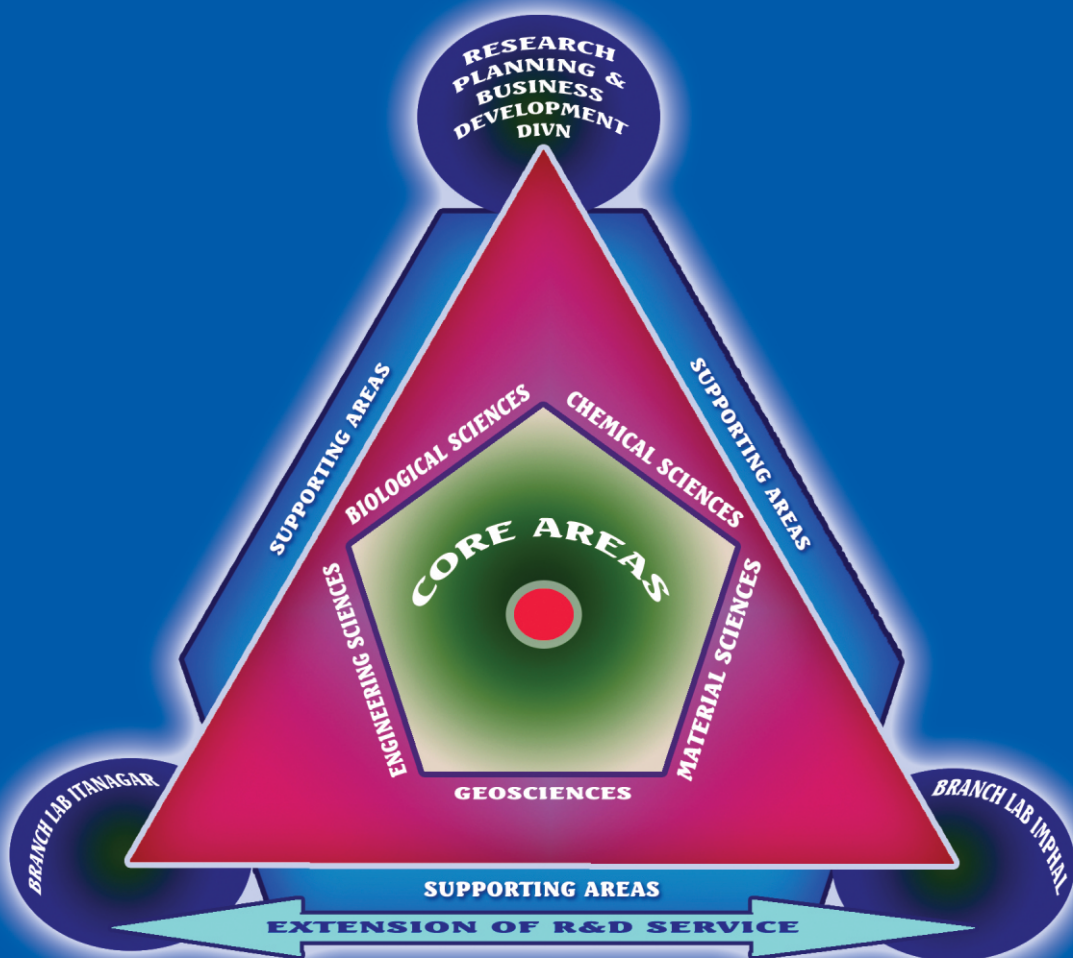


# वार्षिक प्रतिवेदन ANNUAL REPORT 2017-2018



सीएसआईआर-उत्तर पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट  
CSIR-NORTH EAST INSTITUTE OF SCIENCE & TECHNOLOGY, JORHAT



## QUALITY POLICY OF CSIR-NEIST

CSIR-North East Institute of Science & Technology, Jorhat is committed to achieve excellence with quality outputs in R&D in frontier areas, professional consultancy and contract services in Chemical, Biology and Allied Sciences to be offered to customers in public and private domains at national and international levels.



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## About CSIR-NEIST, Jorhat

### CSIR-NORTH EAST INSTITUTE OF SCIENCE & TECHNOLOGY, JORHAT



CSIR-North East Institute of Science and Technology (Formerly Regional Research Laboratory) Jorhat, Assam was established in 1961 under the aegis of Council of Scientific & Industrial Research (CSIR), New Delhi as one of the multidisciplinary CSIR laboratories. The major thrust of R&D activities of CSIR-NEIST has been to develop indigenous technologies and knowledge base by utilizing the immense natural wealth of the North Eastern region of India. The North Eastern region of the country being bestowed with an abundance of material resources like petroleum, natural gas, minerals, tea and aromatic and medicinal plants, the laboratory was assigned to undertake research for development of expertise and know-how for a wide range of industries and extension works. The institute comprising its main campus in Jorhat (Assam) and two branch laboratories, in Imphal, Manipur and Itanagar, Arunachal Pradesh has a glorious existence of more than 5 decades contributing immensely to the economic, industrial and societal upliftment of the North Eastern region in particular and the country as a whole.



## From the Director's Desk

It gives me great pleasure to present before you the Annual Report of CSIR-North East Institute of Science & Technology for the year 2017-18. The report is the snapshot of our Institute's activities, achievements and the progress we have made over the last year in the field of science and technology. I thank all my colleagues and staff members for working together as a team and accomplishing the tasks that came in hand.



During the year, eight (8) new technologies/Know-how namely 'OP-12 Bio-fertilizer', 'Herbal Mosquito Repellent Spray', 'Herbal Mosquito Repellent Liquid Vaporizer', 'Herbal Mosquito Repellent ointment', 'Process for Production of Natural Vanillin', 'Organic Fertilizer - SUFAL', and 'High Yielding Variety of *Kaempferia Galanga* (Brahmaputra -1)' were developed out of which six have been licensed to various companies for commercialization. With an effort to build close linkage with other organizations, the institute has taken up some consultancy assignments and transferred technologies to some of the potential industries which helped in earning sizable cash resources. Our institute marked a significant achievement in terms of translation research as 10 nos. of technologies were transferred to 14 entrepreneurs/parties from various parts of the country for commercialization. The Know-how on 'Herbal Anti-Arthritis Formulation' was transferred to 3 reputed pharmaceutical companies in India. On the publications side, the Institute published a total of 102 papers in reputed journals with an average impact factor of 3.034. On the IPR front, 12 Patents were granted in India & abroad, while 6 patents were filed in India & abroad.

The Institute was also honoured by the visit of many dignitaries such as Prof R K Khandal, President R&D Business Development, India Glycols Ltd. Noida, during National Technology Day on 11 May 2017, Shri S N Pradhan, Joint Secretary, Ministry of DoNER on 12 June 2017, Shri Hitendra Nath Goswami, Hon'ble Speaker, Assam Legislative Assembly on 8 July 2017, Padmabhushan Dr A V Rama Rao on the occasion of 23<sup>rd</sup> Dr. J N Baruah Memorial Lecture held at CSIR-NEIST on 1 September 2017, Hon'ble Member of Parliament, Jorhat Constituency, Shri Kamakhya P Tasa on the occasion of "Beneficiary Interactive Meet for the Weavers Trained under CSIR-Skill Development Initiative" on 25 January 2018 and Shri Naveen Verma, Secretary, MDoNER during 17-18 March 2018.

The 23<sup>rd</sup> Dr J N Baruah Memorial Lecture was held at CSIR-NEIST on 1 September, 2017 with a special programme at Dr J N Baruah auditorium. The programme was jointly organized by Dr J N Baruah



Memorial Trust; Assam Science Society (Jorhat branch) and CSIR-NEIST. It is held annually in the honor and fond memory of Late Dr J N Baruah, former Director of CSIR-NEIST and also an eminent scientist and educationist from Assam who contributed significantly in science and its popularization among the students. On the occasion, the bust of Late Dr J N Baruah was unveiled by the Chief Guest, Padmabhushan Dr A V Rama Rao.

This year, the CSIR-Aroma Mission was launched and CSIR NEIST signed MoU with seven (7) NGOs from different parts of India to bring about 1800 hectares of area under cultivation of various aromatic crops. The Institute continued to render its services to the people of the region through various programs and activities. On the societal front, the Institute along with its branch laboratories in Imphal, Manipur and Itanagar, Arunachal Pradesh imparted training and demonstration of its low-cost technologies like Mushroom cultivation, Vermicompost Production and cultivation of Medicinal & Aromatic Plants to the rural masses to provide them avenues for earning a livelihood. The programs under human resource development have been significant with an increased no. of students, who enrolled in Ph.D. programs under AcSIR and other universities of the region and outside.

It is indeed a proud privilege to mention that CSIR-NEIST received a global ranking of 556<sup>th</sup> among 5250 institutes surveyed by SCImago for 2017. CSIR-NEIST has been ranked 36<sup>th</sup> among the Indian institutes and organizations, while ranked 15<sup>th</sup> among the Indian R&D institutes and 10<sup>th</sup> among CSIR institutes. I also feel proud to mention that some of our colleagues have been honored with prestigious awards during the year such as World Academic Championship Award 2018 from International Agency for Standards and Ratings in the field Membrane Science.

I sincerely acknowledge the leadership and immense contribution of then Director, Dr D Ramaiah for the achievement and exemplary performance of the institute during the year. I also acknowledge the constant support, guidance and encouragement received from Director General, CSIR, Research Council & Management Council and also thank once again each and every member of the Institute for their sincere contributions, hard work and dedication in the overall achievements and progress of the Institute.

