

FORMAT FOR SUBMISSION OF CONSOLIDATED REPORT
BY THE DBT BIOTECH HUBS IN NER (Since inception)

1. **Name & Address of the Institution:** Tezpur University, Napaam, Pin: 784028, Tezpur, Assam
2. **Name & Designation of the Coordinator:** Dr. Shashi Baruah, Professor
3. **Name & Designation of the Co-Coordinator:** Dr. S.K. Ray, Professor
4. **Telephone, Mobile, and Email of the Coordinator & Co-Coordinator:**

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5. **Level of the Biotech Hub:** Institutional
6. **Date & Year of the sanction of biotech hub with DBT's Sanction Order No:** 2011 (30/11/2011) vide sanction No. BT/22/NE/2011

A brief on your organization/institution along with the role played by the Biotech Hub for its development (not exceeding 20 lines):

Tezpur University was established on 21st January in 1994 by an Act of Parliament of India, the Tezpur University Act, 1993 (Act No. 45), as a non-affiliating and residential Central University. The academic programmes offered in the University have a distinct focus on science, technology and humanities, reflecting the objective of the University. The Department of Molecular Biology and Biotechnology (MBBT) was inaugurated on July 24, 1997. The Department offers two-year M.Sc. degree in Molecular Biology and Biotechnology, 5year Integrated M.Sc. in Bioscience and Bioinformatics and Ph.D. in Molecular Biology and Biotechnology. The objective of the Department is to contribute to the advancement of the emerging areas of basic and applied Life Sciences and to create trained manpower in the field of Molecular Biology and Biotechnology. Accordingly, establishment of Institutional Level Biotech Hub at the Department has contributed to creation of trained manpower by conducting trainings and workshops for students of the Department. In addition, enhancement of the infrastructure of the Department by Biotech Hub has contributed to the ongoing teaching and research programs. Institutional Biotech Hub fund was also used to activate Plant Tissue Culture Laboratory of the Department. A total of eleven M.Sc. students have completed their dissertation work with support from Institutional Biotech Hub. Training programs of the Biotech Hub have added another dimension to the activities of the Department by its training programs. Facilities created by Biotech Hub have also assisted research of other Departments of University by collaborative research. Biotech Hub facilitated support with technical expertise to DNA club, Star

Colleges and other Biotech Hubs of the region leading to awareness and applications of Biotechnology. Notably, Faculty, Clinicians, Technical Staff Research scholars and Students of other Colleges and Universities participated in the training programs and thus enhancing manpower training and growth of the region.

7. Details of Grant received so far:

(a) Total Grant received and utilized so far:

(Rs. In lakhs)

Year	1 st (11-12)	2 nd (12-3)	3 rd (13-14)	4 th (14-15)	5 th (15-16)	6 th (16-17)	7 th (17-18)	8 th (18-19) Till 31 st dec, 2019	Total (Till 31 st December, 2019)
Total Grant Received	15 lakhs	CF	5 lakhs	nil	nil	nil	10 lakhs	nil	30 lakhs
a. Non-Recurring	4 lakhs	CF	4.14 lakhs	4.43 lakhs	4.59 lakhs	5.30 lakhs	18.19 lakhs	nil	40.65 lakhs
b. Recurring									
Grant Utilized	nil	48181 lakh	10,50,657 lakhs	4,99,423 lakhs	nil	nil	nil	10,15,542.34 lakhs	30,47,441 lakhs
a. Non-Recurring	nil	26185 lakh	400150 lakhs	4,97,25 lakhs	4,97,661 lakhs	4,93,176 lakhs	7,41372 lakhs	7,84,500 lakhs	36,75,973 lakhs
b. Recurring									

(b) List of equipments' procured under the biotech hub since its inception

Sl. No.	Name of the equipment	Model No. & Brand Name	Cost in Indian Rupees	Date of Purchase	No. of researchers/ students utilized Equipments
1	Autoclave	LabTech; Model LAC 5050S	3,49,225.00	18-06-2012	Ph.D students – 70 M.Sc.- 168 Int. M.Sc.- 120
2.	LCD Projector	SHARP, Model VPL-EX 145	77,500.00	07-08-2012	Ph.D students – 70 M.Sc.-168 Int. M.Sc.-120
3.	PC for LCD	HP, Model:DX 2000 (2 Nos)	55,094.00	07-08-2012	M.Sc.- 168 Int. M.Sc.- 140

