic structure calculations and analysis of the Metagenomic data of plant-microbe interaction, all requiring high performance cluster computations.

Knowledge Resource Center

Knowledge Resource Center (KRC) acts as the primary learning resource center of the Institute. It has been providing up to date and nascent information resources and services both in hard and soft forms to the academic and administrative staff of the Institute. Center's services and resources are also available to the researchers of other educational institutions and faculty members of science and technology and allied subjects of the Institute. The KRC's collection include 9505 books, 2459 bound volume of print journals, 2775 theses, dissertation and reports, 646 non-book materials (CD, DVD) and 379 gratis books. The KRC offers its users the convenient access to the best of basic and applied science related digital resources through its subscription to e-databases and e-journals comprised of scholarly contents via wi-fi network as well as Local Area Network. It also has an institutional repository preserve for institute's intellectual output and broad access within the Institute. The KRC is the member of National Knowledge Resource Consortium (NKRC), National Digital Library (NDL), Developing Library Network (DELNET) and Current Science Association (CSA).

During the year 2016-2017, services and activities of the KRC during this year was in a rise compared to previous years with 197 new books procured to strengthen the institute research programmes, 2274 visitors from the institute and 221 visitors from outside served, 1400 books and bound volumes circulated, two lakhs photocopies provided to users. 86 times resource sharing services, 3 publishers display organized and with KRC service hours extended to 9.30 pm daily.

Initiated implementations of Radio Frequency Identification (RFID) Technology as a replacement for the ubiquitous bar code system due to the increased functionality. RFID systems provide efficiency in terms of circulation, security, inventory, and other areas of library workflow. Preparation for implementation of KOHA web-centric Library Management Software was also initiated during the year 2016-17.

EVENTS AND CELEBRATIONS

Press meet with Dr. Harsh Vardhan

Dr. Harsh Vardhan, Union Minister of Science & Technology and Earth Science, Govt. of India addressed the press meet organized by PIB on 24th May 2016 at IASST during which all the regional centers of NIC in India coordinated participation of the autonomous bodies including IASST through teleconferencing. In this event, on the occasion of completion of two years of central government, the minister stated that in the next three years the country will usher in the 'era of Mission Jan Vigyan'. He mentioned about the R&D achievements of national laboratories and the programme of building Marine Bio-Tech labs in the Andaman and new initiatives in the health sector.

IASST and PIB staff attending address of Honourable Minister of Science & Technology, Govt. of India in the press meet organized through teleconferencing.

World Environment Day

IASST celebrated the World Environment Day on 5th June (Friday), 2016 at the premises of IASST on the theme "GO WILD FOR LIFE" by planting valuable plant species and organizing special lecture by Prof. C. K. Varshney, Professor Emeritus and former Dean, School of Environmental Sciences, JNU and Distinguished Adjunct Professor at AIT, Bangkok. He delivered a talk on "Biodiversity and Human Welfare". In this event, Sri Keshab Mahanta, Honourable Minister of Water Resources Department, Science & Technology and Information Technology appealed to all to conserve the environment by intensifying plantation activities and also to eliminate poaching of wildlife. Two short documentaries were projected on this occasion, one on "IASST activities" and the other on "IASST and its ecosystem".

Honourable Minister of Science & Technology, Govt. of Assam, Sri Keshab Mahanta, planting a jackfruit sapling on the Environment Day, 2016 in Bioresource Conservation Hub of IASST

International Yoga Day

IASST observed the 2nd International Day of Yoga, 2016, IASST on June 21, 2016, on the theme "Yoga for Harmony and Peace". A Yoga and Meditation session of one hour was organized in which faculty members, research scholars and staff members took part enthusiastically in a practise session on various 'asanas' of yoga. Pranayama was demonstrated by a team of Yoga practitioners of Vivekananda Kendra, Guwahati. The participants were enlightend about the benefits of Yogas which was followed by practical demonstrations. The session was very inspiring and soothing.

A scene of yoga demonstration and practise during the
2nd International Yoga Day celebration in IASST campus on June 21, 2016

Independence Day

IASST celebrated India's 70th Independence Day on 15th August 2016. The event started at 9:00 am by Flag Hoisting, followed by national anthem chorus and Director's address on achievements and future challenges of IASST. On this occasion a patriotic movie and few documentaries were screened for the entire IASST family.

IASST family gathering during the 70th Independence Day celebration

Hindi Diwas

IASST celebrated Hindi Diwas on 14th September, 2016. Dr. Badri Yadav, Research Officer, NER, Dept. of Official Language, Regional Implementation Office, Guwahati, Chief Guest, delivered lecture on the event highlighting the importance of Hindi as connecting language and emphasized on simultaneous development of regional languages. The winners of 'Drawing' and 'Essay' writing competitions were awarded certificate on the occasion. The programme was made cheerful by the Hindi songs and poem recitation.

Dr. Badri Yadav, Research Officer, NER, Dept. of Official Language,
Regional Implementation Office, Guwahati delivering Chief Guest's lecture

Swachh Bharat Abhiyan

Swachh Bharat Abhiyan was observed at IASST on the occasion of Gandhi Jayanti on 2nd October 2016. IASST faculties, staff and students actively participated in the drill for cleaning of both the campus premises and office building.

Participation of IASST fraternity in Swachh Bharat Abhiyan programme inside the campus

Vigilance Awareness Week cum Rashtriya Ekta Diwas

The celebration of the Vigilance Awareness Week (31st October to 5th November 2016) begun with "Integrity Pledge" followed by a pledge taken to celebrate **Rashtriya Ekta Diwas (National Unity Day)** as a tribute to Vallabhbhai Patel, who was instrumental in keeping India united. IASST family members joined a march past headed by the security personnel of the institute.

Sri Chandra Kanta Das, IAS, retired, Additional Chief Secretary of Govt. of Assam and currently member of North Eastern Council (NEC), Shillong delivered the "Vigilance Awareness Week" lecture highlighting issues related to the corruption in society and a historical perspective of this menace and the citizen's responsibility to remain vigilant for an honest and healthy society and country.

IASST fraternity and Sri C.K. Das, retired IAS, Govt. of Assam, taking part in the "Integrity Pledge" (left) and "March Past" (right)

38th Foundation Day

The Institute celebrated its 38th Foundation Day on 3rd November 2016. The foundation day lecture was delivered by Prof. Santanu Bhattacharya, Director, Indian Association for the Cultivation of Science, Kolkata on Nanotechnology and related advanced materials through molecular gels and the other lecture was by Prof. Appa Rao Podile, Vice-Chancellor, University of Hyderabad on "Plant Microbes Interaction". Prof. Dhruba Jyoti Saikia, Professor of Astrophysics, TIFR and Vice Chancellor, Cotton College State University, Prof. Sarbeswar Bujarbarua, Former Director, Centre for Plasma Physics and Retd. Prof. C.M. Sarma, Former Head, Dept. of Botany Gauhati University were also present. IASST scholars who successfully completed Ph.D. degree were felicitated in the foundation day. Awards for the different sports events were distributed to the minors followed by a graceful cultural function in which the invited renowned Sarod artist of Assam, Mr. Tarun Chandra Kalita performed.

38th Foundation Day lecture delivered by Prof. Santanu Bhattacharya, Director, IACS, Kolkata(left) and Prof. A.R. Podile, VC, University of Hyderabad(right).

Mr. Tarun Chandra Kalita, renowned Sarod artiste performing in the cultural event of 38th Foundation Day in front of fully packed audience

Children's day

IASST organized children's day on 14th November 2016 at the institute premises. The children from nearby areas and staff of the institute participated in games, singing, dancing events and affectionately encouraged to respect parents and seniors, study well to become good citizens and serve their country when they grow up.

Workshop on official language of Hindi

With an objective of promoting the progressive use of Hindi as an official language and create awareness about the Official Language Act and amendments along with rules and regulations; a workshop on "Official Language in Hindi" was held at IASST on December 07, 2016. Mr. Mohan Koirala, Hindi Officer, Brahamaputra Board, Basistha, Guwahati was the Guest Speakers for the workshop. The workshop revolved around better usage of Hindi as an official language and basic learning tips on grammar, noting and drafting. Mr. Koirala also discussed various kinds of languages, including the difference between mother tongue, state language, official language and national language. He noted that it is the duty of every citizen to work in the official language.

Mr. Madan Ch. Koirala, Hindi Officer, Brahmaputra Board, Guwahati delivering his talk during the workshop

Free health check-up camp cum health awareness lecture

A free health check-up cum health awareness camp was held in IASST on 13th December 2016 in association with Hayat Hospital, Guwahati. Specialist doctors, laboratory technicians and nurses examined vital health parameters of employees of IASST. Dr. Anjan Saikia, Executive Director, Hayat hospital delivered a lecture on "Non-communicable disease".

Hayat Hospital doctors conducting health check-up of IASST employees (left)

Dr. Anjan Saikia, Executive Director of Hayat Hospital delivering a lecture in the health camp (right)

Visit of Rajya Sabha Members of Committee on Papers Laid on the Table (COPLOT) to IASST

Dr. C P Thakur, Chairman and Shri Joy Abraham member of COPLOT, Rajya Sabha visited IASST on 13th January 2017 during their study visit to NE Region of India during 11th to 17th January 2017 for examining the reports and accounts of the Public Undertakings and statutory corporations under the Central Government. Both the Honourable members encouraged the faculty, staff and research scholars to be responsible for the service of the society through duty bestowed on them in publicly funded institutes.

Presentation of IASST in the meeting of COPLOT team at Brahmaputra Hotel, Guwahati

Dr. C P Thakur, Chairman, COPLOT Rajya Sabha and former Minister of Govt. of India delivering lecture at IASST at 6.00 PM in Jan 13, 2017

Akhil Bharatiya Chata Rajbhasha avang Karyashala Sanmilan

Jagdambi Prasad Yadav Samiti Pratishtan and Antarashtriya Hindi Parishad organized Akhil Bharatiya Chata Rajbhasha avang Karyashala Sanmelan at IASST 19th & 20th January 2017. Smt. Bijoya Chakraborty, Hon'ble Member of Parliament graced the 1st day of the programme.

Inaugural session of the program and Smt. Bijoya Chakraborty, Hon'ble Member of Parliament, visiting the event.

Republic Day

IASST celebrated the 68th Republic Day on 26th of January, 2017, with the customary unfurling of the National Flag followed by the National Anthem. Faculty, staff and research scholars were motivated to put maximum efforts in delivering research, technology and innovation outputs for raising the quality and standards of the institute in globally competitive manner and play IASST's part towards national efforts of making a new, better and strong India. On the occasion, inspirational and patriotic short films were screened in the auditorium.

IASST family members took part in the hoisting of the National Flag on the occasion of 68th Republic Day

Dedication of an indigenous material built structure "Chinton Chora" by name to Assam Science Society

IASST was brainchild of Assam Science Society and it is in its current shape after a struggle of 36 years with its taking over in 2009 by DST. It was decided by the IASST fraternity to recognize the contribution of Assam Science Society and perpetuate the memory by raising and dedicating a structure, "Chinton Chora" by name. It was inaugurated by Prof. Kishori Mohan Pathak, Former Vice Chancellor, Tezpur University and Former President, Assam Science Society on 26th of February 2017 in the IASST premises and finally dedicated to Assam Science Society. A large number of the past presidents, secretaries and present members were part of a nostalgic environment created on the occasion. The front of the "Chinton Chora" has been docorated with the statues of three great personalities of Assamese culture, namely, Dr. Bhupen Hazarika, Bishnu Prasad Rabha and Jyoti Prasad Agarwala whose concern for the growth of science to transform the society was often reflected in their literary work. "Chinton Chora" will serve as a venue for intellectual brainstorming of research groups of IASST and will house photographs of luminaries of Assam and India in science for inspiration of visitors.

Gathering of past and present office bearers of Assam Science Society in front of "Chinton Chora" (left)

Prof. Kishori Mohn Pathak, Former Vice Chancellor, Tezpur University and Former President, Assam Science Society inaugurating the Chinton Chora (right)

National Science Day 2017

The National Science Day 2017 was celebrated jointly by the Institute of Advanced Study in Science and Technology (IASST) and Cotton College State University (CCSU) in IASST Campus with different events spread over from 28th February and 1st March 2017. The theme of National Science Day 2017 was "Science and Technology for specially abled persons." There were overwhelming responses from different schools and colleges, especially from the rural schools and colleges. Twenty-five schools and colleges participated in the fair. Other prominent organizations such as Archaeological Survey of India (ASI), Directorate of Archaeology, Assam, IMAGE-Animation and Graphics Institutes, Alfred Marshall (Spray Painting), Academy of Aero-modelling, ENVIRON, WWF, Aarynayak and SRCM Heartfullness Center also participated. Around 2900 participants and visitors attended the two days programs of science day.

Events of the first day started off with an inaugural talk on the topic entitled "From Insects Dream to Virtual Reality" by eminent scientist Dr. Shannon B. Olsson, National Centre for Biological Sciences (NCBS), Bangalore. It was followed by the inauguration of exhibition and demonstration of innovation, eBird workshops, quiz competition, documentary show, extempore competition and the chemistry magic show. The science exhibition and innovation was inaugurated by Dr. Shannon B. Olsson, NCBS, Bangalore and Prof. Kishore Bhattacharjee, Gauhati University respectively in the presence of Prof. Dhruba J. Saikia, Vice Chancellor, CCSU and Dr. N C Talukdar, Director, IASST among others. On the same day Prof. Bijoy Krishna Devasharma, former Dean of Science, North Eastern Hill University (NEHU), Shillong delivered a popular talk (in Assamese) on "Bigyanor Kromobikashot Ganitor Abadan" (Role of Mathematics in the development of science and society). All events continued throughout the second day.

On this day a talk was delivered by Dr. Anil Mukund Limaye, IIT Guwahati on "Green Tea in Health and Chemoprevention: a Historical, Chemical and Biomedical Perspective" where he was highlighting health benefits of tea in a historical perspective and recent research development on tea.

A local theme "wetland ecosystem of Assam" was covered during the Science Fair. In the Science Fair, "Gangetic River Dolphin" was adopted as Mascot. The Gangetic River Dolphin is the 'City Animal' of Guwahati which is locally known as Sihu and is found in greater number in the Brahmaputra River, Guwahati, Assam. The Science Fair venue was given a very festive and elegant look by placing some standees (banner) of scientific quotes, photographs of instruments designed for specially abled persons, the mascot of the Science Fair and by exposure to biodiversity areas within the IASST campus. The science documentaries or reports were shown to enlighten and encourage young children and students with the amazing facts around us. On the occasion of Science Fair, a quiz competition was arranged where students from different schools and colleges along with members of the audience participated. Other attractions of the event were short speech competition, mathematical and statistical puzzles, chemistry magic show, hands-on training on to counting birds in the IASST campus.