26 September, 2018



**(Samit Chattopadhyay)**  
Director, CSIR-NEIST



## निदेशक डेस्क से



वर्ष 2017-18 के दौरान सीएसआईआर-उत्तर पूर्व विज्ञान तथा प्रौद्योगिकी संस्थान, जोरहाट की वार्षिक रिपोर्ट पेश करते हुए मुझे बहुत खुशी हो रही है। यह रिपोर्ट विज्ञान और प्रौद्योगिकी के क्षेत्र में पिछले वर्ष के दौरान हमारे संस्थान की गतिविधियों, उपलब्धियों और प्रगति का एक झलक है। मैं अपने सहयोगियों और कर्मचारियों के साथ-साथ सभी सदस्यों को एक टीम के रूप में मिलकर काम करने और हाथ में आने वाले कार्यों को पूरा करने के लिए धन्यवाद देता हूँ।

वर्ष के दौरान, आठ (8) नई प्रौद्योगिकियों अर्थात् 'ओ पी -12 बायो-उर्वरक', 'हर्बल मच्छर प्रतिरोधी स्प्रे', 'हर्बल मच्छर प्रतिरोधी तरल वेपोराइजर', 'हर्बल मच्छर प्रतिरोधी मलहम', 'प्राकृतिक वैनिलीन उत्पादन के लिए प्रोसेस', 'कार्बनिक उर्वरक दृ सुफल', और 'कैम्फेरिया गलंगा (ब्रह्मपुत्र -1) की उच्च पैदावार किस्मों का विकास किया गया, जिसमें छः (6) को व्यावसायीकरण के लिए विभिन्न कंपनियों को प्रदान दिया गया है। अन्य संगठनों के साथ घनिष्ठ संबंध बनाने के प्रयास के साथ, संस्थान ने कुछ परामर्शी कार्य भी पूरा किया है और कुछ उद्योगों को प्रौद्योगिकियां स्थानांतरित किया है जो बड़े पैमाने पर नकदी संसाधनों की कमाई में मदद कर रहा है। हमारे संस्थान ने बहुपयोगी अनुसंधान के संदर्भ में महत्वपूर्ण उपलब्धियों को प्राप्त किया क्योंकि हमारी 10 प्रौद्योगिकियों को व्यावसायीकरण के लिए देश के विभिन्न हिस्सों से 14 उद्यमियों ६ दलों को स्थानांतरित किया है। 'हर्बल एंटी-गठिया फॉर्मूलेशन' पर नो-हाऊ को भारत में 3 प्रतिष्ठित दवा कंपनियों को स्थानांतरित किया है। अनुसंधान प्रकाशन के क्षेत्र में संस्थान ने 3.034 औसत इंपैक्ट फेक्टर के साथ प्रतिष्ठित पत्रिकाओं में कुल 102 अनुसंधान पत्र प्रकाशित किए हैं। पेटेंट मोर्चे पर, भारत और विदेशों में 12 पेटेंट मंजूर किए जा चुके हैं, साथ ही भारत और विदेशों में अब तक 6 पेटेंट दायर किए गए हैं।

संस्थान कई गणमान्य व्यक्तियों के आगमन से सम्मानित हुआ। 11 मई 2017 को राष्ट्रीय प्रौद्योगिकी दिवस के अवसर पर प्रोफेसर आरके खंडाल, अध्यक्ष आर एंड डी बिजनेस डेवलपमेंट, इंडिया ग्लाइकोल्स लिमिटेड नोएडा ने व्याख्यान दिया। श्री एस एन प्रधान, संयुक्त सचिव, डोनेर मंत्रालय ने 12 जून को 2017 को संस्थान का दौरा किया। माननीय सभापति, असम विधान सभा श्री हितेन्द्र नाथ गोस्वामी ने 8 जुलाई 2017 को संस्थान का दौरा किया। 1 सितंबर 2017 को सीएसआईआर-निस्ट में आयोजित 23वें डॉ जेएन बरुआ मेमोरियल व्याख्यान के अवसर पर पद्मभूषण डॉ एवी राम राव ने व्याख्यान दिया। 25 जनवरी 2018 को "सीएसआईआर-कौशल विकास पहल के तहत प्रशिक्षित वीवरों के लिए लाभार्थी इंटरएक्टिव मीटिंग" के अवसर पर सांसद, जोरहाट निर्वाचन क्षेत्र से माननीय श्री कामख्या प्रसाद तासा का आगमन हुआ और 17-18 मार्च 2018 को डोनेर के सचिव श्री नवीन वर्मा का आगमन हुआ।

सीएसआईआर-निस्ट के डॉ जे एन बरुआ ऑडिटोरियम में 23वें डॉ जे एन बरुआ मेमोरियल व्याख्यान 1 सितंबर, 2017 को एक विशेष कार्यक्रम के साथ आयोजित किया गया। कार्यक्रम असम विज्ञान सोसाइटी (जोरहाट शाखा) और सीएसआईआर-निस्ट द्वारा संयुक्त रूप से डॉ जे एन बरुआ मेमोरियल ट्रस्ट के माध्यम



से आयोजित किया गया। यह आयोजन प्रतिवर्ष सीएसआईआर-निस्ट के पूर्व निदेशक स्वर्गीय डॉ जे एन बरुआ के सम्मान और स्मृति में किया जाता है। वे असम के एक प्रसिद्ध वैज्ञानिक और शिक्षाविद थे जिन्होंने विज्ञान के क्षेत्र में महत्वपूर्ण योगदान दिया और छात्रों के बीच लोकप्रियता भी हासिल किया। इस अवसर पर मुख्य अतिथि, पद्मभूषण डॉ ए वी राम राव ने डॉ जे एन बरुआ के कास्य मूर्ति का अनावरण किया।

इस वर्ष महात्वाकांक्षी सीएसआईआर-अरोमा मिशन लॉन्च किया गया और सीएसआईआर-निस्ट ने विभिन्न सुगंधित फसलों की खेती के तहत लगभग 1800 हेक्टेयर भूमि क्षेत्र इसके अंतर्गत लाने के लिए भारत के विभिन्न हिस्सों से सात (7) गैर सरकारी संगठनों के साथ समझौता ज्ञापन पर हस्ताक्षर किया। संस्थान ने विभिन्न कार्यक्रमों और गतिविधियों के माध्यम से इस क्षेत्र के लोगों को अपनी सेवाएं प्रदान करना जारी रखा है। सामाजिक मोर्चे पर, संस्थान इम्फाल (मणिपुर) और इटानगर (अरुणाचल प्रदेश) में अपनी शाखा प्रयोगशालाओं के साथ-साथ ग्रामीण लोगों को मशरूम की खेती, वर्मीकंपोस्ट से खेती और औषधीय एवं सुगंधित पौधों की खेती जैसे कम लागत वाली प्रौद्योगिकियों का प्रशिक्षण दिया और आजीविका अर्जित करने में उनके मार्ग को प्रशस्त करने के लिए प्रदर्शनी लगाकर लोगों को अवगत कराया। मानव संसाधन विकास के अंतर्गत एसीएसआईआर और अन्य विश्वविद्यालयों में पी.एच.डी. में दाखिला लेने वाले छात्रों की संख्या में महत्वपूर्ण बढ़ोतरी इस वर्ष हुआ है।

यह वास्तव में गर्व की बात है कि सीएसआईआर-निस्ट ने 2017 के लिए एससीआईएमएगो द्वारा सर्वेक्षण किए गए 5250 संस्थानों में 556वें स्थान पर वैश्विक रैंकिंग प्राप्त किया। भारतीय संस्थानों और संगठनों में सीएसआईआर-निस्ट 36वें स्थान पर है, जबकि भारतीय अनुसंधान एवं विकास संस्थानों में 15वें स्थान पर है और सीएसआईआर संस्थानों में 10वें स्थान पर है। मुझे यह उल्लेख करते हुए भी गौरव महसूस हो रहा है कि हमारे कुछ सहयोगियों को इस वर्ष के दौरान प्रतिष्ठित पुरस्कारों के साथ सम्मानित किया गया है जैसे इंटरनेशनल एजेंसी फॉर स्टैंडर्ड्स एंड राइटिंग्स इन झिल्ली साइंस द्वारा अंतर्राष्ट्रीय अकादमिक चौपियनशिप अवॉर्ड 2018 प्राप्त हुआ।

वर्ष के दौरान संस्थान की उपलब्धियों एवं अनुकरणीय प्रदर्शन के लिए मैं वस्तुतः तत्कालीन निदेशक, डॉ डी रामाय्या के नेतृत्व और महत्वपूर्ण योगदान को स्वीकार करता हूं। मैं महानिदेशक, सीएसआईआर, अनुसंधान परिषद और प्रबंधन परिषद से प्राप्त निरंतर समर्थन, मार्गदर्शन और प्रोत्साहन को भी स्वीकार करता हूं और समग्र उपलब्धियों और प्रगति में उनके ईमानदार योगदान, कड़ी मेहनत और समर्पण के लिए संस्थान के प्रत्येक सदस्य को एक बार फिर धन्यवाद देता हूं।

*Samit Chatteropadhyay*

(समित चट्टोपाध्याय)

निदेशक, सीएसआईआर-निस्ट

26 सितंबर, 2018



## CSIR-NEIST AT A GLANCE 2017-2018

### RESOURCE BASE

#### Infrastructural

R&D Groups	13
Branch Laboratory	02
Seismic Stations	27

### HUMAN RESOURCES

#### Total S&T Staff

Scientists	75
Technical Officers/Assistants	51
Support Staff (Technicians/ Lab. Attendants/Assistants)	83
Administrative Staff	75

### FINANCIAL

	(Rs in Lakhs)
Government Allocation	6608.833
From Contract R&D and Consultancy	1129.338
Testing/ Analytical Services	29.37
Miscellaneous including Royalty/ Premia	7.70

### BUDGET

#### Sanctioned

	(Rs in Lakhs)
Recurring	4529.350
Capital	1526.803
Network Project (task force)	
Capital	101.000
Recurring	451.680