4.	SDS PAGE gel running and transfer apparatus	BioRad (1 nos)	1,93,171.00	07-02-2013	M.Sc.-168 Int. M.Sc.- 120
5.	Purification system for ultrapure water	Milli Q	3,60,494.00	10-05-2013	Ph.D students – 70 M.Sc.-168 Int. M.Sc.- 120
6.	Freeze Dryer	HAHNTECH; Model:LYOHAHN 112N-G	4,64,161.00	01-08-2013	Ph.D students – 100 M.Sc.-168 Int. M.Sc.- 60
7.	UPS (7 Nos), SMF battery (22 Nos.), solar system (4 Nos.)		4,99,423.00		The facility is used by the whole Department
	Real Time PCR	Thermofisher Scientific – Quantstudio -3	10,15,542.34 lakhs	25-04-18	The facility is available for the department with prior information
Total expenditure (2012-19):			30,47,441lakhs		

(c) recruitment Details in respect to DBT sanctioned position (since inception):

Sl. No.	Name	Designation	Specialization	Period of engagement
1.	Manash Deep Day	JRF	M.Sc. in Biotechnology	From 30/5/2012 to 30/6/2013
2.	Neelanjana Sarmah	SRF	M.Sc. in Biotechnology	30/12/2013 to present
3.	Dipankar Saikia	Field Assistant	M.Sc. Zoology	14/09/2016 to 14/12/2016
4.	Pawan Kumar	RA	MD	14/10/2017-
4.	Akash Protim Gogoi	SRF	M.Sc. in Biotechnology	23/04/18 to 30/09/18
5.	Dr. Johirul Islam	RA	PhD	05/07/18 to 05/04/19

8. **How the Biotech Hub has facilitated Human Resource development at the host institute:**

a. How the Biotech hub extended its support to execute different teaching labs (course name and number) of the UG/PG programs in Life Sciences and how many awarded degrees so far and their placement status.

- TU Institutional Biotech Hub has supported teaching program of the Department. Plant tissue culture laboratory was activated, and one hands on training on plant tissue culture was successfully conducted. Three students completed their M.Sc. dissertations using the plant tissue culture facility.
M.Sc students who did their dissertation with support of Biotech Hub either joined Ph.D program at different National Institutes like IIT, IGIB, DU , NERIST, TU or joined jobs in allied areas as teachers or research fellows.
Dr Anusree Mahanta, who was partially supported by Biotech Hub for her Ph.D program, is placed at InStem, NCBS Bangalore after completing PDF at Edinburgh.
- Four practical courses that is Plant Biotechnology (BI - 406) and Immunology (BT- 417, & BI-334) were conducted with chemicals and consumables procured through DBT Hub project.
- Biotech Hub also supported the up gradation of teaching program of the Department, which indirectly contributed to higher number of students qualifying NET, GATE, DBT, ICMR amongst others and students were placed in different reputed Institutes IISC, IGIB, NII, IITs and in some reputed companies
- M.Sc students who did their dissertation with support of Biotech Hub either joined Ph.D program at different National Institutes like IIT, IGIB, DU , NERIST, TU or joined jobs in allied areas as teachers or research fellows.
- Dr Anusree Mahanta, who was partially supported by Biotech Hub for her Ph.D program, is placed at InStem, NCBS Bangalore after completing PDF at Edinburgh.

b. Details of Ph.Ds. produced by using the facilities of biotech hub including the other departments of the parent institution.

- The following JRFs/SRFs on Biotech Hub are pursuing/ pursued PhD with the complete or partial support of Biotech Hub
- Ms Neelanjana Sarmah, SRF, pursuing Ph.D and is expected to submit her thesis soon
- Mr Manash Deep, JRF has successfully defended his thesis and has been awarded Doctoral degree.
- Dr Anusree Mahanta was partially supported by Biotech Hub and was awarded Ph.D in 2015
- Mr Akash P. Gogoi, partially supported by Biotech Hub is pursuing Ph.D
- Instruments procured from Biotech Hub like Freeze dryer, Autoclave and Water purification system are general and used by all the students and the PhD scholars of the Department.
- Ph.D scholars from the Departments of Food Engineering Technology, Environmental Sciences, Dept. of Chemical Sciences, Physics (Nanosciences) have utilized the facilities created under Biotech Hub for experimentation.

c. How many life science department's students and individual faculty members are getting involved in the biotech hub activities over a period of time both in terms of use of infrastructural facilities and output in terms of acknowledgment in research publications and technical reports. (Feedback of from the heads of science departments of parent institute to be enclosed)

Apart from the Dept. of MBBT, students of departments of Food Engineering and Technology, Physics, Environmental Sciences, Energy and Chemical Sciences are using the Biotech Hub facilities which are placed in Central Instrumentation facility of the Department. (Feedbacks will be submitted during Review Meeting).

d. How the Biotech Hub facilities have been integrated with similar in-house facility for larger utilization

The instruments and equipment procured under Biotech Hub facility are placed in the Central Instrumentation Facility of the Department and in Teaching Laboratory for integration with the activities of the Department.