Photo gallery of National Science Day, Feb 28, 2017

School students entering IASST to participate in the Science Fair to exhibit models

Dr. Shannon B. Olsson, Eminent Scientist, National Centre for Biological Sciences (NCBS), Bangalore inaugurating the science exhibition

Prof. Kishore Bhattacharjee, Gauhati University inaugurating Innovation Stall of specially abled people

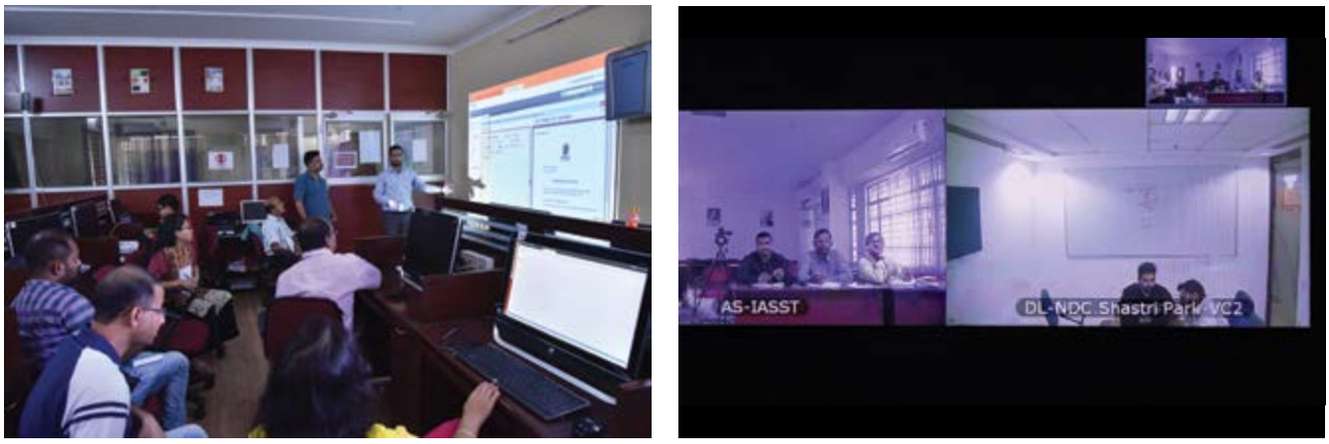
Dr. Shannon B. Olsson, Eminent Scientist, National Centre for Biological Sciences (NCBS), Bangalore delivering lecture on Science Day

Exhibition stall of equipment for specially abled people visited by students

Chemistry based Magic show on the occasion of National Science Day

E-office Training through video- conferencing

In line with the Prime Minister's vision for a DIGITAL INDIA and to build a transparent governance and for the rapid discharge of all official works, IASST initiated the implementation of the e-Office. For this, IASST organized a three days e-Office training program from 6th March to 8th March 2017 through the video conferencing. IASST also held spot classes with the help of e-Office Project Division, National Informatics Center (NIC), Government of India, New Delhi, which is implementing the e-Office at IASST. The program was a preparatory step for implementation of 100% e-governance and e-finance in IASST during 2016-17.



E-office training being undertaken at IASST (left) and through video-conferencing (right)

Free Basic Life Support Training Programme

A team of Doctors of Guwahati Neurological Research Center (GNRC), Guwahati organized a Free Basic Life Support Training Programme at IASST on 27th March 2017. The objective of this program was to train staff and students of the Institute on basic knowledge of first aid covering Cardiopulmonary resuscitation (CPR), recovery position, bleeding, choking and shock. The doctor explained and conducted hands-on on how to recognize and respond to cardiopulmonary arrest, including safe usage of defibrillators, rapid response to emergency situations for saving lives.

Quarterly Meeting of official language implementation

Quarterly Meeting of official language implementation was held, where progress and deficiencies in the progressive use of Hindi in office/ sections/ divisions was reviewed. The meeting also reviewed Prabodh/Praveen/Pragya official training and the writing of Hindi notings in the official works.

REPORT FROM ADMINISTRATION

Major Administrative Activity

A brief account of some major administrative activities undertaken in the year 2016-17 is given below:

E-office implementation

In line with the Prime Minister's vision for a DIGITAL INDIA, the institute is implementing the e-file module of e-office at IASST. The process of implementation of e-office lite (e-lite) was started in July, 2016 and all the files from the year 2009 onwards were scanned and put them in digitized format. With the help of e-Office Project Division, National Informatics Centre and with active involvement of ICT persons, scientists and administrative staff of IASST, it has been successfully implemented. The e-office was formally inaugurated by Prof. Ashutosh Sharma, Secretary, DST, Govt. of India on 09/03/2017 through video conferencing. IASST has become the first among the DST institutes and first institute in North east to implement E office. The system replaced the old manual process with an electronic file system and thereby improved a lot in productivity, transparency and time management in processing of files. It is being used by all the employees of IASST and is running successfully. The process of implementation of some associated modules viz-Leave management system, tour management system, personal file management system etc. are in progress.

E office, IASST inauguration by Prof. Ashutosh Sarma(on screen), Secretary, DST through Video conferencing

Establishment of an Integrated Data Centre

IASST has successfully established a modular Integrated Data Centre in its premises for hosting all servers and storage to a single central place. The total cost of the integrated data Centre was Rs6834820.00. This new Data Centre is a tier II level considering redundancy for all critical components like UPS, cooling etc. along with consideration of security and safety. This Data Centre is more energy efficient than the traditional one giving flexibility to expand as per requirement and fully modular to relocate when required.

Integrated Data Centre

Procurement of Centralized Storage

The institute procured a 10TB SAN Storage mainly for storing e-office related information and now it is ready for sharing with other application also. The cost of the SAN storage was Rs2281587.00. It is helping the institute to maintain centralized storage infrastructure for all the applications which provides another level of redundancy and availability of data centrally without depending local storage of servers.

Implementation of Centralized Antivirus Solution& upgradation of Network

A centralized client-server antivirus solution has been established at IASST. From a single console now we can manage the monitor, all the systems and servers antivirus by putting it centrally. Some of the unmanned switch of the institute have been replaced with high performance manageable switches for better throughput, security and manageable perspective. The total cost of the Manageable switches was Rs2284400.00.

Empanelment of new Hospitals

One new super specialty Hospital namely Narayana Hridayalay Limited, Amingaon , Guwahati-781031 has been empanelled by the institute in April, 2016 for providing medical treatment to IASST employees, their family members and research scholars as per CGHS rates.

Major Civil and Electrical Works Completed/ongoing

A number of engineering project works were undertaken during the year 2016-17. Some of them are detailed below:

Vertical Extension of Library part of Administrative and Academic Building

The project was started in on 21.01.2016 and completed on 27-03-2017. The work was allotted to M/S Buildrite Constructions vide work order No. IASST/919(pt.2)/15-16/139777 dated 21-01-2016. Total work value was ₹9994686.00 (Rupees ninety nine lakh ninety four thousand six hundred eighty six) only. The building is having a total area of 482.91 Sqm. and is consisting of- one conference hall, one Exhibition hall, one IT chamber, one chamber for Technical Officers and 10 Faculty chambers.

Vertical Extension of Library part of Administrative and Academic building

Construction of Director's Bungalow and Maintenance Staff Quarter

The project was started on 20.03.2016 and is undergoing. The work was allotted to M/S D.S. Trading vide work order No. IASST/1184/15-16/16423 dated 02-03-2016. Total work value was ₹14551939.00. Total area for the Director's quarter is 436 sqm. with provision of all the required amenities commensurate with entitled quarter type. The total area of G+one Maintenance staff building is 580 sqm. that contains 12 quarters and two dormitories.

Director's Bungalow(in progress) and Maintenance Staff Quarter

Construction of Boundary Wall at Bio resource Hub

The project was started on 02.03.2016 and completed on 28.02.2017. The work was allotted to M/S D.S. Trading vide work order No. IASST/708(pt.1)/15-16/16907 dated 02-03-2016.Total work value was ₹13147590/- and executed value was ₹70, 00,000.00. The length of the Boundary wall is 360 meters.

Boundary wall at Bio resource Hub and Capsule Toilet

Making of Capsule Toilets

Three nos. of Capsule Toilets were constructed in three locations in the institute campus for campus workman and visitors. The work was started on 08.12.2016 and completed on 20.03.2017. The work value for each toilet was ₹546000.00.

Conversion of Car parking area to Engineering Cell

The project was started on 17.03.2016 .The work was allotted to M/S S.D. Construction vide work order No. IASST/1030(pt.31)/2016-17/12943 dated 02-03-2016. The total work value was ₹800000.00.

Renovation of research scholars' sitting space and provision of modular furniture

The project was started on 18.01.2017 and completed on 11.05.17. The work was allotted to M/S Pradip Talukdar vide work order No. IASST/483/16-17/13452 dated 18-01-2017. Total work value was ₹623167/-.

Renovated PSD Lab

Structure with indigenous material named "Chintan Chora"

A twin structure named as "Chintan Chora" was built in the institute complex and dedicated to the Assam Science Society. The work was allotted to M/S S.D. Construction vide work order No. IASST/1030(pt4/2016-17/14473 dated 09.02.17.The work was started on 09.02.17 and completed on 19.05.17,

Chintan Chora

Construction of Central Instrumentation Facility and Drug Development Centre

To house the sophisticated instruments under Central Instrumentation Facility (CIF) and to accommodate Drug Development Centre the building was planned and designed. The work was allotted to Mr. Bhaskar Baruah, Guwahati at a work value of ₹60926486/-. The total area of the building (G+2) is 3229.6 sq.m. The work is in progress.

The 3-D view of CIF and Drug Development Centre Building (Design)

Staff Welfare Measures

Medical Facility

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 family members are reimbursed as per CGHS rules and rates. In addition to regular employees the medical facility is also provided to research scholars and temporary employees engaged for short term on contract basis. One part time allopathic doctor is also engaged as consultant for 3 days a week for consultation in the institute as well as in his private chamber. Facilities like rest bed, pressure machine and common medicines are available in the institute. A dedicated room equipped with routine medical equipment and medicines is being used as Doctor's Chamber in the main building. Beside this the institute empanelled few renowned hospitals of Guwahati to provide medical facilities as per central government/CGHS rates. These includes-1) International Hospital, G.S. Road, Guwahati-5, (2) Hayat Hospital, Lalganesh, Guwahati-34, (3) Arya Hospital, Rehabari, Guwahati-8, (4)GNRC limited, Guwahati-6 (5)GNRC Limited, Sixmile, Guwahati-22 (6) Narayana Superspeciality Hospital, Amingaon, Guwahat-31 and (7) Panacea Medical Research and Diagnostic, Bhangagarh, Guwahati. Out of these, Hayat Hospital, Arya Hospital and Panacea provide medical facility to beneficiaries on credit basis. These hospitals also organized "Health checkup and Awareness camps" at IASST time to time to spread awareness about risky non-communicable disease and advise on good life style and healthy living to keep doctor's away.

Canteen and Mess Facility

The institute canteen is outsourced to a private Caterer who serves meals, snacks and beverages in hygienic condition to employees, students and guests at subsidized rates. The private caterer also provides hygienic food to the boarders and guests in the Dorothy Hodgkins Students and Scientists' Home.

Benevolent Fund

An IASST employees' Benevolent Fund was established by equal contribution from employees and the Institute. 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 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 in this regard.

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. All the nameplates and signboards of the institute are made bilingual (Hindi and English). The institute appointed a Hindi Officer who is looking after the implementation of official language at IASST. The employees have started getting used to writing note in the file in official Hindi language.

Three employees of IASST have been given training in Hindi proficiency (Praveen and Pragya) programme in the year 2016. A workshop on Hindi was also organized in the institute on 07.12.2016. The institute is also celebrating Hindi Diwas in every year with great zeal to popularize Hindi as a "Rajbhasa".

Housing facility

The institute has limited housing facility. At present, six (6) nos. of quarters are allotted to few essential service staff of the institute. In the newly constructed, Dorothy Hodgkins Students and Scientists Home (SSH) temporarily the Director and Superintendent of SSH also residing in absence of dedicated type quarters. Construction of quarter for the Director and a building for providing accommodation to few essential service staff is under progress and likely to be ready for occupation within the year 2017. In the SSH and the Old hostel accommodation have been made for 52 nos. of research scholars. Moreover, there are 3 (three) nos. of VIP suites and six (6) nos. of scientist room in SSH for accommodating guests who visit IASST from various parts of India and abroad.

Revenue Generation

The Institute realizes that there has to be efforts towards revenue generation venture without affecting the primary mandates of high quality basic research and academic programme of producing Ph.Ds. and training graduate level students for developing research skill. Through several extramural grants, institute earns overhead charges which are handy in reducing the maintenance cost provision of from core budget. Besides, the internal source of income generation during 2016-17 is highlighted in the following table.

Source of Income	Amount (₹)
Laboratory Instrument uses charge	376270.00
Sale Proceeds of institute products	86329.00
Other Receipts (tender paper charge, bank interest etc.)	364193.00
Hostel/guest house receipt	942501.00
Interest from FDR	1746029.00
Total	**3515322.00**

Administrative staff

1st row (Front) L to R: Prabodh Kr. Deka, Dr. Tarini Dev Goswami, Dr. Diganta Goswami, Dr. Narayan Ch. Talukdar, Pradyut Borkataki, Suresh Ch. Sarma

2nd row L to R: Prakash Kachari, Lelin Gogoi, Binoy Kr. Choudhury, Pinky Taye Kalpana B. Das, Sarala Deka, Saraswati Bora ,Sanjubi Sharma, Madhabi Das, Sharmina Devi, Satish Ch. Das, Kumud Baishya

3rd row L to R: Rabin Ch. Kalita, Prabhat Ch. Barma, Gora Gupta, Ramen Mahanta Dwijendra Ch. Deka, Ratul Baishya, Nripen Ch. Goswami, Munna Basfor, Subrata Goswami Subhrojit Sengupta

4th row L to R: Dr. Anil Kumar, Montu Deka, Bolin Das, Hemanta Sarma, Jayanta Barthakur, Debajit Deka, Diganta Das, Niren Sarma, Niranjan Bhagobaty

Not in the photograph: Nimai Hazam, Phatik Baishya

Financial Statements

K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

UTILIZATION CERTIFICATE

Certified that out of a sum of ₹ **28,56,00,000.00** (Rupees Twenty Eight Crores Fifty Six Lacs Only) received as Grant-in-Aid from Government of India, Ministry of Science & Technology during the Financial Year 2016-17 vide letter mentioned hereunder and Interest from Bank ₹ **56,27,071.01** and opening surplus balance of ₹ **41,35,653.61** (being Cash & bank Balance of ₹ 48,01,029.61 plus advance given ₹ 48,000.00 during previous year less earnest money refundable ₹ 7,13,376.00) as on 31.03.2016, a sum of ₹ **22,25,09,045.80** 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 ₹ **7,28,53,678.82** (being Cash & Bank Balance of ₹ 7,35,19,054.82 plus advance given ₹ 48,000.00 less earnest money refundable ₹ 7,13,376.00 of previous year) stands unutilized as on 31.03.2017.