## R&D PERFORMANCE: 2017-2018

### Knowledge Generation

Papers published	102
Peer reviewed Journals:	82
International peer reviewed Journals	81
National peer reviewed Journals	01
Proceedings	01
Non peer reviewed Journals:	19
Average IF	3.034
Highest IF	11.994

### Technological Output

Technologies developed	08
Technologies released to industry	10

### Extramural & Human Resource Development

Sr Research Fellow	19
Jr Research Fellow	30
CSIR-TWAS Fellow	02
DST Inspire Faculty	01
DST-Young Scientist Scheme	02
DBT Ramalingaswami Re-entry fellow	01
DST Ramanujan fellow	01
DST-NPDF	04
DBT Trainees	02
Guest Workers	11
Project Workers	74

### Patents Filed

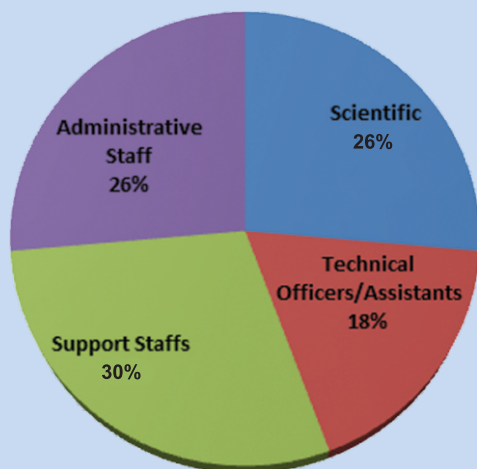
In India	03
Abroad	03

### Patents Granted

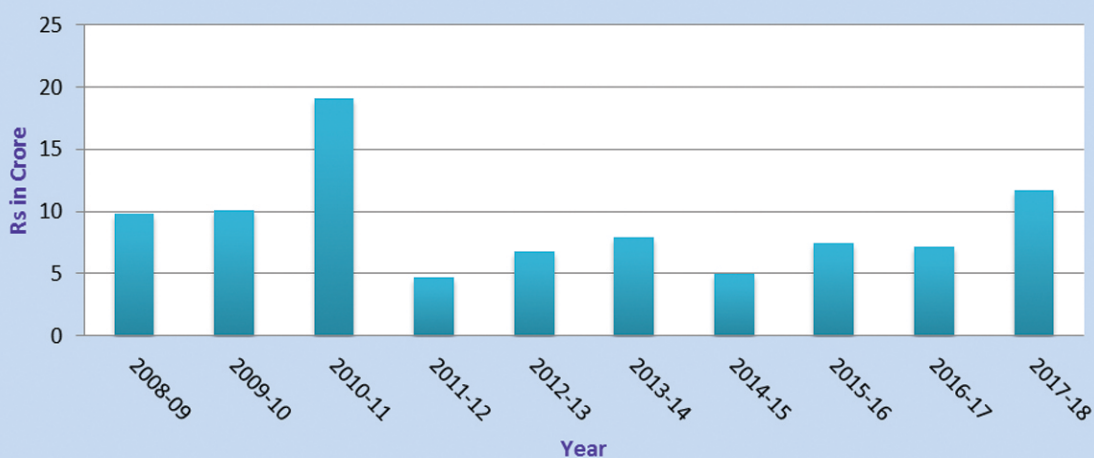
In India	08
Abroad	04

## PERFORMANCE INDICATOR

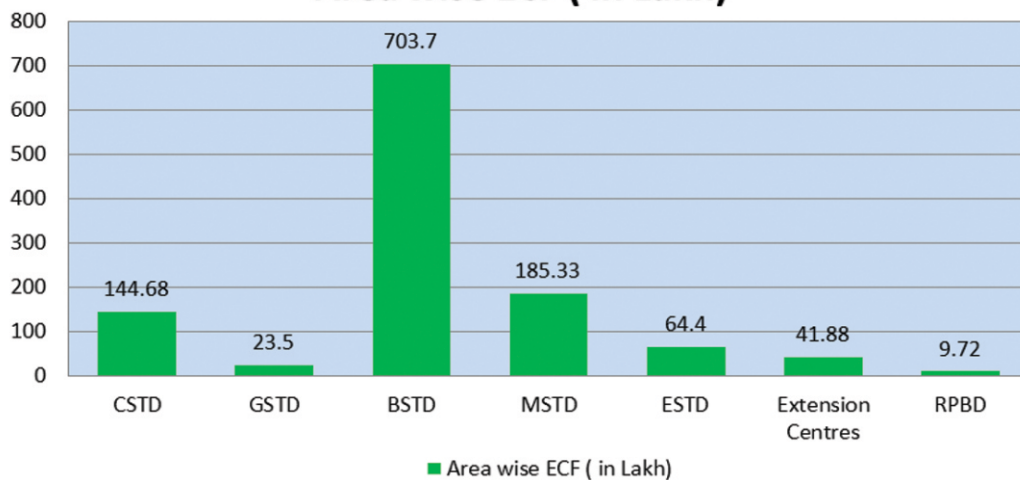
### Human Resources: 2017-2018



### External Cash Flow 2008-2018

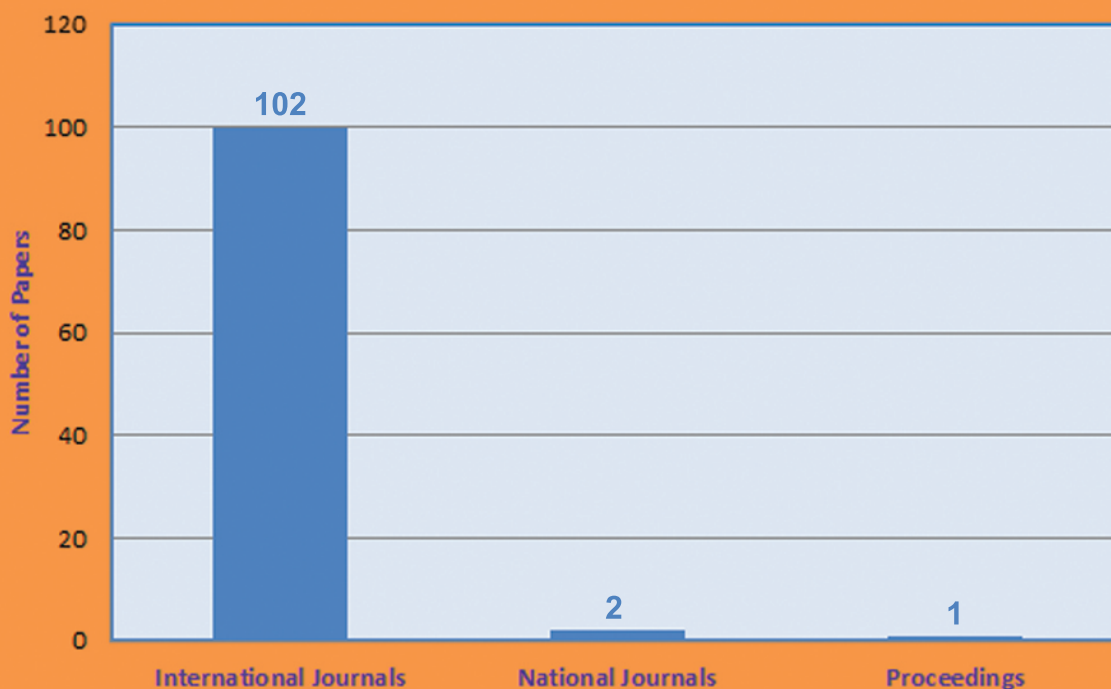


### Area wise ECF ( in Lakh)

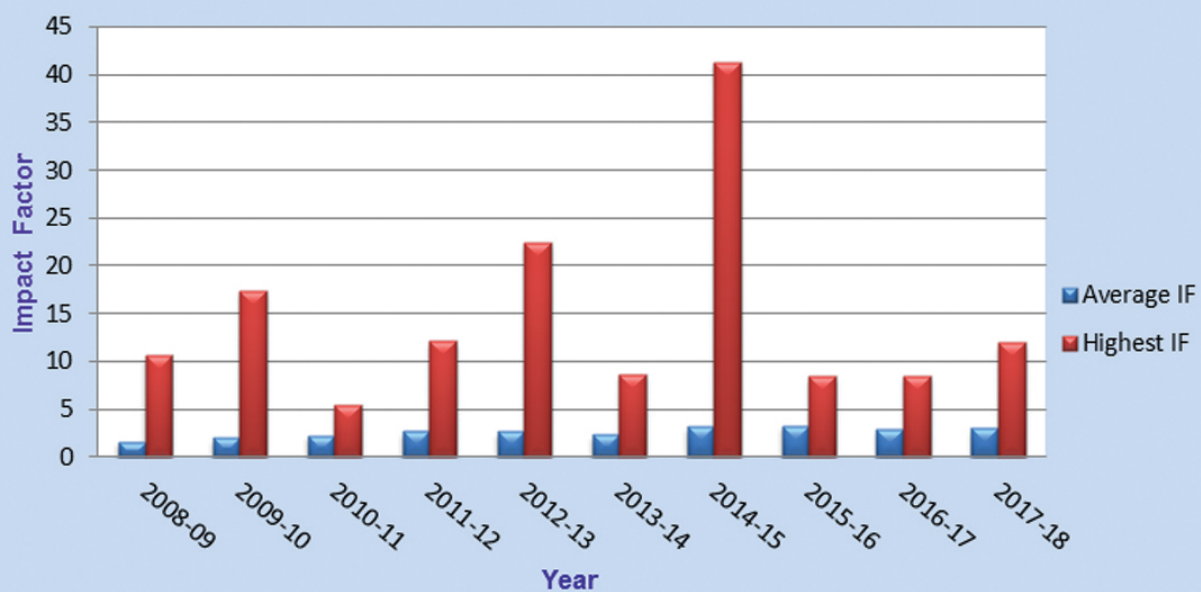




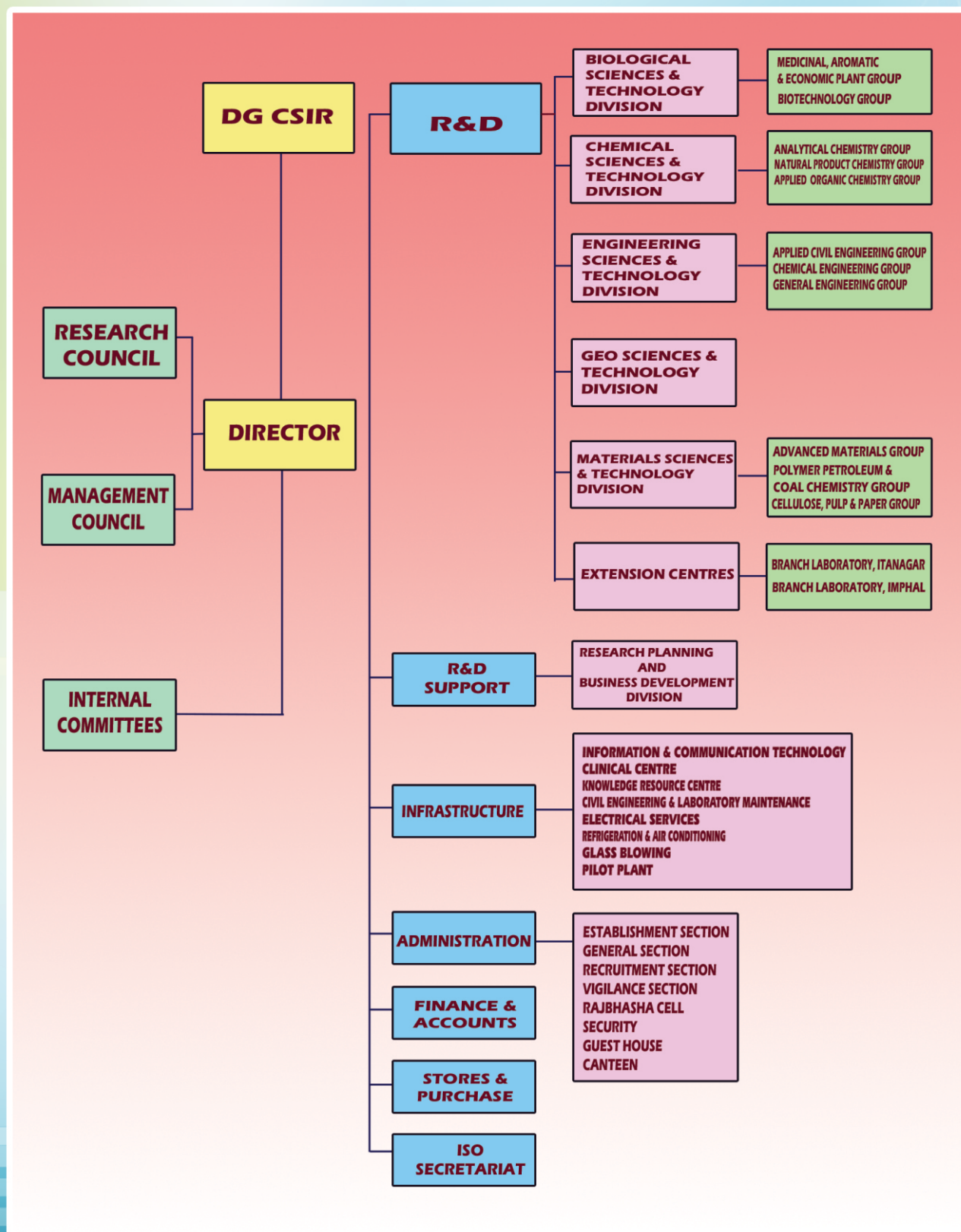
### Papers Published: 2017-2018



### Impact Factor of Publications 2008-2018



## ORGANIZATION STRUCTURE





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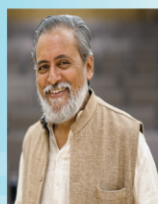
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## R & D ACTIVITIES

### BIOLOGICAL SCIENCES & TECHNOLOGY DIVISION

**Biological Science & Technology Division (BSTD)** is a multi-disciplinary division of CSIR-NEIST, Jorhat, which is dedicated for frontline research at the frontiers of modern biology research. With the highest standards of excellence in research, it ensures interdisciplinary partnerships that will transform the discoveries made through the dedicated study of basic biology into applied solutions to different challenges. The prime mission of the BSTD is to develop indigenous technologies from the enormous bio resources of North East India including plants, microbes and insects using modern tools & techniques of biotechnology.

Other major important activities of the division include environmental monitoring of pollutants, routine analysis of water, food & beverages and soil samples. Thus the division is actively engaged in both basic and applied research by highly experienced professional researchers in different frontier areas of biological sciences.

The division is poised to play an even greater role in defining national & global research initiatives in the areas of health, conservation of biodiversity and the environment through large-scale interdisciplinary collaborations with other divisions at CSIR-NEIST as well as the many research institutions. The division has a DBT-sponsored Bioinformatics Infrastructure Facility (BIF) and DBT sponsored Institutional Biotech Hub which provides training, workshops and caters to the need of researchers and students communities on genomics, proteomics, application to the development of drugs/ drug designing, anti-microbial agents, microbial taxonomic data analysis, mathematical modeling/data analysis, etc.

#### A) National Collaboration

##### (i) Mission Mode

**Project Title:** CSIR AROMA MISSION

**Project No:** HCP-0007

**Funding Agency:** CSIR, New Delhi

**Nodal Officer:** Dr Pinaki Sengupta

**PI & Members:** Dr Siddhartha Proteem Saikia (PI), Dr M Bhuyan, S Haldar, Dr D Banik, Mr J J Bora, Mr D Neog, Dr S B Wann, Dr J C Bora, Dr C Tamuly, Dr H B Singh

##### Objectives (CSIR-NEIST):

- ❖ Bring about 800 hac. of additional area under cultivation of aromatic crops