These Central facilities at the Department are accessed by students and faculty of other teaching Departments as well, and thus giving access to larger number of students and faculty of the University.

❖ **Trainings and workshops:**

- Seven hands on trainings were successfully conducted in different fields of Biotechnology. A total of 132 participants comprising of UG, PG, PhD scholars, Clinicians Technical staff and Faculty members were trained and exposed to various techniques related to gene cloning, animal and plant cell culture, gene expression studies, microbiology, food technology and immunotechniques. The workshops also included theoretical lectures by faculty of the Dept. of Molecular Biology and Biotechnology, Food Technology and Environmental Sciences which helped to enhance knowledge of participants.
- Outreach trainings were also conducted for various Schools and Colleges of neighboring areas to expose the students to advanced facilities and instrumentation. Workshops were found to be successful as per feedback received from the participants.
- TU Biotech Hub also supported summer and winter training programs for undergraduate students and post graduate students in the Department by providing infrastructure, facility and expertise.
- Int. M.Sc. students of the Department were trained in Immunotechniques using chemicals and consumables obtained from DBT Hub fund and the SRF employed in the project was involved in the training program.

❖ **Teaching activity:**

- TU Institutional Biotech Hub had also supported teaching program of the Department. Plant tissue culture laboratory was activated with support of minor instruments and consumables. One

their M.Sc. dissertations using the plant tissue culture facility and is currently being used by faculty Dr Jyoti Saikia among others for practical courses and M.Sc Dissertation studies.

- Four practical courses i.e. Plant Biotechnology (BI - 406) and Immunology (BT- 417, BT- 421 & BI-334) were conducted with chemicals and consumables procured through DBT Hub project.
- PCs and projector obtained from DBT Hub fund is used by UG, PG and PhD students during classes and for progress presentations and seminars.
- Laboratory facilities together with conduct of Seminars and Training programs under the Biotech Hub actively supported the teaching program and research activities of the department. which contributed to increased number of students qualifying NET, GATE, DBT, ICMR etc.
- Faculty members of the Department also visited other Biotech Hubs of nearby Colleges for teaching.

❖ **Research activity:**

- Research activity and infrastructure of the Department has improved with Biotech Hub support. As mentioned in point No. 12, **seven** papers were already published and **seven** papers were presented in national seminars, besides M.Sc dissertations and Ph.D thesis.
- Instruments like autoclave, freeze dryer, water purification system and SDS PAGE gel running apparatus procured through Hub are being used by all the students of the Department for their research work. A total of eleven M.Sc. final year dissertations were completed with the help the chemicals and consumables procured through DBT Hub project.
- One PhD student is pursuing her PhD with the support of Institutional Biotech Hub. One student defended her PhD with partial support from DBT Hub.
- Eleven M.Sc. students completed their final year dissertations using chemicals/consumables procured through DBT Hub fund.
- DBT Hub also helped in research activity of other Departments by providing infrastructure and facilities.

9. Impact made by Institutional Level Biotech Hub at your organisation:

1. The mandate of the University is to contribute to the advancement of emerging areas of Basic and Applied Sciences through teaching and research. Biotech Hub has added another dimension to the activities by its training and outreach programs in Life Sciences.
2. Biotech Hub organized several hands-on training and one seminar for undergraduate, post graduate and PhD students of TU, other Institutes and nearby Colleges of the region and thus contributed to growth of Biotechnology in the region.

3. Hub is contributing to Manpower development by supporting an ongoing PhD thesis. Data obtained from the Research work i.e. HPV status of the patients obtained from the Research work was shared with the Clinical Collaborators, which resulted in appropriate treatment of the patients

4. Hub has extended its support to teaching activity of the Department of Molecular Biology and Biotechnology and has supported eleven M.Sc. Dissertations. In addition, Hub also provided consumable and infrastructure support to Immunology practical course of the Department.

5. Seven publications, two in high impact factor journals (Frontiers in Immunology and Frontiers in Oncology) and seven papers presented in different National and International conferences have been published with the Consumable and Financial support obtained from the Biotech Hub, TU.

6. Tezpur University Biotech Hub has also been reaching out to school students and students of Neighboring Colleges and has initiated mentoring of Kendriya Vidyalaya, TU, and thus supporting the objective to enhance Biotechnology awareness.

6. Facilities created by Biotech Hub have also assisted research of other Departments of University by collaborative research.

e. Details of any periodic orientation programs on the hands-on equipment and methodology to the students (for UG/PG and newly admitted PhD students) are being offered by the Hub.