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/SAL/003/2016/1, dated 05/05/2016	18,615,000.00
2	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/1, dated 05/05/2016	17,037,000.00
3	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/1, dated 05/05/2016	8,163,000.00
4	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/2, dated 23/06/2016	30,681,000.00
5	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/2, dated 23/06/2016	13,027,000.00
6	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/1, dated 23/06/2016	750,000.00
7	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/1, dated 23/06/2016	3,000,000.00
8	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/1, dated 23/06/2016	1,065,000.00

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
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K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

(2)

9	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/1, dated 23/06/2016	12,854,000.00
10	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/2, dated 21/09/2016	2,112,000.00
11	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/2, dated 21/09/2016	9,450,000.00
12	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/2, dated 21/09/2016	2,570,000.00
13	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/3, dated 21/09/2016	42,231,000.00
14	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/3, dated 21/09/2016	3,872,000.00
15	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/3, dated 21/09/2016	17,671,000.00
16	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/3, dated 21/09/2016	651,000.00
17	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/3, dated 22/07/2016	12,550,000.00
18	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/3, dated 22/07/2016	680,000.00
19	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/4, dated 22/07/2016	18,746,000.00

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
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K. P. Sarda & Co. Guwahati Chartered Accountants

Finance & Accounts Officer
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K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

(3)

20	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/4, dated 22/07/2016	6,915,000.00
21	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/1/7/IASST/2016, dated 23/02/2017	45,000,000.00
22	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/3, dated 22/02/2017	17,960,000.00
	Total	**285,600,000.00**

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 : 03/07/2017

Registrar
Institute of Advanced
Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
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Form No. GFR-19A
FORM OF UTILIZATION CERTIFICATE

Sl. No.	Sanction Letter No.	Date	Amount (₹)
1	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/1	05/05/2016	18,615,000.00
2	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/1	05/05/2016	17,037,000.00
3	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/1	05/05/2016	8,163,000.00
4	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/2	23/06/2016	30,681,000.00
5	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/2	23/06/2016	13,027,000.00
6	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/1	23/06/2016	750,000.00
7	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/1	23/06/2016	3,000,000.00
8	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/1	23/06/2016	1,065,000.00
9	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/1	23/06/2016	12,854,000.00
10	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/2	21/09/2016	2,112,000.00
11	Government of India, Ministry of Science and Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/2	21/09/2016	9,450,000.00
12	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/2	21/09/2016	2,570,000.00
13	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/3	21/09/2016	42,231,000.00
14	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/3	21/09/2016	3,872,000.00
15	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/3	21/09/2016	17,671,000.00
16	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SC/003/2016/3	21/09/2016	651,000.00

Registrar
Institute of Advanced
Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

K.P. Sarda & Co.
Guwahati
Chartered Accountants

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

17	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/GEN/003/2016/3	22/07/2016	12,550,000.00
18	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/ST/003/2016/3	22/07/2016	680,000.00
19	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/SAL/003/2016/4	22/07/2016	18,746,000.00
20	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/CAP/003/2016/4	22/07/2016	6,915,000.00
21	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/1/7/IASST/2016	23/02/2017	45,000,000.00
22	Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi vide Letter No. AI/IASST/GEN/003/2016/3	22/02/2017	17,960,000.00
	Total		**285,600,000.00**

Certified that out of ₹ **28,56,00,000/-** Grant-in-Aid sanctioned during the financial year 2016-17 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 ₹ **38,16,374.68** and opening surplus balance of ₹ **16,79,753.75** (being Cash & bank Balance of Rs. 23,45,129.75 plus advance given Rs. 48000 during previous year less earnest money refundable Rs. 7,13,376.00) as on 31.03.2016, a sum of ₹ **22,71,42,580.00 /-** has been utilized for the purpose for which it was sanctioned (total expenditure of ₹ 24,72,52,155.00 less other receipts of ₹ 2,01,09,575.00 of current year) and a surplus balance of ₹ **6,39,53,548.43** (being Cash & Bank Balance of ₹ 6,46,18,924.43 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 2017-18.

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

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 : 03/07/2017

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

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, 2017, 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

Registrar
Institute of Advanced Study in Science & Technology
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IASST, Paschim Boragaon
Guwahati-781035

K. P. Sarda & Co. Guwahati Chartered Accountants

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

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+91 361 2512159, 2634672
kpsarda@gmail.com

K P SARDA & COMPANY
CHARTERED ACCOUNTANTS

SC-11, Parmeshwari Building, 2nd Floor
Chatribari Road, Guwahati - 781001, Assam
http://kpsardaco.org.in

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 on 31st March, 2017;

(b) In case of the Income and Expenditure Account of the Income/Expenditure of Society for the year ended 31st March, 2017;

(c) In case of the Receipts and Payment Account of the Receipts/Payments of Society for the year ended 31st March,2017

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 : 03/07/2017

Registrar
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Paschim Boragaon, Guwahati-35

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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, 2017

RECEIPTS	Amount (₹) 2016-17	Amount (₹) 2015-16	PAYMENTS	Amount (₹) 2016-17	Amount (₹) 2015-16
Opening Balances			**Expenses**		
a) Cash in Hand	50,000.00	70,909.00	Payment on Grants (Annex - 5)	133,696,480.37	146,488,506.00
b) Bank Balances			Advances against Expenditures	6,456,176.00	4,327,601.00
i) In Current Account	66,111.00	66,741.00	of Grants (Annex - 8)		
ii) In Savings Account	21,079,732.61	21,438,574.89			
			Payments made against funds for		
Grant Received	402,016,539.00	246,450,049.00	earmarked projects	33,912,172.20	0.00
Income on Investments			**Investments made**		
Fixed Deposit Interest	3,124,077.01	491,742.72	In Fixed Deposits with Vijaya Bank	30,000,000.00	10,000,000.00
Interest Received			**Expenditure on Fixed Assets**		
a) On Bank Deposits	4,782,825.71	1,168,248.00	Aquisition of Fixed Assets (Annex. - 6)	75,884,386.45	67,838,743.00
b) Interest on LC Deposits	42,221.00	0.00	Advances for Fixed Assets (Annex. - 7)	61,531,222.00	21,944,072.00
Other Income (Annex. - 2)	12,126,213.96	3,840,082.00	**Refund of Unlitilised Grant**	2,253,264.00	48,213.00
Other Receipts			**Other Payments**		
Earnest Money Receipts (Annex - 3)	133,100.00	218,782.00	Earnest Money Payments (Annex. - 9)	177,269.00	376,150.00
			Security Deposit on SSH	60,000.00	0.00
			Catering Charge	1,686,467.00	0.00
Recovery of Loans and Advances	0.00	0.00	Bank Charges	118.76	0.00
			Financial Assistance	20,000.00	0.00
Contribution to Benevolent Fund	7,320.00	0.00	Contribution to Benevolent Fund	7,320.00	0.00
Security Deposit on SSH	20,000.00	0.00	Loans & Advance (Vijaya Bank	2,000,000.00	0.00
Maturity Amount of FD	10,000,000.00	0.00	overhead A/c)		
Loans & Advance (Vijaya Bank overhead A/c)	2,000,000.00	0.00	Advance to Staff (Annex. - 4)	294,000.00	1,526,000.00
Capital Fund	498,604.03	0.00	**Closing Balances**		
Loans & Advances	19,862,429.00	0.00	a) Cash in Hand	20,000.00	50,000.00
Refund against advance	291,309.00	0.00	b) Bank Balances		
			i) In Current Account	65,478.50	66,111.00
			ii) In Savings Account	128,036,128.04	21,079,732.61
TOTAL :	476,100,482.32	273,745,128.61		476,100,482.32	273,745,128.61

NOTES ON ACCOUNT - SCHEDULE '8'

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

K. P. Sarda & Co. Chartered Accountants Guwahati

Registrar
Institute of Advanced
Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

Place : Guwahati
Date : 03/07/2017

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH, 2017

PARTICULARS	Schedule	Amount (₹) 2016-17	Amount (₹) 2015-16
INCOME			
Grant - in - Aid	9	117,531,851.10	143,601,590.28
Interest	10	3,797,792.71	1,855,438.72
Income from Investment	11	5,124,403.01	0.00
Other Income		11,947,616.96	3,840,082.00
TOTAL :		**138,401,663.78**	**149,297,111.00**
EXPENDITURE			
Establishment Expenses	12	79,688,823.00	91,830,749.00
Other Administrative Expenses	13	56,833,877.37	57,466,362.00
Loss on Sale of Assets (Auction)		165,177.65	0.00
Transferred to Employee Benevolent Fund		7,200.00	0.00
Other Expenses		1,706,585.76	0.00
TOTAL :		**138,401,663.78**	**149,297,111.00**

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 : 03/07/2017

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
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Guwahati-781035

Finance & Accounts Officer
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Guwahati-781035

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

BALANCE SHEET AS ON 31ST MARCH, 2017

PARTICULARS	Schedule	Amount (₹) 2016-17	Amount (₹) 2015-16
CAPITAL FUND & LIABILITIES			
Capital Fund	1	484,434,575.62	485,196,330.82
Reserves & Surplus	2	63,950.03	0.00
Earmarked Funds	3	27,869,869.80	(0.00)
Current Liabilities and Provisions	4	275,905,688.89	70,276,729.79
TOTAL :		**788,274,084.34**	**555,473,060.61**
ASSETS			
Fixed Assets	5	488,226,781.80	489,178,504.00
Investments	6	36,714,449.00	14,726,473.00
Current Assets, Loans and Advances	7	263,332,853.54	51,568,083.61
TOTAL :		**788,274,084.34**	**555,473,060.61**

NOTES ON ACCOUNT - SCHEDULE "8"

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 : 03/07/2017

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
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Guwahati-781035

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

SCHEDULE - 1 : :: CAPITAL FUND ::

	Amount(₹) 2016-17	Amount (₹) 2015-16
Opening Balance	485,196,330.82	437,836,771.82
Add : Contribution towards Capital Fund (Addition to Fixed Assets)	74,708,422.80	70,180,491.00
	559,904,753.62	508,017,262.82
Less : Depreciation for the year	75,660,145.00	22,820,932.00
	484,244,608.62	485,196,330.82
Add : Bank Accounts Incorporated in the Financial Year 2016-17		
IASST Employees Benevolent Fund (664178)	50,479.00	0.00
IASST Corpus Fund (943064)	3,158.03	0.00
Students & Scientist Home (IASST) (412886)	444,967.00	0.00
Less : Transferred to Liability from SSH (412886)	255,000.00	0.00
Less : Transferred to Reserves		
IASST Employees Benevolent Fund (664178)	50,479.00	0.00
IASST Corpus Fund (943064)	3,158.03	0.00
TOTAL :	**484,434,575.62**	**485,196,330.82**

SCHEDULE - 2 : :: RESERVES & SURPLUS ::

	Amount(₹) 2016-17	Amount (₹) 2015-16
IASST Employees Benevolent Fund (664178)	60,633.00	0.00
IASST Corpus Fund (943064)	3,317.03	0.00
	63,950.03	**0.00**

SCHEDULE - 4 : :: CURRENT LIABILITIES AND PROVISIONS ::

	Amount(₹) 2016-17	Amount (₹) 2015-16
(a) **CURRENT LIABILITIES :**		
Unutilised Grant in Aid	214,318,347.89	67,411,718.79
Other Current Liabilities (Details 4)	304,083.00	1,719,334.00
Earnest Money	1,101,508.00	1,145,677.00
Security Deposit	215,000.00	0.00
(b) **PROVISIONS :**		
Against Fixed Assets	57,325,019.00	0.00
Against Expenses	2,641,731.00	0.00
TOTAL :	**275,905,688.89**	**70,276,729.79**

Registrar
Institute of Advanced

Director
IASST, Paschim Boragaon
Guwahati-781035

K.P. Sarda & Co. Guwahati Chartered Accountants

Finance & Accounts Officer
IASST, Paschim Boragaon
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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

SCHEDULE - 6 : :: INVESTMENTS ::

	Amount(₹)
Opening Balance	14,726,473.00
Add : Investment in Fixed Deposit during the year	30,000,000.00
Add : Interest Accrued	2,000,326.00
Less : TDS	12,350.00
Less : Fixed Deposit matured during the year	10,000,000.00
Balance as on 31/03/2017	36,714,449.00

SCHEDULE - 7 : :: CURRENT ASSETS, LOANS & ADVANCES ::

		Amount(₹) 2016-17	Amount(₹) 2015-16
CURRENT ASSETS :			
Cash in hand		20,000.00	50,000.00
Balance with Banks	**Account No.**		
SBI Khanapara Branch	(943972)	64,351,309.81	2,040,909.58
SBI Khanapara Branch - Workshop	(943723)	27,134.83	12,482.88
SBI Garchuk Branch - Project	(260721)	14,724,069.18	16,394,814.00
SBI G.U. Branch - Upgrading	(131613)	45,316.86	43,122.86
SBI Garchuk - Seminar	(888433)	65,478.50	66,111.00
Vijaya Bank - Overhead/Miscellaneous	(000466)	8,854,813.53	2,412,777.00
Vijaya Bank - Travel	(000411)	40,239.29	126,160.29
Vijaya Bank - Conference	(000918)	103,278.00	38,537.00
SBI - IASST Employees Benevolent Fund	(664178)	60,633.00	0.00
SBI - IASST Corpus Fund	(943064)	3,317.03	0.00
SBI - Students & Scientist Home (IASST)	(412886)	614,393.71	0.00
SBI Khanapara - International Conference	(635294)	11,484.00	10,929.00
Vijaya Bank - Chemical Profiling of Joha and Black Rice - R Devi	(002509)	4,648,265.00	0.00
Vijaya Bank -Microbial Roles in Yield Management - N C Talukdar	(002510)	1,342,872.00	0.00
Vijaya Bank - Dev. Of nano particle - Poultry Salmonellosis	(002508)	560,583.00	0.00
SBI - Inspire Fellow - Anurupa Goswami	(748311)	3,963.00	0.00
SBI - Fellowship for U.S. Visit - Yogesh	(863775)	24,171.00	0.00
SBI - CSIR SEF Neelam Gitumani Yogesh	(781982)	321,832.00	0.00
SBI - Herbal Medicine N.C. Talukdar	(862670)	28,924,330.80	0.00
SBI - Inspire Faculty Award - Rosy Mondal	(732582)	7,193.00	0.00
SBI - Inspire Fellowship Program - Y. Bailung	(757427)	3,728.00	0.00
SBI - Inspire Fellowship Program - Tulsi Joshi	(770492)	3,445.00	0.00
	Balance c/d	124,761,850.54	21,195,843.61