- ❖ Provide technical and infrastructural support for distillation and values-addition to farmers/growers all over the NE India
- ❖ Enabling effective buy-back mechanisms to assure remunerative prices to the farmers/growers
- ❖ Value-addition to essential oils and aroma ingredients for their integration in global trade and economy.



**Salient Achievements:**
**❖ CSIR AROMA MISSION Launched:**

- CSIR AROMA MISSION Launched at Lunglei, Mizoram by Hon'ble Chief Minister of Mizoram Mr. Lal Thanhawla on 24<sup>th</sup> August 2017.
- CSIR AROMA MISSION Launched at Imphal, Manipur by Hon'ble Governor of Manipur Dr. Najma Heptulla on 19<sup>th</sup> September 2017.

**❖ Variety developed:**

- Java Citronella (Jor Lab C-5, Registration No. INGR 16021)
- Lemongrass (Jor Lab L-8, Registration No. INGR 16020)

**❖ Agrotechnology transferred:**

- Java Citronella (Jor Lab C-5) to 3 parties
- Lemongrass (Jor Lab L-8) to 1 parties

**❖ Technology for Fabrication of Essential Oil Distillation Unit transferred**
**❖ MoU signed**

S.No	Party	Purpose
1	Social Action for People (SAP), Odisha	For the implementation of the "CSIR -Aroma Mission" in 450 hectares of land in the state of Odisha.
2	Subansiri Research & Social Welfare Society (SR&SWS), Itanagar, Arunachal Pradesh	For the implementation of the "CSIR -Aroma Mission" in 70 hectares of land in the state of Arunachal Pradesh.
3	Hills Integrated Society, Karbi Anglong, Assam	For the implementation of the "CSIR-Aroma Mission" in 180 hectares of land in the state of Assam
4	Bath Multi Purposes Cooperative Society, Arunachal Pradesh	For the implementation of the "CSIR -Aroma Mission" in 70 hectares of land in the state of Arunachal Pradesh.
5	Rural Herbal Development and Literary Society, Arunachal Pradesh	For the implementation of the "CSIR -Aroma Mission" in 70 hectares of land in the state of Arunachal Pradesh.
6	All Manipur Trained Medicinal and Aromatic Plants Promoters Consortium, Imphal, Manipur Joriya Aromatic Small	For the implementation of the "CSIR -Aroma Mission" in 500 hectares of land in the state of Manipur.  For the implementation of the "CSIR -Aroma Mission" in
7	Farmers Unit, Goalpara, Assam	30 hectares of land in the state of Assam.



**Project Title:** CSIR Phytopharmaceutical Mission

**Project No:** HCP-0010

**Funding Agency:** CSIR, New Delhi

**Nodal Officer:** Dr Siddhartha Proteem Saikia (PI)

**PI & Members:** Dr Mohan Lal (PI), Dr M Bhuyan, Dr S Haldar, Dr D Banik, Mr J JBora, Mr D Neog, Dr S B Wann, Dr J C Bora, Dr C Tamuly, Dr H B Singh

**Objectives:**

- ❖ Captive cultivation of selected medicinal plants for production of quality planting material and to develop region specific agrotechnologies.
- ❖ Captive cultivation of selected high value rare, endangered and threatened medicinal plant species.

**Salient Achievements:**

- ❖ Captive cultivation of medicinal plants such as *Andrographis paniculata*, *Stevia rebaudiana*, *Tinospora cordifolia*, *Curcuma caesia*, *Solanum khasianum*, *Clerodendrum colebrookianum*, *Zingiber zerumbet* and *Piper longum* undertaken in the experimental farm of CSIR-NEIST Jorhat as well as in the Branch Laboratory Imphal, Manipur and Itanagar, Arunachal Pradesh.