A demonstration and theoretical lecture for FLOW CYTOMETRY was arranged for PhD students, M.SC as well as Integrated M.Sc students where students were exposed to the technical applications of the instrument. Flow cytometry expert also delivered a theoretical lecture which helped students to clear their doubts.

f. Any networking with BLiSS Schools, STAR colleges or any other DBT funded programs in NER

TU IBT Hub has been actively supporting Biotech Hub, Darrang College by helping with teaching and practical classes as well as technical expertise. A seminar on *Careers in Science and Biotechnology* and an outreach program on oral health was conducted where students of Darrang College also participated. Faculty members of the Department of MBBT visited Darrang College

Hub, ADP College, Biotech Hub, B. Baruah. College, Biotech Hub, Kaliabor College and Biotech Hub, Bodoland University for teaching and theoretical lectures. Students of the neighboring Colleges including Darrang College and Kaliabor College were exposed to advanced facilities and instrumentation. Also, one workshop on *Microbiology* was arranged for the B.Sc students of Darrang College.

TU, Biotech Hub is also mentoring Kendriya Vidyalaya Tezpur University by providing teaching, technical and practical support in the form of out reach program.

10. How Biotech Hub has facilitated R&D activities in the Institute, please provide the following details:

The broad area of research of IBT Hub is disease biology and the specific areas are given below in brief

(a) Specific Research areas of working:

A. Study of malarial pathology:

Comparative study of cytokine regulation in severe falciparum malaria in comparison with disease resolution were determined to identify the key dysregulated pathways /transcription . We observed a negative correlation of IL-10 expression with parasitemia and proinflammatory cytokines, suggesting IL-10 to be the key cytokine in tilting the balance to an inflammatory response. Longitudinal analysis revealed that the key cytokines associated with disease were TNF-a, IL-1b, IFN-g, IL-12a, RANTES and TGF-b, while TNF-a, IL-10 and TGF-b discriminated between SM and UM. A higher neutrophil count in SM and its positive association with parasite density, IL-1b and IL-8 provided support for neutrophils in inflammation in malaria (**published in Innate Immunity**) Type 1 Interferon pathway together with T-Bet/GATA-3 levels differed between severe and uncomplicated malaria (**published in CTI**).

(No. of publications – 03, one in *Innate Immunity*, one in *Clinical and Translational Immunology* and one in *Frontiers in Immunology*)

B. Effect of silver nano particles on germination of *Vigna radiata* seeds and fruit extract of *Dillena indica* and *Vigna mungo*:

Vigna radiata is an agro economically important plant of the India. *Vigna radiata* germination experiment has initiated in Plant Tissue Culture Laboratory with the support of Biotech Hub and proposed study is to screen the effect of silver nanoparticle on its germination. Colloidal nanoparticles were synthesized using fruit extract of *Vigna mungo* and *Dillena indica* and their

exudates of *Oryza sativa*, *Vigna mungo* and *Vigna radiata* (No. of publication -01, *Indian Journal of Biology*).

C. Assessment of plant derived anti-inflammatory compounds:

Main objective of this study is to find anti-inflammatory compounds of natural sources with negligible side-effects and their mechanism of action. Mouse macrophage cell line RAW 264.7 have been used as model to induce LPS-mediated inflammation. Inflammation was induced in these cells by treatment with bacterial lipopolysaccharide to induce key inflammatory marker genes tumor necrosis factor alpha (TNF- α), cyclooxygenase -2 (COX-2) and macrophage chemoattractant protein -1 (MCP-1). Treatment of cells with various concentrations of chrysin for 3 hours prior to LPS induction showed significant reduction of TNF- α (up to 90% of induced expression), COX-2 (up to 75% of induced expression) and MCP-1 (up to 70% of induced expression). These results confirm that chrysin, a flavonoid found in most common vegetables and fruits, possesses anti-inflammatory properties and can be used as a preventive anti-inflammatory compound.

D. Toll like receptor (TLR 7) polymorphism, expression and regulation in HNSCC:

The association of TLR7(rs179008) SNP with HNSCC in the population of Assam was determined using PCR-CTPP approach. The study revealed high frequency of T allele. C allele seemed to be protective against the disease. Analysis of expression of TLR7 and downstream signalling molecules, TRAF3, IFN- α and IFN- β showed high expression of IFN- α and IFN- β and were weakly correlated with levels of TRAF-3 (M.Sc. Thesis, Integrated M. Sc. In Biosciences and Bioinformatics).