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

	Balance b/d	124,761,850.54	21,195,843.61
SBI - Effect of Traditional Dietary - M.R. Khan	(749904)	880,963.00	0.00
SBI - Dev. Of Plasma Modified - J. Chutia	(733766)	227,793.00	0.00
Vijaya Bank - Glycolipid Biosurfactant - Suresh Deka	(002790)	1,050,000.00	0.00
Vijaya Bank - Cervical Pre Cancerous and Cancer Lesions - L B Mahanta	(002653)	1,201,000.00	0.00
LOANS, ADVANCES & OTHER ASSETS :			
Crest Award		343,770.00	343,770.00
TDS Receivable		124,024.00	127,923.00
Loans to Staff		1,940,680.00	3,117,193.00
Committed Expenses against Fixed Assets		57,325,019.00	0.00
Committed Expenses against Grants		2,641,731.00	0.00
Current Year Advances			
Advances against Expenditure of Grants		6,456,176.00	4,327,601.00
Advances for Equipments		45,575,251.00	2,787,032.00
Advances for Computer Peripherals		5,581,065.00	50,000.00
Advances for Furniture & Fixture		110,200.00	0.00
Advances for Building & Site Development		10,264,706.00	19,107,040.00
Previous Year Advances			
Advances against Expenditure of Grants		1,499,849.00	311,681.00
Advances against Fixed Assets		3,348,776.00	200,000.00
TOTAL :		**263,332,853.54**	**51,568,083.61**

Previous Year Advances Still unadjusted (31/03/2016) :

Advances against Expenditure on Grants :

General Fund :		
Contingency	103,589.00	
Consumables	5,348.00	
Travel	1,600.00	
Salary (SC/ST)	442,800.00	
Training and Conference	217,177.00	
Works and Services	385,855.00	
		1,156,369.00
Project Fund :		
Contingency	12,440.00	
Travel	98,400.00	
Consumables	116,140.00	
Training & Conference	112,500.00	
Outsourcing	4,000.00	**343,480.00**
TOTAL :		**1,499,849.00**

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Advances against Fixed Assets :	
(A) GENERAL	
a) Books and Journal :	
Books (13/01/2015)	200,000.00
b) Equipment :	
Horizontal Laminar Air Flow (22/02/2016)	170,968.00
Nafion Membranes (03/12/2015)	19,676.00
Plant Growth Chamber (28/01/2016)	2,508,132.00
c) Building and Site Development :	
i) Land and Building	
25/02/2016	441,000.00
02/03/2016	9,000.00
TOTAL :	**3,348,776.00**
Committed Expenses against Fixed Assets :	
(A) GENERAL	
a) Building and Site Development :	
i) Construction of CIF building	40,850,000.00
ii) Land filling, Construction of Boundary wall, Approach road	5,500,000.00
iii) Vertical Extention of Library Building	5,000,000.00
iv) Engineering Cell Sitting Arrangement, Construction of Guard Room and Construction of cover on Badminton Court	1,659,250.00
v) Making of Chintan Monthan Chora	1,714,366.00
vi) Supply, Leveling, Watering etc. in front of green house, Football field orchid avenue and Boundary wall	542,538.00
vii) 900MM Dia NP3 Hume Pipe Culverts at BCH Gate	673,000.00
b) Equipment :	
i) Stackable Shaking Incubator	923,136.00
c) Fridge, Washing Machine and Dryer	63,538.00
(B) PROJECT	
a) Furniture & Fixture	
i) For Supply of Office Furniture to Research Labaratories of Dr. M R Khan	399,191.00
	57,325,019.00
Committed Expenses against Grants :	
(A) GENERAL	
a) Contingency	
i) Supply of Electricity	556,291.00
ii) Supply of Office Stationery	167,676.00
iii) Providing Catering Services to SSH	207,884.00
b) Works & Services	
i) Supply of Spares of Millipore Water Purification	302,692.00
c) Consumables	
i) Supply of Chemical & Glassware	6,175.00
ii) Supply of Chemical & Glassware	764,866.00
iii) Supply of Chemical & Glassware	561,397.00
d) Training & Conference	
i) Broadcasting Services for National Science Day 2017	34,500.00
ii) Broadcasting Services for National Science Day 2017	40,250.00
	2,641,731.00

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SCHEDULE - 3 : **:: EARMARKED FUNDS ::**

Particulars	Salary	Contribution to Employee Benevolent Fund	Contingency	Equipment	Travel	Consumables	Training	Overhead	Misc.	Bank Interest	Refund Against Advance (Receipt)	Refund (Payment)	Investment in FD	2016-17	2015-16
a) Opening Balance	11,696,760	0	3,136,142	3,676,580	1,139,575	1,736,143	102,815	370,942	1,316,092	0	0	0	0	23,175,049	0
b) **Addition to the Funds**															
i) Grants	27,363,756	0	2,185,625	67,204,800	3,272,945	9,726,879	350,000	5,469,630	842,904	0	0	0	0	116,416,539	0
ii) Other Receipts	0	0	0	0	0	0	0	0	0	1,024,992	291,309	0	0	1,316,301	0
	27,363,756	**0**	**2,185,625**	**67,204,800**	**3,272,945**	**9,726,879**	**350,000**	**5,469,630**	**842,904**	**1,024,992**	**291,309**	**0**	**0**	**117,732,840**	**0**
TOTAL (a+b)	39,060,516	0	5,321,767	70,881,380	4,412,520	11,463,022	452,815	5,840,572	2,158,996	1,024,992	291,309	0	0	140,907,889	0
c) **Expenditure towards objectives of Funds**															
i) Capital Expenditure	0	0	0	18,499,066	0	0	0	0	0	0	0	0	0	18,499,066	0
ii) Revenue Expenditure	22,657,419	120	2,589,447	0	3,114,560	5,547,314	151,054	6,318,816	483,778	0	0	2,253,264	30,000,000	73,115,772	0
	22,657,419	**120**	**2,589,447**	**18,499,066**	**3,114,560**	**5,547,314**	**151,054**	**6,318,816**	**483,778**	**0**	**0**	**2,253,264**	**30,000,000**	**91,614,838**	**0**
d) **Advances**															
i) PY Advance Adjusted	0	0	6,300	0	144,211	0	0	0	0	0	0	0	0	150,511	0
ii) CY Advance Given	80,000	0	0	0	291,200	140,000	120,200	0	0	0	0	0	0	631,400	0
	80,000	**0**	**-6,300**	**-0**	**146,989**	**140,000**	**120,200**	**0**	**0**	**0**	**0**	**0**	**0**	**480,889**	**0**
Net Balance as at the year end (a+b-c+d)	**16483097.0**	**(120.0)**	**2726020.0**	**52382314.0**	**1444949.0**	**6055708.0**	**421961.0**	**(478244.0)**	**1675217.8**	**1024992.0**	**291309.0**	**(2253264.0)**	**(30000000.0)**	**49773939.8**	**(0.0)**

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SCHEDULE - 5 : **:: FIXED ASSETS ::**

DESCRIPTION	GROSS BLOCK			DEPRECIATION			NET BLOCK	
	As on 01/04/2016	Addition / (Deletions)	As on 31/03/2017	As on 01/04/2016	For the year	As on 31/03/2017	As on 31/03/2017	As on 31/03/2016
Building & Site Development	268,140,280.00	32,742,102.66	300,882,382.66	15,600,176.00	28,528,220.00	44,128,396.00	256,753,986.66	252,540,104.00
Equipments	246,521,076.00	25,195,190.67	271,716,266.67	44,099,091.00	34,142,577.00	78,241,668.00	193,474,598.67	202,421,985.00
Air Conditioner	3,737,862.00	1,061,578.00	4,799,440.00	478,847.00	648,089.00	1,126,936.00	3,672,504.00	3,259,015.00
Refrigerator	19,600.00	0.00	19,600.00	4,655.00	2,242.00	6,897.00	12,703.00	14,945.00
Projector	142,995.00	0.00	142,995.00	33,960.00	16,355.00	50,315.00	92,680.00	109,035.00
Vehicles	2,994,044.00	4,027,995.00	7,022,039.00	801,324.00	933,107.00	1,734,431.00	5,287,608.00	2,192,720.00
Furniture & Fixtures	24,555,721.00	5,265,034.45	29,820,755.45	4,213,159.00	2,560,759.00	6,773,918.00	23,046,837.45	20,342,562.00
Library	18,326,873.00	1,772,455.00	20,099,328.00	13,872,165.00	3,736,298.00	17,608,463.00	2,490,865.00	4,454,708.00
Computer	6,399,338.00	4,644,067.02	11,043,405.02	2,571,929.00	5,082,885.00	7,654,814.00	3,388,591.02	3,827,409.00
Printer & Xerox Machine	44,041.00	0.00	44,041.00	35,695.00	5,008.00	40,703.00	3,338.00	8,346.00
Computer Software	40,500.00	0.00	40,500.00	32,825.00	4,605.00	37,430.00	3,070.00	7,675.00
TOTAL	**570,922,330.00**	**74,708,422.80**	**645,630,752.80**	**81,743,826.00**	**75,660,145.00**	**157,403,971.00**	**488,226,781.80**	**489,178,504.00**
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**

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

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

Sl.No.	Name of the Project/General Fund	Amount(₹) 2016-17	Amount(₹) 2015-16
1	Androgen	0.00	420,000.00
2	Anurupa Goswami	0.00	231,200.00
3	Atmospheric	0.00	546,400.00
4	Bio Informatics	442,000.00	566,000.00
5	Biosurfactance	673,980.00	120,600.00
6	Biotech Hubs	0.00	571,000.00
7	Brain storming	0.00	165,200.00
8	Brain storming cum stakehold	0.00	300,000.00
9	Brain storming meeting-3	640,000.00	0.00
10	B-ACER Internship Awards	929,500.00	0.00
11	Chemical input	0.00	65,120.00
12	CSIR (Neelam, Gitumoni, Yogesh)	1,904,400.00	0.00
13	Culture Collection - D. Thakur	1,436,800.00	0.00
14	DBT RA (Ashim Kr. Dutta)	527,986.00	0.00
15	DBT RA (Supriyo Sen)	0.00	361,222.00
16	DBT RA (R. Thakur)	0.00	525,200.00
17	DBT Scented Rice Programme (R Devi)	4,796,000.00	0.00
18	DBT Scented Rice Programme (N C Talukdar)	1,528,000.00	0.00
19	Dev. Of nano particle or micro particle	600,000.00	0.00
20	Diabetic Neuropathic	1,005,000.00	0.00
21	DST (Suitable Plant)	540,000.00	996,954.00
22	Department of Science and Technology - General	285,600,000.00	206,394,000.00
23	Electronic Alloys Magnetic	400,000.00	0.00
24	Flora & Fauna	0.00	400,000.00
25	Glycolipid	1,050,000.00	0.00
26	Govt of Assam	0.00	2,000,000.00
27	Herbal Medicine	78,604,000.00	0.00
28	Helfer Fibers	0.00	401,970.00
29	Image Processing (Tabassum Y)	400,000.00	400,000.00
30	Indentification	0.00	507,000.00
31	Inspire Faculty (S Pramanic)	0.00	1,900,000.00
32	Inspire Fellow (B Choudhury)	1,900,000.00	0.00
33	Inspire Fellow (Kangkana Bora)	503,700.00	380,000.00
34	Inspire Fellow (Rosy Mondal)	1,183,657.00	1,900,000.00
35	Inspire Fellow (Y bailung)	0.00	380,000.00
36	Inspire Fellow (Tulsi Joshi)	0.00	380,000.00
37	Inspire faculty (Sumita Sarmah)	1,599,932.00	1,255,860.00
38	Inspire faculty (Sagar Sarmah)	1,147,261.00	0.00
39	Investigation of Rogue Waves	0.00	700,000.00
40	Jhumming	1,669,000.00	1,408,989.00
41	Library Workshop	414,904.00	200,000.00
42	L B Mahanta	1,260,000.00	0.00
43	MR Khan (New)	0.00	5,431,000.00
44	Nanomaterial & Bimaterials	500,000.00	0.00
45	NPDF (Rupamoni Thakur)	1,002,700.00	0.00
46	NPDF Fellowship (Abdul Barik)	350,000.00	0.00
	Balance c/d	**392,608,820.00**	**228,907,715.00**

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

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

		Balance b/d	**392,608,820.00**	**228,907,715.00**
47	Chemical study of Carbon dots		406,734.00	533,066.00
48	Peste-in-tea (Microbial)		456,645.00	0.00
49	Physico Sensor		0.00	500,000.00
50	Planning Committee		1,950,000.00	0.00
51	Plasma modified		0.00	1,400,000.00
52	Polymer & Polymer Nano		464,524.00	1,220,601.00
53	Polymer Based Sensors		0.00	38,400.00
54	Ramalingaswami (MR Khan)		0.00	1,610,000.00
55	Ramalingaswami (S Nandi)		1,819,000.00	2,110,000.00
56	Ramalingaswami (S Kundu)		0.00	1,780,000.00
57	Ramanujan Fellow		250,000.00	1,780,000.00
58	Sailendra Gayri		841,300.00	0.00
59	School Project (H Bailung)		0.00	250,000.00
60	Single Step		0.00	5,267.00
61	Structure of Enzymes		0.00	382,000.00
62	Tissue Repairs		966,116.00	820,000.00
63	Treatment of oil field		0.00	908,000.00
64	UGC Grant (MD shadab)		353,400.00	0.00
65	VRP (G T Gujar)		0.00	1,665,000.00
66	VRP (A K Sahu)		0.00	875,000.00
67	VRP (Ashwani Kumar)		0.00	1,665,000.00
68	Wahengbam Romi		1,900,000.00	0.00
			402,016,539.00	**246,450,049.00**

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Annexure - 2 : :: OTHER INCOME ::

Name of the Project/General Fund	Amount(₹) 2016-17	Amount(₹) 2015-16
Mess Dues	1,874,571.00	0.00
Other receipts	4,971,152.96	2,322,093.00
Income Tax Refund	16,980.00	0.00
Institutional Charges Receipts	4,725,623.00	1,326,634.00
Sample Analysis	376,270.00	0.00
Sale of Assets through Auction	161,617.00	0.00
Contributions from NPS	0.00	191,355.00
Total :	**12,126,213.96**	**3,840,082.00**

Annexure - 3 : :: EARNEST MONEY RECEIPTS ::

Name of the Firm	Details of Works	Amount(₹) 2016-17
M/s Suncraft Energy Pvt.Ltd	Solar Project	50,000.00
Mr. Sanjay Kalita	Making Capsule Toilet between Cool lab & Green	7,600.00
Mr. Monoj Goswami	Making of Sedimentation Tank at IASST	5,000.00
M/s S.D. Construction	Making of Shed over Badminton Court, Engg.	54,000.00
Mr. Sanjay Kalita	Mission and Vision at IASST	4,000.00
Mr. Pradip Kr. Talukdar	Supply and fitting oftiles, painting etc. Of PSD	12,500.00
	Total :	**133,100.00**

Annexure - 4 : :: LOANS TO STAFF ::

	Amount(₹) 2016-17	Amount(₹) 2015-16
Opening Balance	3,117,193.00	2,775,165.00
Add : Advances for the year	294,000.00	1,526,000.00
	3,411,193.00	4,301,165.00
Less : Recovered during the year	1,470,513.00	1,183,972.00
Total :	**1,940,680.00**	**3,117,193.00**

Annexure - 5 : :: PAYMENT ON GRANTS ::