**(i) In-house, Grant in aid & Consultancy Projects**

**Project Title:** Exploration of microorganisms, plants and insects from North East Gene pool through sustainable indigenous & modern technology for Socio-economic upliftment of NE region

**Project No:** OLP-2001

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Hari Prasanna Deka Boruah (PI), Dr S B Wann, Dr R Saikia, Dr C Chikkaputtaiah, Dr J Kalita, Dr A K Singh, Dr Y S Devi, Dr A K Srivastava, Ms Yadav, Ms P Bordoloi

**Objectives:**

- ❖ Collection and isolation of microbes, plants and insects for bio-profiling.
- ❖ Screening and short-listing of the microbial strains/metabolites/ plant species for potential applications.
- ❖ Molecular characterization of species /metabolites/plants using standard operating procedures.
- ❖ *In-vitro*, *in-vivo* and field-scale application of leads/hits and promising species.
- ❖ Optimization of process parameters and development of process/technology for gainful utilization.
- ❖ Value addition to existing MAP by novel product development

### Salient Achievements:

- ❖ Collection and screening of plant pathogenic fungi for development of sustainable biotic stress tolerance in rice and tomato crop models through CRISPR-Cas9 genome editing approach.
- ❖ Establishing CRISPR-Cas9/Cpf1 genome editing technology for sustainable development of crop resistance.
- ❖ Standardized genomic DNA extraction protocol of commercial spice and spice powders for 8 spices and 3 major adulterant. The barcode primer ITS2 was standardized successfully and others are in progress. A total of 29 samples were amplified with ITS2 primer and sent for sequencing.
- ❖ Screening of EPs from synthetic analogues (11-H Pyridine (2 1-b) quinazolin -11-one analogues) have been done and presently under review.
- ❖ Herbal ingredient based antibacterial Hand Wash has been developed and its techno-economic evaluation has been done and now it is ready for transfer.
- ❖ Knock out construction of different Efflux pump genes and their regulator study will delineate a clue of their molecular function and control.

**Project Title:** Raising of clonal microgarden and validation of microclones of 'Assam Teak' (*Phoebe goalparensis* Hutchinson) through multilocal trials in selected areas of North East Region.

**Project No:** GPP-298

**Funding Agency:** Department of Biotechnology (DBT), Govt. of India

**PI & Members:** Dr K D Mudoi (PI), Dr S P Saikia (Co-PI)

### Objectives:

- ❖ Optimization of nutritional status, culture conditions for in vitro propagation/ multiplication of *Phoebe goalparensis* through different explants sources.
- ❖ Standardization of the reproducible protocol for mass multiplication, rooting, followed by hardening and acclimatization for regeneration of quality propagules.
- ❖ To study genetic fidelity of tissue culture raised propagules for rising of clonal microgarden and to assess validation through multilocal field trials.

### Salient Achievements:

- ❖ Successful *in vitro* propagation of this species was recorded at BAP (2 mg/l) enriched MS medium and root induction was noticed at IBA (2.0 mg/l) supplemented WPM medium. However, 70% of root induction was recorded during rooting experiment and 80-85% survivability was observed during acclimatization of this species. Clonal fidelity of *P. goalparensis* was determined with ISSR marker and it was proved that *in vitro* raised plantlets were monomorphic and genetically uniform. During field performance study with clonal plantlets of *P. goalparensis*, 100% survivability was recorded at three plantation sites, which proved the suitability of successful *in vitro* micropropagation protocol.



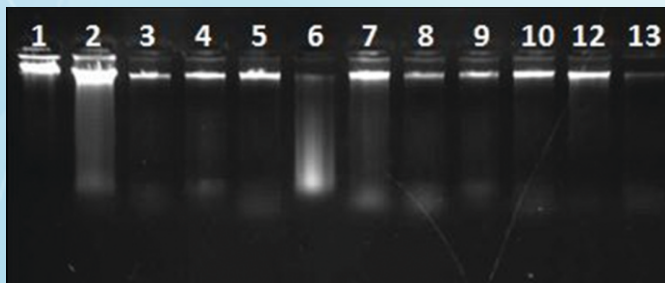


Fig: Isolated Genomic DNA of mother plant & *in vitro* raised plantlets of *Phoebe goalparensis*; 1- mother plant; 2-13 tissue culture raised plantlets.

**Project Title:** Genetic Improvement of *Java citronella* (*Cymbopogon winterianus* Jowit): A commercially prospective plant species of North East India

**Project No:** GPP-304

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**PI & Members:** Dr Mohan Lal (PI)

**Objectives:**

- ❖ Collection, Evaluation and characterization of different accessions of *Java citronella*.
- ❖ Creation of variability through mutagenic agents such as Gamma rays and chemical mutagens.
- ❖ To study the heritability and genetic advancement for oil and herbage yield.
- ❖ Selection of high herbage and high quality oil variety of *Java citronella*.

**Salient Achievements:**

- ❖ During the period 469 M<sub>5</sub> mutation progenies were evaluated and two lines were identified having high essential oil content (1.50%) and high geraniol content (52%). For confirmation of the results both genotypes will be evaluated in MLT trial in different locations of NE India.
- ❖ Multilocation trial of advance lines of *Cymbopogon*, ginger, *Acorus calamus* and *Curcuma caesia* has been planted in five locations (Jorhat, Lakhamijan, Imphal, Pasighat and Shillong in North-East India. Morphological and other data were taken from average of five locations.

Pedigree	Botanical name	Plant height (cm)	No. of tillers/plant	No. of leaf/plant	No. of primary rhizome	Dry rhizome recovery %	Fresh rhizome yield/tones/ha	Oil %	Total dry rhizome yield/tones/ha/year	Major oil Constituent %
Jor Lab AC -1	<i>Acorus calamus</i>	88	8	12	1	32	6.8	2.5	2.18	80% cis-sasarone
Jor Lab Z-4	<i>Zingiber officinale</i>	72	18	48	8	35.00	28.15	0.7	9.85	29% geraniol
KH 2	<i>Curcuma caesia</i>	145	8	16	10	24	32.01	0.85	9.78	32 % camphor

**Project Title:** Characterization and chemical composition of High Yielding Varieties of Amada Haldi (*Curcuma zedoaria* Rose) and Kali Haldi (*Curcuma caesia* Roxb): Endangered High Value Medicinal Plants

**Project No:** GPP-312

**Funding Agency:** Ministry of Ayush, Govt. of India

**PI & Members:** Dr Mohan Lal (PI), Dr S P Saikia (Co-PI)

**Objectives:**

- ❖ Collection, evaluation, characterization and assessing the genetic diversity of different accessions of *Curcuma zedoaria* and *Curcuma caesia*.
- ❖ To study the heritability, genetic variability and genetic advancement for morphological, oil yield, rhizome and starch characters etc.
- ❖ To find out the direct and indirect effects of some quantitative characters on oil, starch and rhizome yield.
- ❖ Selection of high rhizome and high quality oil varieties of both curcuma species and make a germplasm repository of both the species.

**Salient Achievements:**

- ❖ During the period 126 germplasm of *Cucuma caesia* and 46 germplasm of *Curcuma zeodoria* has been collected from different locations of India and planted in RCB design at Experimental farm of CSIR-NEIST Jorhat. All morphological and essential oil quality data has been recorded, one high rhizome essential oil line was identified and second year evaluation trial has been planted.

**Project Title:** Process development and optimization for production of in-situ generated Vitamin D fortified mushrooms

**Project No:** GPP-314

**Funding Agency:** Department of Biotechnology (DBT), Govt. of India

**PI & Members:** Dr Siddhartha Proteem Saikia (PI)

**Objectives:**

- ❖ Development and optimization of protocol for enhancement of Vitamin D fortified mushrooms by the UV treatment.
- ❖ Screening of mushroom types for its Vitamin D accumulation potential
- ❖ Demonstration and installation of a pilot production unit for fortified mushrooms
- ❖ Skill training for growing fortified Mushroom as a functional food

**Salient Achievements:**

- ❖ Effect of UV treatment has been studied on different mushroom for a fixed period of time i.e. 2 hrs. Four different UV treatments 254nm, 290nm, 310nm and 365nm have been evaluated on



the proximate and vitamin D content of the different mushrooms. Also effect of sun light was evaluated on the proximate and Vitamin D composition of the mushrooms. The mushroom varieties taken for the study were Oyster mushroom (7 strains). The results indicated that in all the strains invariably, UV-C (100-290nm) treatment has resulted in significant increase in the Vitamin D content. It was observed from the results that the Vitamin D content was significantly increased in the *in situ* treatment (whole fruit body) in comparison to the sliced fruit body. This suggested that the precursor of the Vitamin D<sub>2</sub> in mushroom are mostly located near the surface of the mushroom fruit body. Moreover the proximate analysis of the mushroom did not show any kind of change in the carbohydrate and protein content of the fruit body.

**Project Title:** Application of DNA barcoding to detect contamination and substitution from selected spice products available in the market.

**Project No:** GPP-317

**Funding Agency:** FSSAI, Ministry of Health and Family Welfare

**PI & Members:** Dr Sawlang Borsingh Wann (PI), Dr D Banik (Co-PI)

**Objectives:**

- ❖ Collection of different types of spices available in the market for extraction of DNA and its analysis.
- ❖ DNA barcoding of spices using different standard barcode primers.
- ❖ High resolution melting (HRM) curve analysis using RT-PCR.
- ❖ Data analysis in order to check the adulterants and contaminants in the spices.
- ❖ Develop standard operating procedure SOP for fast and reliable detection of contaminants from different spices.