E. Study of CTL4 gene expression and regulation in SLE:

CTLA-4 + 49 A/G polymorphism (SNPrs231775) is a potential genetic factor for lupus susceptibility. The study was undertaken to analyze the frequency of SNPrs231775 and the expression levels along with foxp3 and IL 10 in the SLE patients of Assam. It was observed that both the alleles (A to G) has frequency almost equal to 50% and most of CTLA-4. Fox p3 and IL 10 were found to be downregulated (M.Sc. Thesis, Integrated M. Sc. In Biosciences and Bioinformatics).

F. Understanding of immune suppression in HNSCC and association of HPV with the disease:

This work was initiated to understand immunosuppression in tumor microenvironment, particularly in reference to HPV and to tumor associated macrophages and natural killer (NK) cells. Tumor cells modulate the microenvironment by down regulating immune cell cytokine

HNSCC. The study showed that expression of TNF α , TGF β and IL-10 were down regulated indicating immune suppression. Association of HPV subtypes (HPV 16 and 18) were studied in patient samples using PCR-SSP approach. The amplicons of HPV 16 and 18 typing were validated by sequencing to confirm the specificity of band amplification. Sequencing results showed 99% similarity. HPV protein expression was also determined and HPV presence was confirmed using ELISA and IHC. Since HPV tumors are reported to be radiosensitive, the work has direct relevance to disease management and patient care (**No. of Publication -01, *Frontiers in Oncology*, No. of Conference presentation-02, work has clinical applications as HPV status is shared with Clinician for appropriate treatment**)

G. IL1R1 receptor polymorphism, signaling and expression in Head & Neck Squamous Cell Carcinoma (HNSCC):

The study suggested that rs3917328 of IL1RI was associated with HNSCC. Genotyping of the population for IL1RI SNP was performed where CC genotype was seen at higher frequency in control while in cancer CT was seen to be positively associated with HNSCC. In the expression study of the downstream signaling molecules of IL1RI pathway TRAF6 and NF-kB was seen to have upregulation in their expression level by 2 folds and MyD88 showed a 6-fold upregulation. MAPK14 showed a very high expression level with a 16-fold change. The upregulation of MAPK14 might be due to other factors as well because MAPK14 is involved in several other pathways. This might also be the effect of the decoy receptor IL1RII. The observations suggested that IL1B might be signaling through the TRAF6 pathway as upregulation in IL1B, TRAF6, MyD88 and NF-kB was observed (**M.Sc. Thesis, M. Sc. In Molecular Biology and Biotechnology**).

H. Effect of plant derived polyphenols on type 2 diabetes:

Obesity-associated chronic low-grade inflammation in adipose tissue is a focal point in the pathogenesis of insulin resistance and type 2 diabetes. Subsequent studies demonstrated that prevention of macrophage M1 polarization state improved insulin sensitivity providing a potential link between inflammation and insulin resistance. From the study it was found that a plant derived polyphenol, Ferulic acid (FRL), effectively suppressed the palmitate induced macrophage M1 polarization in RAW264.7 macrophages.

I. Activation of Neutrophils in Systemic Lupus Erythematosus (SLE) Patients in Assam:

Neutrophils extracellular traps (NETs) contain chromatin decorated with granule enzymes that can

of autoantibodies. In this study, neutrophils were isolated from SLE patients and Control participants & their activation status studied by determining ROS and cytokine secretion and release of NETs. Evidence of Neutrophil activation with increased NETosis and IFN were found in patients of SLE. The study supports a pathogenic role for neutrophils in SLE and hence need to be targeted for immune therapy (**M.Sc. Thesis, Integrated M. Sc. In Biosciences and Bioinformatics**).

J. Expression and regulation of HLA-G in HNSCC:

PCR reaction was standardized for exon 2, exon 3 and exon 4 to amplify the exonic regions of HLA-G gene using cDNA as the template. After optimization of PCR conditions, expression study of HLA-G isoforms was carried out in 80 HNSCC tissue samples and their adjacent normal tissues. Soluble isoforms of HLA-G (G5, G6, and G7) were predominant as compared to membrane-bound isoforms (G1, G2, G3, and G4). HLA-G7 was found to be the most frequent isoform with the frequency of 36.25% and HLA-G1, the full-length membrane-bound form of HLA-G was the least abundant isoform (2.5%). HLA-G was found to be upregulated in tumor tissue. However, mean relative expression of HLA-G gene was higher in HPV positive tumors (Student's t-test $p = 0.002$) compared to HPV negative tumors. Soluble isoforms (87.5%) were seen more frequently in HPV positive tumors than membrane-bound isoforms (12.5%) with HLA-G7 (81.25%). HPV and HLA-G have been reported to modulate immune responses by altering cytokine profiles and manipulating the signaling pathways in cancer. We were interested to see how the interaction between HPV and HLA-G changes the expression pattern of the immunoregulatory genes. We compared the expression profiles of regulatory molecules (IL-10, PD1, TGF- β , IFN- γ , SOCS1, and SOCS3) with HPV and HLA-G7 status as HLA-G7 was the most frequent isoform found in HPV positive tumors. Our data revealed that when HPV was present with HLA-G7, all the immune regulatory molecules (IL-10, PD1, TGF- β , SOCS1, and SOCS3) were downregulated whereas, inflammatory IFN- γ was overexpressed. In contrast, HPV without HLA-G7 was contributed to downregulation of IFN- γ . When HLA-G7 expression was seen with HPV negativity, increased expression of all the molecules was observed in the tumor. This data suggested that HPV was involved in downregulation of immune checkpoint molecules while the presence of HLA-G7 leads to increased expression of IFN- γ (**No. of Publication -01, *Frontiers in Oncology*, No. of Conference presentation- 01**)