	Amount(₹) 2016-17	Amount(₹) 2015-16
Bank charges	5,832.55	5,093.00
Contingency - Emiratus Scientist	0.00	52,463.00
Contingency (Details 1)	16,164,209.82	15,981,438.00
Contributory Provident Fund	8,069,816.00	5,277,819.00
Honorarium	2,394,248.00	1,852,580.00
Laboratory Consumables (Details 2)	6,974,668.00	10,093,987.00
Meeting Expenses	0.00	284,569.00
Miscellaneous Expenses	0.00	132,228.00
Overhead Expenses	6,318,816.00	1,331,901.00
Salary	69,904,284.00	85,368,958.00
Security Services	1,491,230.00	1,406,036.00
Training and Conference	3,837,375.00	1,444,580.00
Travelling Expenses	3,032,587.00	4,257,749.00
Works & Services (Details 3)	15,437,281.00	18,704,055.00
Outsourcing	0.00	264,555.00
Labour Charge	0.00	6,000.00
Analysis	0.00	11,275.00
SC/ST	66,133.00	13,220.00
	133,696,480.37	**146,488,506.00**

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

Particulars	Amount(₹) 2016-17	Amount(₹) 2015-16
(A) **GENERAL FUND :**		
Building and Site Development	33,962,665.00	31,555,558.00
Equipments	6,627,023.45	16,978,391.00
Furniture and Fixtures	5,300,301.00	5,524,301.00
Library Books	1,772,455.00	1,866,446.00
Computer	4,683,303.00	1,908,084.00
Air Conditioner	1,061,578.00	1,010,381.00
(B) **PROJECT FUND :**		
Equipment	18,499,066.00	7,544,814.00
Bus (Overhead A/c)	0.00	1,450,768.00
(C) **MISC. FUND :**		
Vehicle (Tata Safari & Staff Bus)	3,977,995.00	0.00
Total :	75,884,386.45	67,838,743.00

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

Name of Fixed Assets	Date	Amount(₹) 2016-17
(A) **GENERAL**		
a) Equipment :		
Quartz Cuvette 10mm pathlength 3.5	01/01/2016	1,073,921.00
Thero Scientific Vaccum Pump	19/09/2016	205,547.00
Air Curtains	04/10/2016	56,436.00
Sputtering target	14/10/2016	220,327.00
Spectoflurometer Model No. FP - 8500	02/11/2016	1,339,430.00
Anaerobic Chamber	06/12/2016	1,918,457.00
Incubator shaker	06/03/2017	142,975.00
Transmission Electron Microscope	28/03/2017	40,618,158.00
		45,575,251.00
b) Computer peripherals :		
Implementation of e-Office-Lite and for supply of te	04/08/2016	3,265,987.00
Digital Signature and cost of digitalisation of docun	06/02/2017	76,793.00
Bidefender Business Security	09/01/2107	139,178.00
Manageable Switches	03/02/2017	1,262,879.00
GEL COMPAR II Software	31/03/2017	836,228.00
		5,581,065.00
c) Building and Site Development :		
Vertical Extension	27/12/2016	5,000,000.00
Installation of lift at SSH	27/01/2017	300,000.00
Chintan Chora	02/02/2017	350,000.00
Bust with pedestral	03/02/2017	60,000.00
Boundary wall incld. Soil nailed wall for stability of embankment at IASST	17/02/2017	1,814,706.00
Badminton Court	21/02/2017	750,000.00
Consultancy services for owners Engineering and project management	22/02/2017	690,000.00
Supply, lelvelling, water etc. At front of green house football field orchid avenue	10/03/2017	700,000.00
Installation of lift at SSH	14/10/2016	600,000.00
		10,264,706.00
d) Furniture & Fixture :		
Pedal Boat	23/03/2017	110,200.00
		110,200.00
	Total (A+B)	**61,531,222.00**

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

Particulars	Amount(₹) 2016-17
(A) GENERAL FUND :	
Consumables	816,517.00
Contingency	1,526,402.00
Salary	621,813.00
Training & Conference	856,225.00
Travel	100,273.00
SC/ST	27,200.00
Works and Services	1,596,346.00
Imprest Advance	
Consumable (Fuel)	250,000.00
Contigency (Registrar)	20,000.00
Contingency (Postage)	5,000.00
Works and Services (SSH)	5,000.00
	5,824,776.00
(B) PROJECT FUND :	
Salary	80,000.00
Travel	291,200.00
Training & Conference	120,200.00
Consumables	140,000.00
	631,400.00
Total (A+B)	**6,456,176.00**

Annexure - 9 : :: EARNEST MONEY PAYMENTS ::

Name of the Firm	Details of Works	Amount(₹) 2016-17
M/S. ASE Instruments Agency Pvt. Ltd.	Instrument	18,669.00
M/S. Excel Instruments	Instrument	10,600.00
M/S. Nirupama Associates	Entrance Gate of IASST	53,000.00
M/S. Bonna Agela India (P) Ltd.	Instrument	30,000.00
Electrodynamic	Electrical	40,000.00
Mr. Hari Das	Interior & Electrical work of VVIP Suit of SSH	25,000.00
	Total :	**177,269.00**

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SCHEDULES FORMING PART OF INCOME & EXPENDITURE FOR THE YEAR ENDED 31/03/2017

Schedule - 9 : :: GRANT - IN - AID ::

Particulars	Amount(₹) 2016-17	Amount(₹) 2015-16
Grants	402,016,539.00	246,450,049.00
Add : Unutilised Grant Brought forward from previous years	67,411,718.79	34,791,964.07
	469,428,257.79	281,242,013.07
Less : Transferred to Capital Fund	74,708,422.80	70,180,491.00
	394,719,834.99	211,061,522.07
Less : Transferred to Earmarked Fund	62,869,636.00	0.00
Less : Refund of Unutilised Grant	0.00	48,213.00
	331,850,198.99	211,013,309.07
Less : Unutilised Grant Carried forward	214,318,347.89	67,411,718.79
	117,531,851.10	143,601,590.28

Schedule - 10 : :: INTEREST INCOME ::

Bank Interest	3,754,840.71
Interest on LC on Equipments	42,221.00
Interest on Income Tax Refund	731.00
	3,797,792.71

Schedule - 11 : :: INCOME FROM INVESTMENT ::

Fixed Deposit Interest (Received)	3,124,077.01
Fixed Deposit Interest (Accrued)	2,000,326.00
	5,124,403.01

Schedule - 12 : :: ESTABLISHMENT EXPENSES ::

Particulars	Current Year			Previous Year
	Payments	P.Y. Advances	Total	
	Amount(₹)	Amount(₹)	Amount(₹)	Amount(₹)
Salary	71,374,797.00	244,210.00	71,619,007.00	86,552,930.00
Contribution to Provident Fund	8,069,816.00	0.00	8,069,816.00	5,277,819.00
Total :	79,444,613.00	244,210.00	79,688,823.00	91,830,749.00

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

For R. Sarda & Co.
Chartered Accountants
Guwahati

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

Details 1 : Contingency Expenses :

	Amount(₹) 2016-17	Amount(₹) 2015-16
General Fund :		
Meeting Expenses	1,324,211.00	1,475,616.00
Advertisement	2,877,532.00	513,188.00
Postage	213,193.00	195,977.00
Electricity & Power	6,772,645.00	6,678,369.00
Audit Fee	36,225.00	45,592.00
Telephone Charges	67,039.00	671,931.00
Repairs & Maintenance - Vehicle	1,519,029.00	830,433.00
Printing & Stationery	2,194,449.00	1,549,948.00
Computer Stationery	322,183.00	266,796.00
Hospitality	2,232,767.00	1,354,973.00
Conveyance	55,953.00	87,382.00
Fee/Due etc.	17,250.00	0.00
Hostel Rent & Electricity		0.00
	17,632,476.00	**13,670,205.00**
Project Fund :	**83,135.82**	**2,311,233.00**
	17,715,611.82	**15,981,438.00**

Details 2 : Laboratory Consumables :

	Amount(₹) 2016-17	Amount(₹) 2015-16
General Fund :		
Laboratory Gas Refilling	133,842.00	68,551.00
Chemicals & Glassware	5,992,558.00	6,460,079.00
Sample Collection	587,141.00	249,790.00
Renewal/Other Fee Payments	859,603.00	458,517.00
Experimental Animal Maintenance	468,041.00	99,042.00
	8,041,185.00	**7,335,979.00**
Project Fund :	**0.00**	**2,758,008.00**
	8,041,185.00	**10,093,987.00**

Details 3 : Works & Services :

	Amount(₹) 2016-17	Amount(₹) 2015-16
General Fund :		
Repairing & Maintenance (Equipment)	3,249,372.00	470,238.00
Gardening & Landscaping	139,664.00	149,797.00
Repairing & Maintenance (Electrical)	1,707,224.00	1,914,285.00
Repairing & Maintenance (General)	11,753,261.00	16,030,803.00
Repairing & Maintenance (SSH)	189,106.00	138,932.00
	17,038,627.00	**18,704,055.00**
Project Fund :	**0.00**	**0.00**
	17,038,627.00	**18,704,055.00**

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K. P. Sarda & Co. Guwahati Chartered Accountants

Finance & Accounts Officer
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Details 4 : Other Current Liabilities :

(a) Movement during the year :

	Amount(₹) 2016-17	Amount(₹) 2015-16
Opening Balance	1,719,334.00	1,719,334.00
Add: Committed for Fixed Assets	0.00	0.00
	1,719,334.00	1,719,334.00
Less : Last year liabilities paid off	1,415,251.00	0.00
Less : Last year liabilities written back	0.00	0.00
	304,083.00	**1,719,334.00**

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

Sl.	Project Name	Head	Amount(₹) 2016-17	Amount(₹) 2015-16
1.	Upgrading	Earth Filling	300,262.00	1,715,513.00
2.	DST Govt of Assam	Grants-in-Aid	3,821.00	3,821.00
			304,083.00	**1,719,334.00**

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Director
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N. L. Sarda & Co. Guwahati Chartered Accountants

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Guwahati-781035

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

RECEIPTS & PAYMENTS ACCOUNT OF EXTRAMURAL PROJECTS FOR THE YEAR ENDED 31ST MARCH 2017

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **EXPENDITURES :**		
Cash in Hand	0.00		Contingency		2,672,582.82
Cash at Bank	16,394,814.00	16,394,814.00	Consumables		5,547,314.00
(As per Annexure A&B)			Overheads		6,318,816.00
			Salary		22,666,216.00
" Grant- in-Aid			Contribution to Benevolent		
(As per Annexure C)		116,416,539.00	Fund		120.00
			Travel		4,212,660.00
" Interest on Savings Bank A/c		1,024,992.00	Training		151,054.00
			Miscellaneous		483,778.20
" **OTHER RECEIPTS :**		14,753,694.00			
(As per Annexure B)			" Equipments		18,499,066.00
" Refund against advance		291,309.00	" Investment in Fixed Deposit		30,000,000.00
			" Earnest Money refund payments		152,269.00
			" Loans & Advance (Vijaya Bank Overhead A/c)		2,000,000.00
			" Refund of unutilised grant		2,253,264.00
			" **CLOSING BALANCE :**		
			Cash in hand	0.00	
			Cash at Bank	53,924,207.98	53,924,207.98
			(As per Annexure A&B)		
		148,881,348.00			148,881,348.00

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 2016 to 31st March, 2017 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 : 03/07/2017

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

INCOME & EXPENDITURE ACCOUNT OF EXTRAMURAL PROJECTS FOR THE YEAR ENDED 31ST MARCH 2017

INCOME	Amount (₹)	EXPENDITURE	Amount (₹)
Grants	35,651,617.02	Expenditure on Grants :	
Interest on Saving Bank A/c	2,297,622.00	Contingency	2,678,882.82
Interest on Fixed Deposit	0.00	Consumables	5,407,314.00
Other Income	3,330,984.00	Overheads	6,318,816.00
Refund against advance	291,309.00	Salary	22,586,216.00
		Travel	4,065,671.00
		Training	30,854.00
		Miscellaneous	483,778.20
	41,571,532.02		41,571,532.02

NOTES ON ACCOUNT - SCHEDULE "8"

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 : 03/07/2017

Director
IASST, Paschim Boragaon
Guwahati-781035

Registrar
Institute of Advanced
Study in Science & Technology
Paschim Boragaon, Guwahati-35