**Salient Achievements:**

- ❖ Genomic DNA extraction protocol is standardized from fresh, and commercial samples for 8 spices and 3 major adulterants.
- ❖ Barcode primer ITS2 was standardized successfully and 29 samples were amplified and got sequenced by PathCare.
- ❖ Spice specific primers were designed for high resolution melting curve (HRM) analyses. All the HRM primers are designed ranging 20-24 bp, GC Content (50-57%), calculated T<sub>m</sub> (53.8-57.6) °C with a product range 131 - 267 bp to check the adulteration in the commercial spices collected from markets in comparison to their reference sequences of the control species.
- ❖ The Turmeric specific primers could amplify the Turmeric DNA without amplifying the Cassava and Maize which are common biological adulterants.

**Project Title:** Delineating the regulation of multi drug resistant efflux pumps over expressed in clinical mycobacteria

**Project No:** GPP-329

**Funding Agency:** DST-SERB

**PI & Members:** Dr Anil Kumar Singh (PI)

**Objectives:**

- ❖ Constructions of  $\beta$ -galactosidase transcriptional fusion of 10 efflux pump genes promoter, trapping and identification of promoter binding EP regulator.
- ❖ Knock out generation of EP regulators and study of EP regulator mutants on drug susceptibility.
- ❖ qRT PCR of EP regulator mutant and wild type strains and Gel shift assay.
- ❖ Complementation of each promoter binding protein and susceptibility assay.
- ❖ Different phenotypical assays, e.g., biofilm formation, congo red straining, aggregation assay

**Salient Achievements:**

- ❖ Knock out constructs of different efflux pump genes (MSMEG\_5008, MSMEG\_2619, MSMEG\_0695, MSMEG\_3815 etc) are under progress.
- ❖ In our Promoter DNA-Protein binding assay, we found a promoter binding regulator for MSMEG\_5008, MSMEG\_2619 efflux pump. Identification of this DNA-binding regulator is under progress.

**Project Title:** Novel therapeutic against metabolic syndrome via activation of coagulation unrelated vitamin K dependent proteins

**Project No:** GPP-331

**Funding Agency:** Department of Science and Technology (DST), Govt. of India

**PI & Members:** Dr Prasenjit Manna (PI)

**Objectives:**

- ❖ To examine the link between activated/ non-activated coagulation unrelated VKDPs and the determinants of metabolic syndrome among young adults.
- ❖ To examine the role of activated/ non-activated coagulation unrelated VKDPs against adipogenesis, insulin resistance, glucose intolerance, hyperlipidemia, and inflammation in cell culture and animal models of metabolic syndrome.
- ❖ To investigate the molecular mechanism underlying the beneficial role of activated/ non-activated coagulation unrelated VKDPs against metabolic syndrome using both cell culture and animal models.
- ❖ To identify the potential therapeutic(s) for the treatment of metabolic syndrome.

**Salient Achievements:**

- ❖ Newly sanctioned: Work in Progress

**Project Title:** Vitamin K as an adjuvant therapy for the prevention of insulin resistance and vascular inflammation in diabetes



**Project No:** GAP-372

**Funding Agency:** Department of Biotechnology (DBT), Govt. of India

**PI & Members:** Dr Prasenjit Manna (PI)

**Objectives:**

- ❖ Does vitamin K supplementation prevent hepatic insulin resistance and upregulate glucose homeostasis in diabetic animals?
- ❖ Does vitamin K have any effect on glucose metabolism in adipose tissue to upregulate glucose homeostasis in the body?
- ❖ Does vitamin K supplementation have any effect on the pro-inflammatory cytokines to reduce vascular inflammation and improve insulin sensitivity and glucose metabolism in diabetic animals?
- ❖ Do the vitamin K-dependent proteins mediate the effect of vitamin K on insulin sensitivity, glucose homeostasis, and vascular inflammation?

**Salient Achievements:**

- ❖ Our studies demonstrate that type 2 diabetic patients have lower plasma levels of vitamin K compared to age-matched control. Both animal and cell culture studies demonstrate that vitamin K supplementation reduces plasma glucose and the secretion of pro-inflammatory cytokines via regulating SIRT1/AMPK signaling pathways.
- ❖ Published nine articles as a corresponding author.
- ❖ Published five other articles related to the host institute's in house projects as a co-author.

**Project Title:** Role of SAM Pointed Domain Containing ETS Transcription Factor (SPDEF) in distinguishing indolent from aggressive prostate cancer and in the improvement of resistance to conventional therapy of prostate cancer

**Project No:** GAP-732

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**PI & Members:** Dr Mintu Pal (PI)

**Objectives:**

- ❖ To evaluate the feasibility of using SPDEF, transmembrane receptor, and its downstream signaling partner's expression and the mechanism to distinguishing indolent prostate cancer from aggressive prostate cancer.

**Salient Achievements:**

- ❖ Novel electrochemical biosensor development as an alternative diagnostic tool for the detection of cancer biomarkers, in particular prostate specific antigen (PSA), a valuable biomarker for early detection of prostate cancer.
- ❖ Prostate derived transcription factor has an important role in the regulation of

transmembrane protein, integrin  $\beta 3$  and adhesion-complex proteins leading to the suppression of metastasis in prostate cancer.

- ❖ FSPCre-Pparb/d-/- mouse model could serve as a novel tool in the current gunnery of animal models to better understand dermal fibrosis.

**Project Title:** Development of commercial bioformulation of Plant Growth Promoting Rhizobacteria (PGPR) using Coir pith as carrier

**Project No:** CLP-0286

**Funding Agency:** Central Coir Research Institute, Coir Board, Ministry of MSME, Govt. of India

**PI & Members:** Dr Jatin Kalita (PI), Dr HP Dekaboruah (Co-PI)

### Objectives:

- ❖ Compatibility studies of various PGPRs to Coir pith as substrate/carrier.
- ❖ Colony establishment of PGPRs in coir pith.
- ❖ Field application of PGPR formulation with coir pith in specific agricultural crops for determining its ability to enhance crop production.
- ❖ Influence of inorganic nutrients (MOP, Urea and Rock Phosphate) on PGPRs with coir pith as substrate.
- ❖ Developing a commercial PGPR formulation using Coir pith for commercialization.

### Salient Achievements:

- ❖ Compatibility studies of various PGPRs to Coir pith as substrate/carrier has been completed and found to be compatible to grow in coir pith medium.
- ❖ The microbial population have been significantly increased (increased CFU) up to day 90 in compost coir pith medium.
- ❖ Preparation of bioformulation of PGPR strains using decomposed coir pith as medium has been successfully completed.
- ❖ Nutritional analysis of compost is done for estimation of their macro and micro nutrient composition using standard methods.
- ❖ Field application of PGPR formulation with coir pith in specific agricultural crops for determining its ability to enhance crop production has been done in experimental field and farmers' field and observed the differences in height, number of leaves, early fruiting and total biomass after treatment.





## CHEMICAL SCIENCES & TECHNOLOGY DIVISION

**Chemical Science & Technology Division (CSTD)** is a multi-disciplinary division of CSIR-NEIST, Jorhat, which is dedicated for frontline research at the frontiers of modern chemical research with emphasis effective utilization of the vast resources of the North east India. The division has three groups (i) Analytical Chemistry Group (ii) Applied organic chemistry Group and (iii) Natural products Chemistry Group and all these groups has maintained the highest standards of excellence in research

**Applied Organic Chemistry Group (AOCG)** under Chemical Science & Technology Division (CSTD) is dedicated for frontline research in applied & application oriented basic organic chemistry. The group is actively engaged, for last several years in the area of bioactive molecules with main emphasis being laid on the development of process route for drugs/drug intermediates and synthesis of new molecular entities (NMEs) based on known drug molecules and on lead molecules from natural sources. A major thrust of the AOCG is directed in the development of process/heterogeneous recyclable catalyst for industrially important specialty chemicals. The group is also involved in the synthesis of stable metal nanoparticles on nanoporous biopolymers/cellulose templates and their application in organic synthesis.

The major emphasis of **Natural Products Chemistry Group (NPCG)**, since its inception, has been on chemical investigation of selected traditionally reputed medicinal plants of the northeastern region of India for drugs, pest management agents and nutraceuticals. This group has investigated a large number of plants and isolated a quite a good number of interesting molecules of different class having novel structures and published ~ 500 research papers in peer reviewed national and international journals. The group has filed a sizeable number of patents and developed several technologies and transferred to private industries, as well. The technology for Arteether, Artemether and Artesunate has been transferred to M/s FDC Ltd. Mumbai for commercial exploitation. In the recent past, this group played a key role in developing two herbal drugs: one for treatment of rheumatoid arthritis and one for fungal infection.

Presently Analytical Chemistry group is under Chemical Sciences and Technology Division (CSTD). Apart from analytical services provided to different in house as well as grants aided projects of the laboratory, it involves in the own generated R & D Projects. In the earlier stage, the group was involved in process development work on tea waste, essential oils, petrochemicals and pesticides etc. Presently, the main thrust areas of the group are focused on investigation of the different products with the help of different instrumental methods, chemical analysis including new research areas like development of nano-composites based electrochemical biosensors, Molecules to Materials to Devices (M2D) etc. This group, also, extends its support to different educational institutions, industries, NGO's and govt. & semi-govt. organizations of NE region.