S. No.	Title of the project	Name of the PI/Co-PIs	Funding agency	Sanctioned budget	Project duration (Dates)	
					From	to
1.	Diagnosis and Immunopathogenesis of Dengue Virus Infections; a longitudinal investigation into genotype diversity, diagnosis and immune response to dengue infections in Assam, Northeast India	Dr. S. Baruah	DRDO	61,59,727 lakhs	2017	2020
2.	Polymorphism of Toll like and Nod like receptors and their role in inflammasome activation in Head and Neck Squamous Cell Carcinoma	Dr. S. Baruah	ICMR	49,81,130 lakhs	2016	2019
3.	Systemic Lupus Erythematosus (SLE) - An investigation into diagnostics and disease pathogenesis	Dr. S. Baruah	DBT	206.84 lakhs	2015-	2017
4.	Longitudinal analysis of changes in cytokine profile of malarial patients at different stages of treatment and disease resolution: Understanding molecular basis of cure and malarial pathology	Dr. S. Baruah	DBT	67.06 Lakhs	2011	2014
5.	KIR haplotypic variation and activation of Natural Killer cells in cancer	Dr. S. Baruah	ICMR	27.3 lakhs	2010	2013
6.	Understanding the molecular interaction between NK receptor diversity and activation with diverse malignancy in HNSCC prevalent in the population of Assam	Dr. S. Baruah	DBT	49.59 Lakhs	2011	2014
7.	Protein Folding Kinetics is a Selection Force on Shaping Codon Usage Bias in the High Expression Genes	Dr. S. K. Ray	DBT	24.72 lakhs	2014	2016
8.	Sequencing genomes of some bacteria that invade/resides in tomato plant	Dr. S. K. Ray	DBT	127.63 lakhs	2013	2016

	alternative sigma factor, in the pathogenicity of R. solanacearum, the causal agent of bacterial wilt in plants	Ray				
10..	Characterization of a potential auto transporter adhesion function in Ralstonia solanacearum, the causal agent of bacterial wilt in plants	Dr. S. K. Ray	DBT	35.66 lakhs	2012	2015
11.	Understanding causes of codon usage bias in organisms	Dr. S. K. Ray	DBT	15.50 lakhs	2012	2014

Publications

1. **Sarmah, N.**, Baruah, M.N., **Baruah, S.**, Immune modulation in HLA-G expressing Head and Neck Squamous Cell Carcinoma in relation to Human Papilloma Virus positivity: a study from North-East India. *Frontiers in Oncology, Section- Head & Neck Cancer*, doi: 10.3389/fonc.2019.00058, 2019, (Impact factor- 4.4)
2. Mahanta, A., Ganguli, P., Barah, P., Sarkar, R.R., **Sarmah, N.**, Phukan, S., Bora., M., Baruah, S., Integrative Approaches to Understand the Mastery in Manipulation of Host Cytokine Networks by Protozoan Parasites with Emphasis on Plasmodium and Leishmania Species. *Frontiers in Immunology*, 9:296. doi: 10.3389/fimmu.2018.00296 9, 2018. (Impact factor- 5.5).
3. Mahanta, A., **Baruah, S.**, Lower expression of GATA3 and T-bet correlates with downregulated IL-10 in severe falciparum malaria. *Clinical and Translational Immunology*, doi: 10.1038/cti.2015.30, 4(11), e49, 2015
4. Dutta, A., Banerjee, A, Saikia, N, Phookan, J, Narayan, M, **Baruah, S.**, Negative regulation of natural killer cell in tumor tissue and peripheral blood of oral squamous cell carcinoma, *Cytokine*, 76(2), 123-130, 2015 (Impact factor- 3.5).
5. Mahanta, A, Kar, S. K; Kakati, S; **Baruah, S.**, Heightened inflammation in severe malaria is associated with decreased IL-10 expression levels and neutrophils, *Innate Immunity* 21(5),546-552,2015. (Impact factor- 2.3).
6. Mahanta, A, Kakati, S, **Baruah, S.**, The association of IL8-251 T/A polymorphism with complicated malaria in Karbi Anglong district of Assam, *Cytokine*, 65:210-216, 2015 (Impact factor – 3.5).
7. Dutta, A, Saikia, N, Phookan, J, Baruah, M. N, **Baruah, S.**, Association of Killer cell immunoglobulin-like receptor gene 2DL1 and its HLA-C2 ligand with family history of cancer in oral squamous cell Carcinoma, *Immunogenetics*, 66(7-8), 439-448, 2015 (Impact factor – 2.0).