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

	Project Name	Opening Balance									Grant				
		Salary	Contingency	Equipment	Travel	Consumables	Training	Overhead	Misc.	Total	Salary	Contingency	Equipment	Travel	Consumables
1	Androgen	163,691.00	49,324.00	-433,028.00	96,724.00	88,594.00	0.00	9,342.00	0.00	**-25,353.00**	0.00	0.00	0.00	0.00	0.00
2	Anurupa Goswami	231,200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**231,200.00**	0.00	0.00	0.00	0.00	0.00
3	Aquatic Biodiversity	-17,308.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-17,308.00**	0.00	0.00	0.00	0.00	0.00
4	Atmospheric	0.00	8,188.00	0.00	0.00	0.00	0.00	0.00	0.00	**8,188.00**	0.00	0.00	0.00	0.00	0.00
5	Bharalu River	-579,338.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-579,338.00**	0.00	0.00	0.00	0.00	0.00
6	Bio Informatics	25,016.00	90,643.00	466,460.00	-25,112.00	0.00	-34,685.00	0.00	198,000.00	**720,322.00**	214,000.00	30,000.00	0.00	50,000.00	0.00
7	Biosurfactance	91,800.00	24,465.00	11,500.00	-25,668.00	51,808.00	0.00	0.00	0.00	**153,845.00**	432,000.00	25,000.00	0.00	40,000.00	151,980.00
8	Biotech Hubs	-29,179.00	142,116.00	402,228.00	22,876.00	0.00	50,000.00	0.00	0.00	**588,041.00**	0.00	0.00	0.00	0.00	0.00
9	Brain storming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-80,259.00	**-80,259.00**	0.00	0.00	0.00	0.00	0.00
10	Brain storming cum stakeheld	0.00	-68.00	0.00	0.00	0.00	0.00	0.00	240,000.00	**239,932.00**	0.00	0.00	0.00	0.00	0.00
11	Brain storming meeting-3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	160,000.00	0.00	400,000.00	0.00
12	B-ACER Internship Awards	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	904,500.00	25,000.00	0.00	0.00	0.00
13	Chemical input	10,320.00	-6,110.00	0.00	9,854.00	-11,231.00	0.00	0.00	0.00	**2,833.00**	0.00	0.00	0.00	0.00	0.00
14	Crops of Assam	0.00	1,937.00	498.00	8,405.00	-10,610.00	0.00	0.00	0.00	**230.00**	0.00	0.00	0.00	0.00	0.00
15	CSIR	-73.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-73.00**	0.00	0.00	0.00	0.00	0.00
16	CSIR (Neelam, Gitamoni, Yogesh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	1,814,400.00	90,000.00	0.00	0.00	0.00
17	Culture Collection - D. Thakur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	800,000.00	0.00	636,800.00	0.00	0.00
18	DBT -Crest (D Devi)	-343,770.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-343,770.00**	0.00	0.00	0.00	0.00	0.00
19	DBT RA (Supriyo Sen)	852.00	26,925.00	0.00	-40,191.00	0.00	0.00	0.00	15,264.00	**850.00**	0.00	0.00	0.00	0.00	0.00
20	DBT RA (Ashim Kr. Dutta)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	477,986.00	53,000.00	0.00	0.00	0.00
21	DBT RA (R. Thakur)	376,781.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	**426,781.00**	0.00	0.00	0.00	0.00	0.00
22	DBT Scented Rice Programme (R Devi)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	1,564,000.00	50,000.00	2,082,000.00	50,000.00	1,000,000.00
23	DBT Scented Rice Programme (N C Talukdar)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	578,000.00	50,000.00	450,000.00	50,000.00	500,000.00
24	Dev. Of nano particle - Poultry Salmonellosis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	360,000.00	20,000.00	0.00	0.00	200,000.00
25	Diabetic Neuropathic	19,600.00	-20,373.00	-51,410.00	836.00	-9,131.00	0.00	0.00	0.00	**-60,678.00**	360,000.00	10,000.00	0.00	60,000.00	525,000.00
26	DST (J Medhi)	-50,000.00	-13,015.00	0.00	0.00	0.00	0.00	0.00	0.00	**-63,015.00**	0.00	0.00	0.00	0.00	0.00
27	DST (Suitable Plant)	23,968.00	366.00	0.00	-55,182.00	0.00	0.00	0.00	0.00	**-30,848.00**	500,000.00	0.00	0.00	40,000.00	0.00
28	Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-33,598.00	**-33,598.00**	0.00	0.00	0.00	0.00	0.00
29	Electronic Alloys magnetic	-156,800.00	166,898.00	-4,708.00	-23,000.00	56,554.00	0.00	0.00	0.00	**38,944.00**	200,000.00	0.00	0.00	0.00	0.00
30	Flora & Fauna	3,480.00	28,753.00	0.00	32,075.00	0.00	0.00	-39,990.00	-74,885.00	**-50,567.00**	0.00	0.00	0.00	0.00	0.00
31	Food colour	-1,153.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-1,153.00**	0.00	0.00	0.00	0.00	0.00
32	Glycolipid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	360,000.00	50,000.00	300,000.00	50,000.00	200,000.00
33	Govt of Assam	0.00	0.00	-140,113.00	0.00	0.00	0.00	0.00	0.00	**-140,113.00**	0.00	0.00	0.00	0.00	0.00
34	Herbal Medicine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	6,373,000.00	200,000.00	62,251,000.00	200,000.00	5,000,000.00
35	Heifer Fibres	0.00	0.00	0.00	42,070.00	53,799.00	0.00	0.00	0.00	**95,869.00**	0.00	0.00	0.00	0.00	0.00
36	Image Processing (Tabassum Y)	31,129.00	20,194.00	0.00	40,000.00	238.00	0.00	0.00	1,486.00	**93,047.00**	370,000.00	0.00	0.00	0.00	0.00
37	Image Processing (LB Mahanta)	0.00	1,205.00	0.00	0.00	0.00	0.00	0.00	0.00	**1,205.00**	0.00	0.00	0.00	0.00	0.00
38	Indentification	94,475.00	23,441.00	-1,066.00	6,460.00	120,212.00	0.00	0.00	0.00	**243,522.00**	0.00	0.00	0.00	0.00	0.00
39	Inspire faculty (S Pramanik)	901,333.00	30,000.00	245,000.00	35,000.00	0.00	0.00	35,000.00	350,000.00	**1,596,333.00**	0.00	0.00	0.00	0.00	0.00
40	Inspire Fellow (B Choudhury)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	1,200,000.00	35,000.00	245,000.00	35,000.00	350,000.00
41	Inspire Fellow (Kangkana Bora)	-119,033.00	11,463.00	0.00	0.00	0.00	0.00	0.00	0.00	**-107,570.00**	501,700.00	0.00	0.00	0.00	0.00
42	Inspire Fellow (Rosy Mondal)	282,667.00	-19,351.00	265,727.00	43,000.00	290,000.00	0.00	0.00	0.00	**864,043.00**	709,013.00	21,793.00	245,000.00	0.00	172,854.00
43	Inspire Fellow (Y baihang)	282,581.00	20,000.00	0.00	0.00	0.00	0.00	0.00	0.00	**302,581.00**	0.00	0.00	0.00	0.00	0.00
44	Inspire Fellow (Tulsi Joshi)	282,581.00	20,000.00	0.00	0.00	0.00	0.00	0.00	0.00	**302,581.00**	0.00	0.00	0.00	0.00	0.00
45	Inspire faculty (Sumita Sarmah)	474,211.00	35,086.00	+196,423.00	154,544.00	-7,204.00	0.00	0.00	0.00	**460,214.00**	1,372,092.00	0.00	0.00	0.00	0.00
46	Inspire Faculty (Sagar Sarma)	-80,903.00	18,731.00	285,000.00	36,705.00	-86,690.00	0.00	0.00	0.00	**172,843.00**	772,325.00	356,390.00	0.00	0.00	0.00
47	Intestinal Microbiota	19,419.00	33,441.00	0.00	55,798.00	-156,729.00	0.00	0.00	0.00	**-48,071.00**	0.00	0.00	0.00	0.00	0.00
48	Investigation of Rogue Waves	134,280.00	106,220.00	-6,594.00	42,025.00	46,822.00	0.00	0.00	0.00	**322,753.00**	0.00	0.00	0.00	0.00	0.00
49	Jhumming	101,648.00	-5,421.00	0.00	154,705.00	-316,203.00	87,500.00	0.00	0.00	**22,229.00**	819,000.00	50,000.00	0.00	200,000.00	500,000.00
50	Library Workshop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	200,000.00	**200,000.00**	0.00	0.00	0.00	0.00	0.00
51	Loan refund	5,000,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**5,000,000.00**	0.00	0.00	0.00	0.00	0.00
52	L B Mahanta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	960,000.00	50,000.00	750,000.00	50,000.00	0.00
53	Effect of Traditional Dietary Mi Khan (New)	1,298,000.00	50,000.00	2,633,000.00	50,000.00	1,000,000.00	0.00	400,000.00	0.00	**5,431,000.00**	0.00	0.00	0.00	0.00	0.00

Director
IASST, Paschim Boragaon

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

54	NABARD	29,255.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29,255.00	0.00	0.00	0.00	0.00	0.00
55	Nano Material & Biomaterials	196,490.00	-13,106.00	-1,374.00	2,646.00	-2,124.00	0.00	0.00	0.00	182,732.00	550,000.00	50,000.00	0.00	50,000.00	75,000.00
56	Normal Tea Plant	0.00	48,290.00	9,003.00	18.00	226,684.00	0.00	0.00	-9,025.00	274,970.00	0.00	0.00	0.00	0.00	0.00
57	NPDF (Ruparoni Thakur)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	702,700.00	0.00	0.00	0.00	200,000.00
58	NPDF Fellowship (Abdul Barik)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	275,000.00	0.00	0.00	0.00	50,000.00
59	Oxidative degradation	-121,264.00	-1,124.00	0.00	16,281.00	-39,162.00	0.00	-26,632.00	0.00	-171,901.00	0.00	0.00	0.00	0.00	0.00
60	Peste in tea (Microbial)	-42,077.00	-27,514.00	0.00	5,000.00	-71,057.00	0.00	0.00	0.00	-135,648.00	76,645.00	25,000.00	0.00	25,000.00	300,000.00
61	Chemical study of Carbon dots	88,000.00	-25,752.00	-111,854.00	39,161.00	132,906.00	0.00	0.00	0.00	122,461.00	319,500.00	0.00	0.00	30,000.00	51,905.00
62	Physico Sensor	-1.00	14,176.00	-2,341.00	-8,995.00	59,327.00	0.00	0.00	0.00	62,166.00	0.00	0.00	0.00	0.00	0.00
63	Planning Committee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100,000.00	0.00	1,850,000.00	0.00
64	Plasma modified	662,400.00	21,610.00	314,702.00	30,000.00	136,210.00	0.00	16,000.00	0.00	1,180,922.00	0.00	0.00	0.00	0.00	0.00
65	Polymer & Polymer Nano	0.00	-7,939.00	-7,827.00	7,941.00	-15,384.00	0.00	0.00	0.00	-23,209.00	520,250.00	10,000.00	0.00	52,059.00	50,000.00
66	Polymer Based Sensors	-568.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-568.00	0.00	0.00	0.00	0.00	0.00
67	Proton Exchange	-111,600.00	-3,360.00	0.00	-6.00	30.00	0.00	-22,325.00	0.00	-137,261.00	0.00	0.00	0.00	0.00	0.00
68	Ramalingaswami (MR Khan)	184,900.00	605,367.00	0.00	0.00	0.00	0.00	0.00	0.00	790,267.00	0.00	0.00	0.00	0.00	0.00
69	Ramalingaswami (S Nandi)	3,632.00	66,974.00	0.00	-25,736.00	0.00	0.00	0.00	0.00	44,870.00	1,195,935.00	587,645.00	0.00	0.00	0.00
70	Ramalingaswami (S Kundu)	255,000.00	695,000.00	0.00	-22,334.00	0.00	0.00	0.00	0.00	927,666.00	0.00	0.00	0.00	0.00	0.00
71	Ramanujan Fellow	935,000.00	695,000.00	0.00	0.00	0.00	0.00	0.00	0.00	1,630,000.00	85,000.00	105,000.00	0.00	0.00	0.00
72	Sailendra Gayri	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	578,590.00	0.00	0.00	0.00	162,950.00
73	School Project (Il Ballung)	0.00	0.00	0.00	185,000.00	0.00	0.00	0.00	65,000.00	250,000.00	0.00	0.00	0.00	0.00	0.00
74	Silk Protein Based	20,122.00	-19,112.00	0.00	20,839.00	10,224.00	0.00	0.00	0.00	32,073.00	0.00	0.00	0.00	0.00	0.00
75	Stimuli	1,415.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,415.00	0.00	0.00	0.00	0.00	0.00
76	Structure of Enzymes	120,082.00	39,201.00	0.00	24,757.00	199,804.00	0.00	-453.00	0.00	383,391.00	0.00	0.00	0.00	0.00	0.00
77	Tissue Repairs	-57,167.00	32,885.00	0.00	24,114.00	12,770.00	0.00	0.00	0.00	12,602.00	653,000.00	0.00	0.00	25,886.00	287,250.00
78	Treatment of oil field	4,891.00	78,676.00	0.00	40,237.00	-154,314.00	0.00	0.00	439,109.00	408,599.00	0.00	0.00	0.00	0.00	0.00
79	UGC Grant (MD Shadab)	0.00	-9,615.00	0.00	0.00	0.00	0.00	0.00	7,000.00	-2,615.00	353,400.00	0.00	0.00	0.00	0.00
80	VRP (G T Gujar)	503,226.00	23,051.00	0.00	50,000.00	50,000.00	0.00	0.00	0.00	626,277.00	0.00	0.00	0.00	0.00	0.00
81	VRP (A K Saha)	1.00	3,636.00	0.00	50,000.00	30,000.00	0.00	0.00	0.00	83,637.00	0.00	0.00	0.00	0.00	0.00
82	VRP (Ashwani Kumar)	553,548.00	25,000.00	0.00	36,730.00	50,000.00	0.00	0.00	0.00	665,278.00	0.00	0.00	0.00	0.00	0.00
83	Wahengbam Romi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,300,000.00	35,000.00	245,000.00	35,000.00	350,000.00
	Total	11,696,760.00	3,136,142.00	3,676,560.00	1,139,575.00	1,736,143.00	102,815.00	370,942.00	1,316,092.00	23,175,049.00	27,361,756.00	2,185,625.00	67,204,800.00	5,272,945.00	9,726,879.00

K. P. Sarda & Co. Guwahati Chartered Accountants

Registrar
Institute of Advanced
Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI-781035

Training	Overhead	Misc.	Total (a)	Interest (b)	Refund Against Advance (c)	Total Receipts (d) = (a+b+c)	Expenditure							
							Salary	Contribution to Employee Benevolent Fund	Contingency	Equipment	Travel	Consumable	Training	Overhead
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	1,030.00	0.00	1,030.00	305,067.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50,000.00	0.00	48,000.00	442,000.00	0.00	0.00	442,000.00	332,800.00	0.00	84,584.00	402,195.00	8,503.00	0.00	13,573.00	0.00
0.00	25,000.00	0.00	673,980.00	0.00	0.00	673,980.00	673,819.00	0.00	18,869.00	0.00	52,091.00	8,416.00	0.00	25,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	123,871.00	0.00	142,268.00	0.00	11,240.00	0.00	49,981.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37,546.00	0.00	0.00	0.00
0.00	0.00	80,000.00	640,000.00	0.00	0.00	640,000.00	0.00	0.00	127,029.00	0.00	440,610.00	0.00	0.00	0.00
0.00	0.00	0.00	929,500.00	6,719.00	0.00	936,219.00	911,979.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	1,904,400.00	6,943.00	0.00	1,911,343.00	1,786,220.00	0.00	50,215.00	0.00	7,786.00	0.00	0.00	0.00
0.00	0.00	0.00	1,436,800.00	0.00	0.00	1,436,800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	527,986.00	0.00	0.00	527,986.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	30,000.00	0.00	4,796,000.00	0.00	0.00	4,796,000.00	68,571.00	0.00	34,164.00	0.00	0.00	0.00	0.00	50,000.00
0.00	100,000.00	0.00	1,528,000.00	0.00	0.00	1,528,000.00	80,258.00	0.00	0.00	0.00	23,385.00	0.00	0.00	100,000.00
0.00	20,000.00	0.00	600,000.00	0.00	0.00	600,000.00	7,435.00	0.00	1,235.00	0.00	12,749.00	0.00	0.00	20,000.00
0.00	50,000.00	0.00	1,005,000.00	0.00	0.00	1,005,000.00	300,581.00	0.00	0.00	0.00	33,926.00	254,152.00	0.00	50,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	540,000.00	0.00	0.00	540,000.00	322,925.00	0.00	0.00	0.00	80,825.00	135,250.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	200,000.00	0.00	400,000.00	0.00	0.00	400,000.00	201,600.00	0.00	5,000.00	0.00	3,876.00	0.00	0.00	200,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	90,000.00	0.00	1,090,000.00	0.00	0.00	1,090,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	4,280,000.00	333,000.00	78,604,000.00	936,672.00	113,900.00	79,674,573.00	1,754,790.00	0.00	679,076.00	14,400,285.00	361,963.00	0.00	0.00	4,280,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	30,000.00	0.00	400,000.00	0.00	0.00	400,000.00	360,000.00	0.00	4,808.00	0.00	21,133.00	0.00	0.00	30,000.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	71,862.00	0.00	0.00	0.00	0.00	148,774.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	35,000.00
0.00	35,000.00	0.00	1,900,000.00	0.00	0.00	1,900,000.00	957,419.00	0.00	14,933.00	0.00	0.00	326,634.00	0.00	35,000.00
0.00	0.00	0.00	503,700.00	0.00	0.00	503,700.00	350,323.00	0.00	9,400.00	0.00	0.00	0.00	0.00	0.00
0.00	75,000.00	0.00	1,183,657.00	9,556.00	0.00	1,193,213.00	1,320,832.00	0.00	21,506.00	356,053.00	81,904.00	376,796.00	0.00	25,732.00
0.00	0.00	0.00	0.00	910.00	0.00	910.00	410,000.00	0.00	10,000.00	0.00	9,763.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	864.00	0.00	864.00	400,000.00	0.00	20,000.00	0.00	0.00	0.00	0.00	0.00
0.00	27,840.00	0.00	1,599,932.00	0.00	0.00	1,599,932.00	1,126,932.00	0.00	27,187.00	270,685.00	0.00	538,692.00	0.00	27,840.00
0.00	18,746.00	0.00	1,147,261.00	0.00	0.00	1,147,261.00	852,695.00	0.00	12,039.00	199,500.00	0.00	274,120.00	0.00	18,746.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	120,240.00	0.00	86,095.00	0.00	40,414.00	64,615.00	0.00	0.00
300,000.00	0.00	0.00	1,669,000.00	0.00	147,306.00	1,816,306.00	568,814.00	0.00	67,415.00	48,290.00	176,295.00	199,274.00	67,500.00	0.00
0.00	0.00	414,904.00	414,904.00	0.00	0.00	414,904.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	614,904.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	50,000.00	0.00	1,260,000.00	0.00	0.00	1,260,000.00	0.00	0.00	5,000.00	0.00	4,000.00	0.00	0.00	50,000.00
0.00	0.00	0.00	0.00	38,913.00	0.00	38,913.00	1,111,521.00	0.00	50,796.00	2,388,954.00	49,926.00	1,049,922.00	0.00	400,000.00