### A) National Collaboration

#### (i) Inhouse, Grant in aid & Consultancy Projects

**Project Title:** Bio-derived molecules for the development of herbal formulations/ new chemical entities/biosensors and value addition by advanced synthetic methodologies

**Project No:** OLP-2002

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Manobjyoti Bordoloi (PI), Dr R Khan, Dr P J Saikia, Mr P P Khound, , Ms A Phukan, Mrs K Gogoi, Mr J M Boruah, Mr D Sarmah, Mr C K Pathak, Dr P J Bhuyan, Dr S Gogoi, Dr P Pahari , Dr R A Maurya, Dr A Roy, Dr H N Borah, Mr K C Lekhok, Mr R N Das, Mr G K Rastogi, Mr D Borah, Dr A M Das, Dr S Ghosh, Dr G Baishya, Dr P Borah, Mr J Bori, Mrs R Borah, Mr B C Borah, Mr R Saikia

### Objectives:

- ❖ Different plants parts of selected medicinal plants will be extracted and extracts will be bio evaluated against different diseases and pests and the active extracts will be chemically investigated to look for drug like molecules.
- ❖ New chemistry will be developed and applied in the synthesis of bioactive molecules, natural products and biopolymers
- ❖ Phytochemical analysis of economic plants materials will be taken up as service to farmers as and when required.
- ❖ Development of sensor for healthcare monitoring
- ❖ Development of technology(ies) and product(s) useful for the people Assam and India
- ❖ Maintenance of the state-of-the-art equipment facilities

### Salient Achievements:

- ❖ **Anti-Cancer Potential of Aroma Compounds of Plant Essential Oils:** Cancer is a grave health problem for the world as the global cancer burden rises to 14 million new cases with 8.2 million deaths every year which is expected to rise by 70% in the next 2 decades as reported by the WHO. These steady rises in death demand for rapid developments in anti-cancer agents. 125 volatile components of plant essential oils were screened through in silico and in vitro methods against A549 lung cancer cells and found that Methyl nonanoate, (R)-citronellol, cis-carveol (L-carveol), 3-methyl-Cyclohexanone, 4-carene and thujopsene have inhibited lung cancer cells through inhibition of the phosphatidylinositol-3-kinase pathway. Furthermore, immunoblotting assay confirmed the efficacy of the compounds for inhibiting mTOR and AKT enzymes which are bandmasters for downstream signaling of the PI3K pathway. Thus these volatile compounds have potential for PI3K targeted anti-cancer therapies

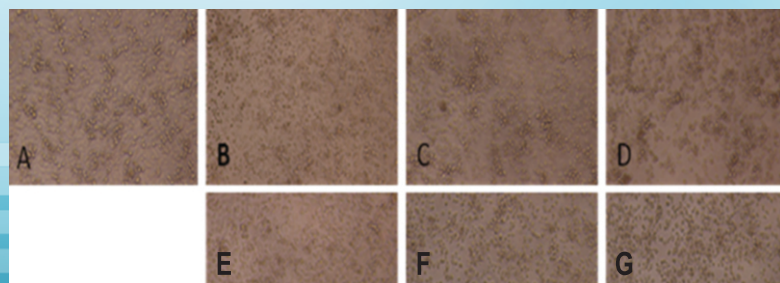
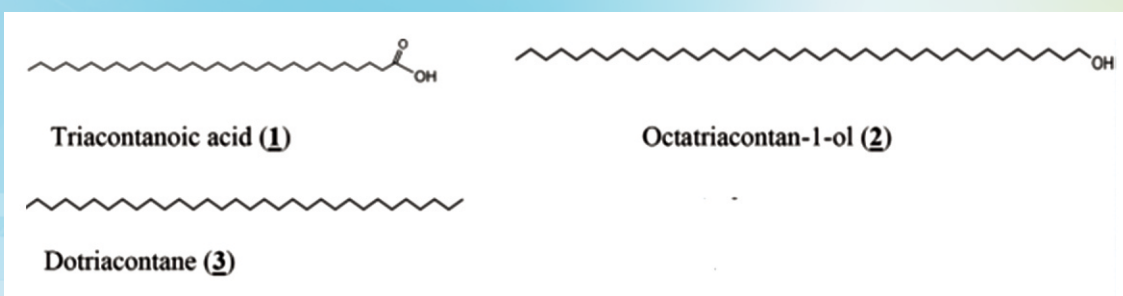


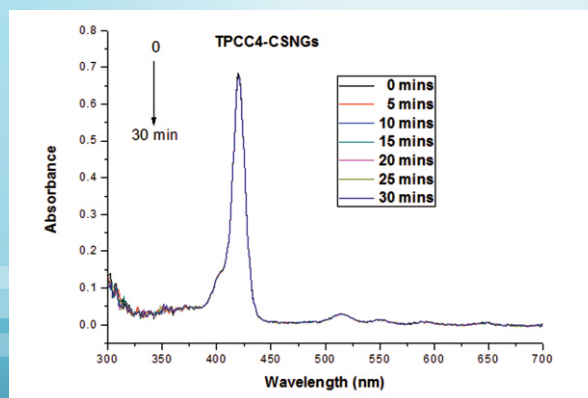
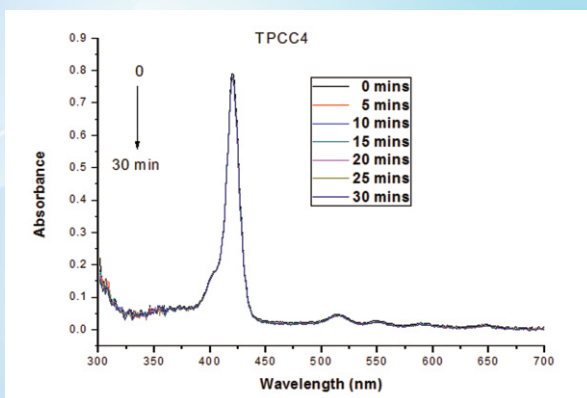
Fig: Micrograph of control and treated A549 Cell line after 24 h of incubation: (A) Control, (B) Methyl nonanoate 100 µg/ml treated, (C) (R)-citronellol , 100 µg/ml treated, (D) cis-carveol (L-carveol) 100 µg/ml treated, (E) 3-methyl-cyclohexanone, 50 µg/ml treated, (F) 4-carene 250 µg/ml treated, (G) thujopsene 50 µg/ml.



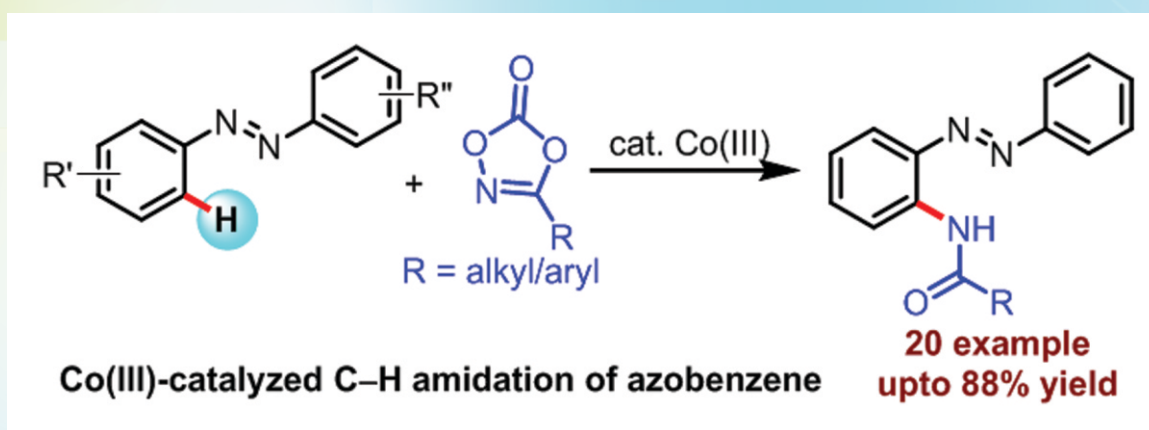
- ❖ **Very long chain alkane derivatives from *Cinnamomum obtusifolium*, *Elaeocarpus lanceifolius* and *Baccaurea sapida*:** In continuation of our search for bioactive secondary metabolites from the flora of the Indo-Burma biodiversity belt, we have isolated three new white powdered compounds were extracted from *Cinnamomum obtusifolium* (Roxb.) Nees (Lauraceae) and *Elaeocarpus lanceifolius* (Roxb.) (Elaeocarpaceae) characterized as Triacontanoic acid (1), octatriacontan-1-ol (2) and dotriacontane (3) from *C. obtusifolium* and *E. lanceifolius*. These natural compounds were found to have different mode of interactions through hydrogen bonds, hydrophobic interactions and C-H...X (X:  $\pi$  or O) bonding patterns with important proteins and enzymes of the two fungi indicating Complete inhibition of pathogenic fungi *A.tenuissima* and *A. alternata* were observed for compound 2 and 3. Further, insilico molecular binding analysis of these compounds towards endopolygalacturonase, b-isopropyl dehydrogenase, plasma membrane ATPase, calmodulin, ACR-toxin biosynthesis hydroxylase and synthetase peptide (transcription regulator of Amt-gene) of *A. tenuissima* and *A.alternata* revealed that they are effective in inhibiting multiple targets and indicated the possible use of them as potential antifungal agents.



- ❖ **Design of a photoresponsive chitosan nanogel to regulate CXCR4 signalling through slow release of SDF-1 $\alpha$  in the infarcted myocardium:** The studies have synthesized a photosensitizer decorated chitosan nanogel through ionic gelation technique and have investigated its photophysical and morphological properties under different conditions. The chlorin based sensitizer, tetra-phenyl-chlorin-tetra-carboxylate (TPCC4) was encapsulated onto the chitosan nanogel, which in turn was prepared through the self-assembly of low molecular weight chitosan (CS) in the presence of sodium tripolyphosphate (TPP) under aqueous conditions.