- populations of Assam state, Northeast India, 2013, Tissue Antigens, Volume 82, Issue 1, pages 48–52, July 2013 (Impact factor – 2.5).
9. Mahanta, A, Kakati, S, **Baruah, S**, The association of IL8-251 T/A polymorphism with complicated malaria in Karbi Anglong district of Assam, 2013, Cytokine, 65(2):210-6. 10.1016/j.cyto.2013.11.001 (Impact factor-3.5).
 10. Lourembam, S. D., Sawian, C. E., **Baruah, S.**, Dysregulation of cytokines expression in complicated falciparum malaria with increased TGF-beta and IFN-gamma and decreased IL-2 and IL-12, 2013 Cytokine, 2013, 64(2):503-8: (Impact factor -3.5).
 11. Sawian, C.E., Lourembam, S.D., Banerjee, A., **Baruah, S.**, Polymorphisms and expression of TLR4 and 9 with malaria in two ethnic groups of Assam, Northeast India, Innate Immunity, 19 (2), 174-183, 2012. (Impact factor – 2.3)
 12. Satapathy S. S, **Ray S. K**, Sahoo A. K, Begum T, Ghosh T. C, Codon usage bias is not significantly different between the high and the low expression genes in human. Int J Mol Genet Gene Ther 1. Doi <http://dx.doi.org/10.16966/ijmgt.103>, 2015
 13. Baruah V.J, Satapathy S.S, Powdel B.R, Konwarh R, Buragohain A.K, **Ray S.K.** Comparative analysis of codon usage bias in Crenarchaea and Euryarchaea genome reveals differential preference of synonymous codons to encode highly expressed ribosomal and RNA polymerase proteins. J. Genet., 2015
 14. **Ray S.K.**, Kumar R, Peeters N, Boucher C, Genin S., rpoN1, but not rpoN2, is required for twitching motility, natural competence, growth on nitrate and virulence of *Ralstonia solanacearum*. Front. Microbiol, 6, 229, 2015.
 15. Satapathy, S.S., **Ray S.K.**, Missed cites. Curr Sci, 107, 1633-1634.
 16. **Ray S.K.**, V.J. Baruah, S.S. Satapathy and R. Banerjee, Co-translational protein folding is revealing the selective use of synonymous codons along the coding sequence of a low expression gene. J. Genet. 93, 613–617, 2014.
 17. Satapathy, S.S., Powdel, B.R., Dutta, M., Buragohain, A.K. and **Ray S.K.**, Constraint on dinucleotides by codon usage bias in bacterial genomes. Gene, 536, 18, 2014.
 18. Satapathy, S.S., Powdel, B.R., Dutta, M., Buragohain, A.K. and **Ray S.K.**, Selection on GGU and CGU codons in the high expression genes in bacteria. J Mol Evol. 78, 13, 2014.
 19. Kumar R, Barman A, Jha G, **Ray S.K.** Identification and establishment of genomic identity of *Ralstonia solanacearum* isolated from a wilted chilli plant at Tezpur, North East India. Current Sci. 105, 1571-1578, 2013.
 20. Barman A, Kumar P, Kumar V, Doley R, and **Ray S.K.**, Heat shock at 37 °C with plasmid ligated at 37°C yields more number of Escherichia coli transformants than plasmid ligated at 16

2013.

21. Pandey A, **Ray S.K.**, Sonti R, Rajeshwari R. gltB/D mutants of *Xanthomonas oryzae pv. oryzae* are virulence deficient. *Curr Microbiol.* September, 2013.

22. Khanppnavar B, **Baruah S**, and **Ray S.K.**, TALE: an emerging tool for genome editing and genetic engineering. *Current Sci.* 104:576-578, 2013.