Director
IASST, Paschim Boragaon

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	35,000.00	0.00	500,000.00	0.00	0.00	500,000.00	250,400.00	0.00	7,558.00	0.00	13,139.00	31,219.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	274,857.00	0.00	0.00
0.00	100,000.00	0.00	1,002,700.00	0.00	0.00	1,002,700.00	688,387.00	0.00	4,994.00	0.00	0.00	41,212.00	0.00	100,000.00
0.00	25,000.00	0.00	350,000.00	0.00	0.00	350,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	30,000.00	0.00	456,645.00	0.00	0.00	456,645.00	31,360.00	0.00	0.00	0.00	23,500.00	256,058.00	0.00	30,000.00
0.00	5,329.00	0.00	406,734.00	0.00	0.00	406,734.00	319,503.00	0.00	7,191.00	39,678.00	16,271.00	60,587.00	0.00	5,329.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	112,722.00	0.00	5,900.00	0.00	0.00	32,989.00	0.00	0.00
0.00	0.00	0.00	1,950,000.00	0.00	0.00	1,950,000.00	33,250.00	0.00	256,797.00	0.00	1,126,124.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	3,385.00	0.00	3,385.00	877,600.00	0.00	10,011.00	316,712.00	0.00	33,391.00	0.00	16,000.00
0.00	32,365.00	0.00	464,524.00	0.00	0.00	464,524.00	320,192.00	0.00	1,725.00	0.00	51,209.00	59,912.00	0.00	32,365.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	184,800.00	120.00	603,666.00	0.00	0.00	0.00	0.00	0.00
0.00	35,450.00	0.00	1,819,000.00	0.00	0.00	1,819,000.00	1,554,418.00	0.00	100,139.00	0.00	17,955.00	161,846.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	253,000.00	0.00	0.00	0.00	52,874.00	0.00	0.00	0.00
0.00	60,000.00	0.00	250,000.00	0.00	0.00	250,000.00	742,387.00	0.00	67,467.00	36,714.00	16,980.00	488,869.00	0.00	60,000.00
0.00	100,000.00	0.00	841,300.00	0.00	0.00	841,300.00	578,387.00	0.00	0.00	0.00	0.00	192,744.00	0.00	100,000.00
0.00	0.00	0.00	0.00	0.00	30,100.00	30,100.00	0.00	0.00	0.00	0.00	200,599.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	966,116.00	0.00	0.00	966,116.00	599,333.00	0.00	31,627.00	0.00	39,835.00	300,000.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	353,400.00	0.00	0.00	353,400.00	338,400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	503,226.00	0.00	23,000.00	0.00	49,539.00	50,000.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,789.00	32,395.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	553,548.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	35,000.00	0.00	1,900,000.00	0.00	0.00	1,900,000.00	480,000.00	0.00	5,000.00	0.00	0.00	4,500.00	0.00	35,000.00
350,000.00	5,469,630.00	842,904.00	116,416,539.00	1,024,992.00	291,309.00	117,732,840.00	22,657,419.00	120.00	2,589,447.00	18,499,066.00	3,314,560.00	9,547,314.00	151,054.00	6,318,816.00

Director
IASST, Paschim Boragaon
Guwahati-781035

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

K. B. Sarda & Co.
Guwahati
Chartered Accountants

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

ANNEXURE : "A"

Misc.	Refund	Investment in FD	Total	Balance as on 31/03/2017												
				Salary	Contingency	Equipment	Travel	Consumables	Training	Overhead	Misc.	Bank Interest	Refund Against Advance (Receipt)	Refund (Payment)	Investment in FD	Total
0.00	0.00	0.00	**0.00**	163,691.00	49,324.00	-433,038.00	96,724.00	88,594.00	0.00	9,342.00	-0.00	0.00	0.00	0.00	0.00	**-25,353.00**
0.00	0.00	0.00	**305,067.00**	-73,867.00	0.00	0.00	-0.00	-0.00	0.00	0.00	0.00	1,050.00	0.00	0.00	0.00	**-72,817.00**
0.00	0.00	0.00	**0.00**	-17,308.00	0.00	-0.00	0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	**-17,308.00**
0.00	8,188.00	0.00	**8,188.00**	-0.00	8,188.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	8,188.00	0.00	**0.00**
0.00	0.00	0.00	**0.00**	-579,338.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-579,338.00**
48,000.00	0.00	0.00	**889,652.00**	-63,784.00	36,059.00	64,265.00	16,388.00	-0.00	1,742.00	-0.00	188,000.00	0.00	0.00	0.00	0.00	**272,670.00**
0.00	0.00	0.00	**778,195.00**	-150,019.00	30,536.00	11,500.00	-37,759.00	195,372.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**49,630.00**
0.00	0.00	0.00	**327,360.00**	-153,050.00	-352.00	402,228.00	11,696.00	-0.00	19.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**260,681.00**
0.00	0.00	0.00	**0.00**	0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	80,259.00	0.00	0.00	0.00	0.00	**-80,259.00**
0.00	0.00	0.00	**239,932.00**	-0.00	-68.00	0.00	-37,546.00	-0.00	-0.00	-0.00	102,190.00	0.00	0.00	64,576.00	0.00	**0.00**
137,810.00	64,576.00	0.00	**693,888.00**	-0.00	32,971.00	-0.00	-40,610.00	-0.00	-0.00	-0.00	-43,289.00	0.00	0.00	0.00	0.00	**-50,888.00**
123,249.00	0.00	0.00	**912,048.00**	-7,479.00	25,000.00	0.00	0.00	0.00	0.00	0.00	-69.00	6,719.00	0.00	0.00	0.00	**24,371.00**
69.00	0.00	0.00	**0.00**	10,320.00	-6,110.00	-0.00	9,854.00	-11,251.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**2,833.00**
0.00	0.00	0.00	**0.00**	-0.00	1,957.00	498.00	8,405.00	-10,610.00	0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**230.00**
0.00	0.00	0.00	**0.00**	-73.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-73.00**
0.00	0.00	0.00	**1,844,221.00**	28,180.00	99,785.00	0.00	-7,286.00	0.00	0.00	0.00	0.00	6,943.00	0.00	0.00	0.00	**67,122.00**
0.00	0.00	0.00	**0.00**	800,000.00	0.00	656,800.00	0.00	-0.00	0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**1,456,800.00**
0.00	0.00	0.00	**0.00**	-343,770.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-343,770.00**
0.00	0.00	0.00	**0.00**	852.00	26,925.00	-0.00	-40,193.00	-0.00	-0.00	-0.00	13,264.00	0.00	0.00	0.00	0.00	**850.00**
0.00	0.00	0.00	**0.00**	477,986.00	50,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**527,986.00**
0.00	426,781.00	0.00	**426,781.00**	376,781.00	50,000.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	426,781.00	0.00	**0.00**
0.00	0.00	0.00	**152,735.00**	1,495,429.00	15,836.00	2,082,000.00	50,000.00	1,000,000.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**4,643,265.00**
0.00	0.00	0.00	**203,643.00**	497,742.00	50,000.00	450,000.00	26,615.00	300,000.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**1,324,357.00**
0.00	0.00	0.00	**39,417.00**	552,567.00	18,765.00	0.00	-117.00	200,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**569,583.00**
0.00	0.00	0.00	**638,658.00**	79,020.00	-10,573.00	-51,410.00	26,910.00	261,717.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**305,664.00**
0.00	0.00	0.00	**0.00**	-50,000.00	-13,015.00	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**-63,015.00**
0.00	0.00	0.00	**509,116.00**	201,066.00	366.00	0.00	-96,005.00	-105,390.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**36.00**
0.00	0.00	0.00	**0.00**	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	-33,598.00	0.00	0.00	0.00	0.00	**-33,598.00**
0.00	0.00	0.00	**410,476.00**	-158,400.00	161,898.00	-4,708.00	-26,876.00	56,554.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**28,468.00**
0.00	0.00	0.00	**0.00**	5,480.00	28,753.00	-0.00	32,875.00	0.00	0.00	-39,990.00	-74,885.00	0.00	0.00	0.00	0.00	**-50,567.00**
0.00	0.00	0.00	**0.00**	-1,153.00	-0.00	-0.00	0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-1,153.00**
0.00	0.00	0.00	**0.00**	360,000.00	50,000.00	300,000.00	50,000.00	200,000.00	0.00	90,000.00	0.00	0.00	0.00	0.00	0.00	**1,050,000.00**
0.00	0.00	0.00	**0.00**	-0.00	-0.00	-140,113.00	0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-140,113.00**
568.20	0.00	50,000,000.00	**51,436,942.20**	4,628,210.00	-479,076.00	47,850,715.00	-161,963.00	5,000,000.00	-0.00	0.00	299,451.80	956,672.00	113,901.00	0.00	50,000,000.00	**28,237,930.80**
0.00	0.00	0.00	**0.00**	-0.00	-0.00	-0.00	42,070.00	53,799.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**95,869.00**
0.00	0.00	0.00	**415,941.00**	41,129.00	15,386.00	-0.00	18,867.00	258.00	-0.00	0.00	1,486.00	0.00	0.00	0.00	0.00	**77,106.00**
0.00	0.00	0.00	**0.00**	-0.00	1,205.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**1,205.00**
0.00	0.00	0.00	**220,636.00**	22,613.00	23,441.00	-1,066.00	6,460.00	-28,562.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**22,886.00**
0.00	1,561,333.00	0.00	**1,596,333.00**	901,333.00	30,000.00	245,000.00	35,000.00	0.00	-0.00	0.00	350,000.00	0.00	0.00	1,561,333.00	0.00	**0.00**
0.00	0.00	0.00	**1,334,006.00**	242,581.00	20,067.00	245,000.00	35,000.00	23,346.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**565,994.00**
0.00	0.00	0.00	**359,723.00**	34,344.00	2,063.00	-0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**36,407.00**
0.00	0.00	0.00	**2,360,623.00**	329,352.00	-18,867.00	154,674.00	-36,934.00	-113,942.00	0.00	11,268.00	0.00	9,556.00	0.00	0.00	0.00	**-323,367.00**
0.00	0.00	0.00	**429,763.00**	127,419.00	10,000.00	0.00	-9,763.00	0.00	0.00	0.00	0.00	930.00	0.00	0.00	0.00	**-126,272.00**
0.00	0.00	0.00	**423,000.00**	117,419.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	864.00	0.00	0.00	0.00	**-116,555.00**
0.00	0.00	0.00	**1,991,336.00**	919,571.00	7,899.00	-467,108.00	154,544.00	-545,896.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	**68,810.00**
0.00	0.00	0.00	**1,337,100.00**	-141,273.00	362,882.00	85,500.00	36,733.00	-360,810.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**-16,998.00**
0.00	0.00	0.00	**0.00**	19,419.00	33,441.00	-0.00	55,798.00	-156,729.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	**-48,071.00**
0.00	0.00	0.00	**311,362.00**	14,040.00	20,127.00	-6,594.00	1,681.00	-17,793.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**11,391.00**
0.00	0.00	0.00	**1,147,546.00**	551,854.00	-22,856.00	-48,290.00	178,412.00	-215,437.00	300,000.00	-0.00	0.00	0.00	147,308.00	0.00	0.00	**690,991.00**
0.00	0.00	0.00	**614,904.00**	0.00	0.00	0.00	0.00	0.00	0.00	-614,904.00	614,904.00	0.00	0.00	0.00	0.00	**0.00**
0.00	0.00	0.00	**0.00**	5,000,000.00	-0.00	0.00	-0.00	-0.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**5,000,000.00**
0.00	0.00	0.00	**59,000.00**	360,000.00	45,000.00	750,000.00	46,000.00	-0.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	**1,201,000.00**
0.00	0.00	0.00	**5,051,326.00**	186,479.00	-796.00	2[illegible]6.00	74.00	-49,922.00	0.00	0.00	-207.00	38,913.00	0.00	0.00	0.00	**418,567.00**