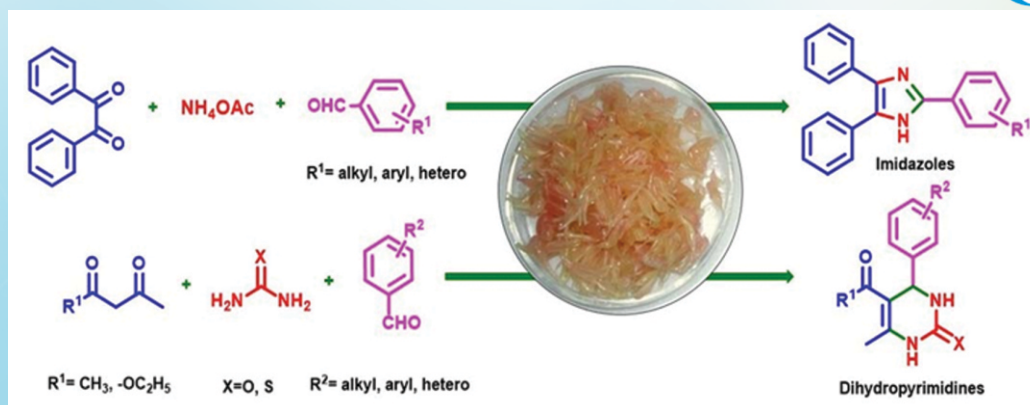


- ❖ Photostability experiment was made using a halogen lamp (Optel) with 630 nm long-pass filter, while the light was delivered to the sample through a fiber optic cable. Free TPCC4 and TPCC4-CSNGs were irradiated. Absorption spectra of photoirradiated free TPCC4 (10 µg in 1ml) and TPCC4-CSNGs (1 µg in 1ml) in DMSO/water with various time interval. The TPCC4-CSNGs have higher photostability when compared to free TPCC4. Our results demonstrate that enhanced the photophysical properties and bioefficacy of the photosensitizer thereby the potential of the nanogel as an effective vehicle for drug molecules in Photodynamic therapeutic (PDT) applications. Further work, the cell viability assay of these nanogels with various cell cultures experiments and SDF-1 encapsulation and release studies are under progress now.
- ❖ **Cp\*Co(III)-catalyzed ortho-amidation of azobenzenes with dioxazolones:** Over the past decades, the azobenzene derivatives have attracted a great deal of attention due to their extensive application in many fields such as photochemical switches, molecular machines, protein probes, organic dyes, nonlinear optical devices, chemosensors, polymers etc. As a consequent numerous efforts have been made for the efficient synthesis and functionalization of azobenzene. In this context, we have successfully disclosed an efficient Co(III)-catalyzed C–H amidation of azobenzenes with 1,4,2-dioxazol-5-ones. The reaction does not require any external oxidant and generates gaseous carbondioxide as only side product. More significantly, this reaction represents the first example of cobalt-catalyzed C–H amidation of azobenzenes.



- ❖ **Greener and Facile Synthesis of Imidazole and Dihydropyrimidine Derivatives under Solvent-Free Condition Using Nature-Derived Catalyst** Over the past few years, the up-gradation of resource and eco-friendly processes around new pathways in terms of sustainable chemistry has become a focal point in chemical research. Hence, now-a-days natural substances are increasingly used in organic syntheses for their safety aspects towards the environment. So, we have identified a natural substance, water extract of pomelo (WEP) which can promote the synthesis of imidazole and dihydropyrimidine derivatives and can be sustainable as it can be obtained from plant sources. These WEP promoted reactions are found to afford desired products and can be an alternative protocol for the existing procedures, which is immensely favorable to academic and industrial researches.





- ❖ **Antimalarial silver and gold nanoparticles: Green synthesis, characterization and in vitro study:** In spite of ample effort to extinguish, malaria is still a widespread disease in many tropical and subtropical countries. Moreover, there is an alarming increase of incidence of resistance of *Plasmodium falciparum* to quinines, artemisinins, and as of late to artemisinin based combination therapy (WHO 2015). These factors, stress the need of finding alternative antimalarials to tackle this disease. We have found that of silver (AgNPs) and gold (AuNPs) nanoparticles synthesized by leaf and bark extract of *Syzygium jambos* (L.) Alston (Myrtaceae) have excellent antimalarial potential against chloroquine sensitive (3D7) and resistant (Dd2) strain of *Plasmodium falciparum* by using 24 h schizont maturation assay and are found to be biocompatible

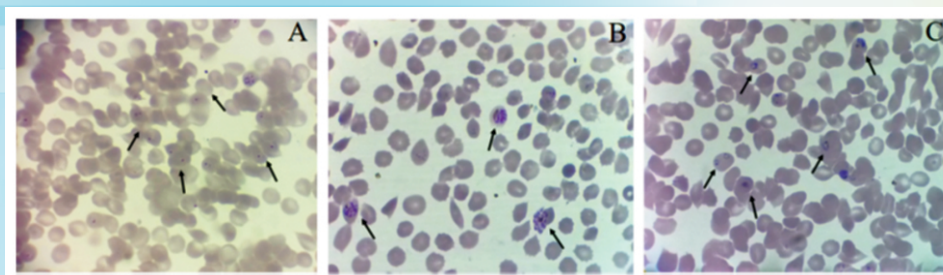


Fig. (A) D-sorbitol synchronized ring stage parasites (arrow) at 0 h; (B) No growth of inhibition of parasites with schizonts (arrow) in negative control (24 h); (C) Inhibition of growth, shrinkage, and pyknotic bodies (arrow) in the parasite morphology in treatment group (*S. jambos* bark silver nanoparticles, 15 mg mL<sup>-1</sup>) (24h)

**Project Title:** Bio-derived molecules for the development of herbal formulations/ new chemical entities/biosensors and value addition by advanced synthetic methodologies

**Project No:** OLP-2002

**Funding Agency:** CSIR, New Delhi

**PI & Members:** Dr Prakash Jyoti Saikia (PI)

**Objectives:**

- ❖ To synthesis and develop of polyester particles blended with biopolymers for application in the tissue engineering

**Salient Achievements:**

- ❖ Gelatin is a natural biopolymer derived from collagen by controlled hydrolysis and has been recognized as excellent biomaterial in tissue engineering. Gelatin is biocompatible, biodegradable and commercially available at relatively low cost. Synthesized polycaprolactone (PCL) particles blended with gelatin by modified emulsion and solvent evaporation method under the different reaction conditions. Modified the reaction parameters with the variation of weight ratio and reaction time and established the formation of PCL blended gelatin particles of different particle sizes. Characterized the prepared PCL blended gelatine particles using OM and SEM analysis. The preparation of effective polymer particles with definite size and shape, reaction conditions need to be optimized.

**Project Title:** Cobalt Pincer Complexes: Synthesis and its application in C-C bond forming reaction.

**Project No:** GAP-738 (DST)

**PI & Members:** Dr Pitambar Patel (PI)

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**Salient Achievements:**

- ❖ Over the past decades, the azobenzene derivatives have attracted a great deal of attention due to their extensive application in many fields such as photochemical switches, molecular machines, protein probes, organic dyes, nonlinear optical devices, chemosensors, polymers etc. As a consequent numerous efforts have been made for the efficient synthesis and functionalization of azobenzene. In this context, we have successfully developed an efficient C-H alkylation/annulations of azobenzenes with diazo compounds. The reaction does not require any external oxidant and generates gaseous nitrogen as only side product. Details mechanistic studies were carried out in order to understand the catalytic cycle of the reaction.

**Project Title:** Multidisciplinary research in medicinal and organic chemistry

**Project No:** GAP-744

**PI & Members:** Dr Ram Awatar Maurya (PI)

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

**Objectives:**

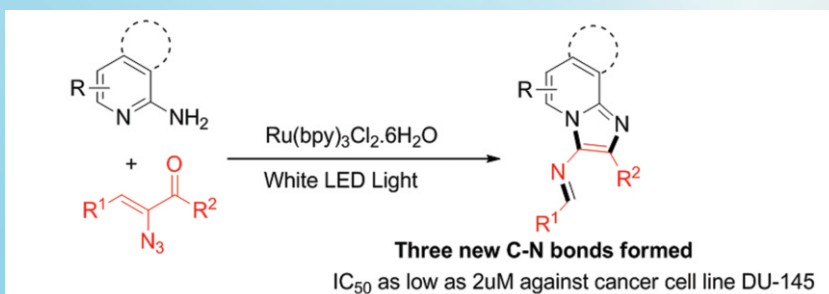
- ❖ Development of new synthetic methodologies for fine chemicals and pharmaceuticals
- ❖ Design, synthesis and biological evaluation of heterocyclic scaffolds

**Salient Achievements:**

- ❖  $\alpha$ -Keto vinyl azides and 2-aminopyridines were coupled to yield 1-aryl-N-(2-arylimidazo[1, 2-a]pyridin-3-yl)methanimines in the presence of visible light using  $\text{Ru}(\text{bpy})_3\text{Cl}_2 \cdot 6\text{H}_2\text{O}$  as a photocatalyst. This synthetic protocol allows the formation of 3 new C-N bonds in the overall transformation at ambient temperature. It is applicable to a wide range of vinyl azides and 2-



aminopyridines providing a straightforward access to a variety of highly functionalized imidazo[1, 2-a]pyridines in high yields. The synthesized imidazo[1, 2-a]pyridines were evaluated for their cytotoxic activity against a set of four selected human cancer cell lines i.e, A549 (lung cancer), DU-145 (prostate cancer), MCF-7 (breast cancer) and Hela (cervical cancer). Many compounds of the series (4e, 4g, 4i, 4j and 4u) exhibited promising cytotoxicity in these cancer cell lines. **ChemistrySelect** 2017, 2, 8158–8161.



**Project Title:** Development of Fluorescence Biosensor Based on Upconversion Carbon Nanoparticles

**Project No:** GAP-748

**PI & Members:** Dr Satyabrata Gogoi (PI), Dr R Khan

**Funding Agency:** Department of Science & Technology (DST), Govt. of India

#### Objectives:

- ❖ To prepare carbon quantum dot based upconversion nanomaterial/nanohybrid for fluorescence biosensor

#### Salient Achievements:

- ❖ A prompt and sensitive detection technique of cTnT in biological fluid using NIR active anti-cTnT labelled carbon dots (CDs) and molybdenum disulfide (MoS<sub>2</sub>). The method relies on NRET between CDs and MoS<sub>2</sub> with an observable turn OFF/ON type of response in presence cTnT.