Director
IASST, Paschim Boragaon
Guwahati 781035

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati 781035

0.00	0.00	0.00	0.00	29,255.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	29,255.00
0.00	0.00	0.00	282,356.00	296,090.00	9,336.00	-1,374.00	19,507.00	41,657.00	-0.00	35,000.00	0.00	0.00	0.00	0.00	0.00	400,416.00
0.00	0.00	0.00	274,837.00	-0.00	48,290.00	9,003.00	18.00	-48,155.00	0.00	0.00	-9,055.00	0.00	0.00	0.00	0.00	133.00
0.00	0.00	0.00	934,593.00	14,513.00	-4,994.00	-0.00	-0.00	158,788.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	168,107.00
0.00	0.00	0.00	0.00	275,000.00	0.00	0.00	-0.00	50,000.00	-0.00	25,000.00	-0.00	0.00	0.00	0.00	0.00	350,000.00
0.00	0.00	0.00	0.00	-121,264.00	-1,124.00	0.00	16,281.00	-39,362.00	-0.00	-26,632.00	0.00	0.00	0.00	0.00	0.00	-171,901.00
0.00	0.00	0.00	320,918.00	3,208.00	-2,514.00	0.00	6,500.00	-7,115.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	79.00
0.00	0.00	0.00	448,556.00	88,000.00	-32,943.00	-151,552.00	52,890.00	124,224.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	80,639.00
0.00	0.00	0.00	349,611.00	-112,723.00	10,276.00	-2,341.00	-8,995.00	26,338.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	-87,449.00
173,875.00	0.00	0.00	1,590,046.00	-53,250.00	-156,797.00	-0.00	723,876.00	-0.00	-0.00	0.00	-173,875.00	0.00	0.00	0.00	0.00	359,954.00
0.00	0.00	0.00	1,253,714.00	-213,200.00	11,599.00	-2,010.00	30,000.00	102,819.00	0.00	0.00	0.00	3,385.00	0.00	0.00	0.00	-69,407.00
0.00	0.00	0.00	465,203.00	108.00	336.00	-7,827.00	8,791.00	-25,296.00	-0.00	0.00	-0.00	0.00	0.00	0.00	0.00	-23,884.00
0.00	0.00	0.00	0.00	-568.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	-568.00
0.00	0.00	0.00	0.00	-111,600.00	-3,560.00	0.00	6.00	30.00	-0.00	-22,325.00	0.00	0.00	0.00	0.00	0.00	-137,261.00
0.00	0.00	0.00	788,666.00	-100.00	1,701.00	0.00	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00	0.00	1,601.00
0.00	0.00	0.00	1,634,336.00	-154,881.00	554,480.00	0.00	-43,669.00	-161,846.00	-0.00	35,450.00	-0.00	0.00	0.00	0.00	0.00	229,534.00
0.00	0.00	0.00	507,874.00	-0.00	695,000.00	0.00	-73,208.00	-0.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	619,792.00
0.00	0.00	0.00	1,427,412.00	277,613.00	737,338.00	-76,714.00	-16,980.00	-488,869.00	0.00	20,000.00	0.00	0.00	0.00	0.00	0.00	452,588.00
0.00	0.00	0.00	871,131.00	3.00	-0.00	-0.00	-0.00	-29,834.00	-0.00	0.00	0.00	0.00	0.00	0.00	0.00	-29,831.00
0.00	79,701.00	0.00	280,100.00	0.00	0.00	0.00	-15,399.00	0.00	0.00	0.00	65,000.00	0.00	30,300.00	79,701.00	0.00	0.00
0.00	0.00	0.00	0.00	20,122.00	-19,112.00	-0.00	20,839.00	10,224.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32,073.00
0.00	0.00	0.00	0.00	1,415.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	1,415.00
0.00	0.00	0.00	0.00	120,082.00	36,201.00	0.00	24,757.00	199,804.00	0.00	-453.00	0.00	0.00	0.00	0.00	0.00	383,391.00
0.00	0.00	0.00	964,815.00	2,500.00	1,258.00	0.00	10,145.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13,903.00
0.00	0.00	0.00	0.00	4,899.00	78,676.00	0.00	83,257.00	-154,314.00	0.00	0.00	439,139.00	0.00	0.00	0.00	0.00	408,599.00
0.00	0.00	0.00	338,400.00	15,000.00	-9,615.00	0.00	0.00	0.00	0.00	0.00	7,000.00	0.00	0.00	0.00	0.00	12,385.00
0.00	492.00	0.00	626,277.00	-0.00	51.00	0.00	441.00	0.00	0.00	0.00	0.00	0.00	0.00	492.00	0.00	0.00
0.00	465.00	0.00	83,637.00	1.00	3,656.00	0.00	-789.00	-2,385.00	0.00	0.00	0.00	0.00	0.00	465.00	0.00	0.00
0.00	111,750.00	0.00	665,278.00	-0.00	25,000.00	0.00	36,750.00	50,000.00	0.00	0.00	0.00	0.00	0.00	111,750.00	0.00	0.00
0.00	0.00	0.00	524,500.00	720,000.00	30,000.00	245,000.00	35,000.00	345,500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,375,500.00
463,778.20	2,253,264.00	30,000,000.00	91,614,538.20	16,402,977.00	2,732,320.00	52,382,314.00	1,297,960.00	5,915,708.00	301,761.00	-478,244.00	1,675,217.80	1,024,992.00	291,309.00	2,253,264.00	30,000,000.00	89,293,050.80

K. P. Sarda & Co. Guwahati Chartered Accountants

Director
IASST, Paschim Boragaon
Guwahati-781035

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Finance & Accounts Officer
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Guwahati-781035

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 2017

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **EXPENDITURES :**		
Unspent as on 31/03/2016		-6,780,235.00	Salary	8,797.00	
			Contingency	83135.82	
* **OTHER RECEIPTS :**			Travel	1,098,100.00	1,190,032.82
Interest on Saving Bank A	1,272,630				
Earnest Money Deposit	133,100		* Loans & Advance (Vijaya Bank Overhead A/c)		2,000,000.00
Maturity Amount of FD	10,000,000				
Income Tax Refund	16,980		* Earnest Money refund payments		152,269.00
Other Receipts	3,330,984	14,753,694.00			
			* **CLOSING BALANCE :**		
			Unspent as on 31/03/2017		4,631,157.18
		7,973,459.00			7,973,459.00

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 : 03/07/2017

Director
IASST, Paschim Boragaon
Guwahati-781035

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

HE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOG
PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

ANNEXURE : "C"

DETAILS OF GRANT-IN-AID OF EXTRAMURAL PROJECTS FOR THE FINANCIAL YEAR 2016-17

Sl.No.	Name of the Project	Amount(₹)
1	Bio Informatics	442,000.00
2	Biosurfactance	673,980.00
3	Brain storming meeting-3	640,000.00
4	B-ACER Internship Awards	929,500.00
5	CSIR (Neelam, Gitumoni, Yogesh)	1,904,400.00
6	Culture Collection - D. Thakur	1,436,800.00
7	DBT RA (Ashim Kr. Dutta)	527,986.00
8	DBT Scented Rice Programme (R Devi)	4,796,000.00
9	DBT Scented Rice Programme (N C Talukdar)	1,528,000.00
10	Dev. Of nano particle or micro particle	600,000.00
11	Diabetic Neuropathic	1,005,000.00
12	DST (Suitable Plant)	540,000.00
13	Electronic Alloys magnetic	400,000.00
14	Glycolipid	1,050,000.00
15	Herbal Medicine	78,604,000.00
16	Image Processing (Tabassum Y)	400,000.00
17	Inspire Fellow (B Choudhury)	1,900,000.00
18	Inspire Fellow (Kangkana Bora)	503,700.00
19	Inspire Fellow (Rosy Mondal)	1,183,657.00
20	Inspire faculty (Sumita Sarmah)	1,599,932.00
21	Inspire Faculty (Sagar Sarma)	1,147,261.00
22	Jhumming	1,669,000.00
23	Library Workshop	414,904.00
24	L B Mahanta	1,260,000.00
25	Nano Material & Bimaterials	500,000.00
26	NPDF (Rupamoni Thakur)	1,002,700.00
27	NPDF Fellowship (Abdul Barik)	350,000.00
28	Peste in tea (Microbial)	456,645.00
29	Chemical study of Carbon dots	406,734.00
30	Planning Committee	1,950,000.00
31	Polymer & Polymer Nano	464,524.00
32	Ramalingaswami (S Nandi)	1,819,000.00
33	Ramanujan Fellow	250,000.00
34	Sailendra Gayri	841,300.00
35	School Project (H Bailung)	0.00
36	Tissue Repairs	966,116.00
37	UGC Grant (MD shadab)	353,400.00
38	Wahengbam Romi	1,900,000.00
		116,416,539.00

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Director
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K. P. Sarda & Co. Chartered Accountants Guwahati

Finance & Accounts Officer
IASST, Paschim Boragaon
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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 2017

RECEIPTS		Amount (₹)	PAYMENTS		Amount (₹)
To **OPENING BALANCE :**			By **SALARY & ALLOWANCES :**		
Cash in hand	50,000.00		Salary	63,808,059.00	
Cash at Bank	2,295,129.75	2,345,129.75	N.P.S Contribution	8,069,816.00	
			Gratuity Premium	2,660,680.00	
" **GRANT-IN-AID :**			Contribution to Employee Benevolent Fund	7,200.00	
From Ministry of Science and Technology Department of Science & Technology, New Delhi			Children Education	1,168,820.00	
			Medical Contribution	1,422,211.00	
			Leave Travel Concession	1,098,854.00	
			Telephone/Internet	208,012.00	
Letter No.			Uniform Allowances	150,664.00	
AI/IASST/SAL/003/2016/1	18,615,000.00		Loans & Advances	294,000.00	78,888,316.00
AI/IASST/CAP/003/2016/1	17,037,000.00				
AI/IASST/GEN/003/2016/1	8,163,000.00		" **GENERAL :**		
AI/IASST/SAL/003/2016/2	30,681,000.00		Contingency	17,632,476.00	
AI/IASST/GEN/003/2016/2	13,027,000.00		Bank Charges	5,832.55	
AI/IASST/ST/003/2016/1	750,000.00		Consumables	8,041,185.00	
AI/IASST/ST/GEN/003/2016/1	3,000,000.00		Training & Conference	4,693,600.00	
AI/IASST/SC/003/2016/1	1,065,000.00		Travelling	2,034,760.00	
AI/IASST/CAP/003/2016/1	12,854,000.00		Honorarium	2,394,248.00	
AI/IASST/SC/003/2016/2	2,112,000.00		Security Service	1,491,230.00	
AI/IASST/ST/GEN/003/2016/1	9,450,000.00		Works and Services	17,038,627.00	53,331,958.55
AI/IASST/ST/003/2016/2	2,570,000.00				
AI/IASST/SAL/003/2016/3	42,231,000.00		" **CAPITAL :**		
AI/IASST/CAP/003/2016/3	3,872,000.00		Equipments	52,202,274.45	
AI/IASST/GEN/003/2016/3	17,671,000.00		Library	1,772,455.00	
AI/IASST/SC/003/2016/3	651,000.00		Computer & Peripherals	10,264,368.00	
AI/IASST/ST/GEN/003/2016/1	12,550,000.00		A.C.	1,061,578.00	
AI/IASST/ST/003/2016/3	680,000.00		Furniture & Fixtures	5,410,501.00	
AI/IASST/SAL/003/2016/4	18,746,000.00		Land & Building	38,199,844.00	
AI/IASST/CAP/003/2016/4	6,915,000.00		Student Scientist Home	6,027,527.00	114,938,547.45
AI/1/7/IASST/2016	45,000,000.00				
AI/IASST/GEN/003/2016/3	17,960,000.00	285,600,000.00	" SC/ST		93,333.00
" **INTEREST :**					
Bank Interest	2,396,106.00		" **CLOSING BALANCE :**		
Interest on Fixed Deposit	1,378,047.68		Cash in hand	20,000.00	
Interest on L/C Deposit	42,221.00	3,816,374.68	Cash at Bank	64,598,924.43	64,618,924.43
" **OTHER RECEIPTS :**					
Loan	165,440.00				
Workshop & Conference	76,706.00				
Loans & Advances	19,862,429.00				
Misc. Receipts	5,000.00	20,109,575.00			
		311,871,079.43			311,871,079.43

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 2016 to 31st March, 2017 from the Books of Accounts and vouchers produced before us.

For K. P. Sarda & Co.
Chartered Accountants
FRN : 319206E
(CA. K P Sarda)
Partner
Membership No. 054555

K. P. Sarda & Co. Guwahati Chartered Accountants

Place : Guwahati
Date : 03/07/2017

Registrar
Institute of Advanced Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
IASST, Paschim Boragaon
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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 2017

INCOME	Amount (₹)	EXPENDITURE	Amount (₹)
Grants	106,612,835.87	**Expenditure on Grants**	
Bank Interest	2,396,106.00	Salary	81,157,739.00
Interest on Fixed Deposit	1,378,047.68	Contingency	16,377,331.00
Other Income	20,109,575.00	Bank Charges	5,832.55
		Consumables	7,183,739.00
		Training & Conference	4,170,267.00
		Travelling	1,974,087.00
		Honorarium	2,394,248.00
		Security Service	1,491,230.00
		Works and Services	15,525,958.00
		SC/ST	216,133.00
	130,496,564.55		130,496,564.55

NOTES ON ACCOUNT - SCHEDULE "8"

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 : 03/07/2017

Registrar
Institute of Advanced
Study in Science & Technology
Paschim Boragaon, Guwahati-35

Director
IASST, Paschim Boragaon
Guwahati-781035

Finance & Accounts Officer
IASST, Paschim Boragaon
Guwahati-781035

(2)

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.

(viii) Since projects are earmarked funds, they have not been included in the preparation of Consolidated Income & Expenditure Account. Only Overheads from the project have been taken in the Consolidated Income & Expenditure Account.

K. P. Sarda & Co. Guwahati Chartered Accountants

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THE INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY

PASCHIM BORAGAON, GARCHUK, GUWAHATI- 781035

Schedule - 13 : :: OTHER ADMINISTRATIVE EXPENSES ::

Particulars	Current Year			Previous Year
	Payments	P.Y. Advances	Total	
	Amount(₹)	Amount(₹)	Amount(₹)	Amount(₹)
Labour Charge	0.00	0.00	0.00	6,000.00
Contingency (Details 1)	16,164,209.82	296,257.00	16,460,466.82	16,692,833.00
Bank charges	5,832.55	0.00	5,832.55	5,093.00
Contingency - Emiratus Scientist	0.00	0.00	0.00	55,663.00
Honorarium	2,394,248.00	0.00	2,394,248.00	1,852,580.00
Laboratory Consumables (Details 2)	6,974,668.00	209,071.00	7,183,739.00	10,164,099.00
Meeting Expenses	0.00	0.00	0.00	284,569.00
Miscellaneous Expenses	0.00	0.00	0.00	132,228.00
Overhead Expenses	6,318,816.00	0.00	6,318,816.00	1,331,901.00
Security Services	1,491,230.00	0.00	1,491,230.00	1,406,036.00
Training and Conference	3,837,375.00	332,892.00	4,170,267.00	2,000,130.00
Travelling Expenses	3,032,587.00	39,600.00	3,072,187.00	4,500,549.00
Works & Services (Details 3)	15,437,281.00	83,677.00	15,520,958.00	18,745,631.00
Outsourcing	0.00	0.00	0.00	264,555.00
Analysis	0.00	0.00	0.00	11,275.00
SC/ST	66,133.00	150,000.00	216,133.00	13,220.00
Total :	**55,722,380.37**	**1,111,497.00**	**56,833,877.37**	**57,466,362.00**

N. P. Sarda & Co. Guwahati Chartered Accountants

Registrar
Institute of Advanced
Study in Science & Technology
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Director
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Fifth instar Muga Silk worm released in *Som plant* with intact leaf

INSTITUTE OF ADVANCED STUDY IN SCIENCE AND TECHNOLOGY (IASST)

(An Autonomous Institute Under DST, Govt. of India)

Vigyan Path, Paschim Boragaon
Garchuk, Guwahati, Assam - 781035, India
http://iasst.gov.in