(c) Measurable achievements in terms of publication/ patents/ technology transfer etc. under the R & D work undertaken, since inception:

(i) Details of papers published (directly from the Hub) in peer reviewed journals, citing bibliographic references. Give only papers emerged out of biotech hub support with acknowledgement of biotech hub/DBT

S.No	Title	Authors	Journal	Impact Factor
1	Heightened inflammation in severe malaria is associated with decreased IL-10 expression levels and neutrophils.	Mahanta, A., Kar, S.K., Kakati, S. & Baruah, S.	Innate immunity	2.459
2	Lower expression of T-bet and GATA3 explains down regulated levels of IL-10 in severe falciparum malaria.	Mahanta, A. & Baruah, S.	Clinical and Translational Immunology	7.27
3	Synthesis of Colloidal Silver Nanoparticle (SNP) Using Vigna Radiata Seed Exudate: A Novel Green Method	Saikia, J.P.	Indian Journal of Biology	
4	<i>Vigna mungo</i> seed non-destructive based colloidal silver nanoparticle synthesis and toxicity	Saikia, J.P.	Indian Journal of Biology	
5	Antibacterial and toxicity of <i>Dillenia indica</i> L. based green colloidal silver nanoparticle (CSNP)	Saikia, J.P.	Indian Journal of Biology	
6	Integrative Approaches to Understand the Mastery in Manipulation of Host Cytokine Networks by Protozoan Parasites with Emphasis on Plasmodium and Leishmania Species	Mahanta, A, Ganguly, P, Sarkar, R, Borah, P, Sarmah, N, Phukan, S, Bora, M, Baruah, S	Frontiers in Immunology	5.5

expressing Head and Neck Squamous Cell Carcinoma in relation to Human Papilloma Virus positivity: a study from North-East India.	Baruah, S.	Oncology, Section- Head & Neck Cancer,
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Papers presented in National/International seminars

1. **Understanding inflammation in severe malaria pathogenesis, Baruah, S**
presented at 83rd annual meeting of Society of Biological Chemists (SBCI), December 18-21, 2014, at KIIT University, Bhubaneswar.
2. **Subversion of anti-inflammatory response in severe falciparum malaria, Mahanta, A and Baruah, S**
presented at International Conference on Disease Biology and Therapeutics- December 3rd 2014 at IASST, Guwahati.
3. **Severe malaria malady: a SNP to the rescue? Mahanta, A and Baruah, S**
presented at National Seminar On “Recent Advances in Biotechnological Research in North East India: Challenges and Prospects” held at Department of Molecular Biology and Biotechnology, Tezpur University, November 27-29, 2014.
4. **Cytokine and Chemokine profile differs with Human Papilloma Virus (HPV) positivity in Head & Neck Squamous Cell carcinoma, Sarmah, N, Baruah, S and Baruah, M.N**
presented at Immunocon, 2017, 44th Annual Meeting of Indian Immunology Society, held at Nirma University, Ahmedabad, India
5. **Understanding intense Inflammation in *P.falciparum* Malaria, Baruah, S**, presented at Immunocon, 2017, 44th Annual Meeting of Indian Immunology Society, held at Nirma University, Ahmedabad, India
6. **HLA-G expression and regulation in Head & Neck Squamous Cell carcinoma: a study from Northeast India, Sarmah, N, Bora, M, Longkumer, I, Baruah, S and Baruah, M**
presented at Immunocon, 2018, 45th Annual Meeting of Indian Immunology Society, held at THSTI, Faridabad, India
7. **Immunoregulation in Head and Neck Squamous Cell carcinoma with respect to HPV positivity: a study from northeast India, Sarmah, N, Longkumer, I, Baruah, M.N, Baruah, S**
Presented at Asian Advanced Course in Basic and Clinical Immunology by Federation of Clinical Immunology Societies (FOCIS) held at Jaipur, India

(ii) **Research leads generated along with their translational aspects, if any:**

Not applicable

(iii) **Whether any patent application filed/grant by the biotech hub. Pl. provide details**

The process of filling for a patent in the area of immunodiagnostics has been initialized

(iv) **Technologies developed/transferred/commercialized, if any:**

Not applicable

Biotech Hubs, if yes details be provided?

11. Contribution of Biotech Hubs in terms of Capacity Building at the Host/neighboring NER institutions:

(a) Hands on trainings/workshops conducted for host / neighboring schools or institutions:

Sl. No.	Dept./Institution collaborated	Nature of collaboration	Duration
1.	Gauhati Medical College & Hospital (GMCH)	Clinical research	7 years (ongoing)
2.	North-East Cancer Hospital & Research Institute	Clinical research	8 years (ongoing)
3.	Tezpur Medical College & Hospital (TMCH)	Clinical Research	2 year (ongoing)
5.	Dept. of Food Engineering & Technology	Teaching and Research	1 year (ongoing)

Serial No.	Topic	Duration and Date	No. of Participants	Level of Participants	Target participants
01	Basic Genetic Engineering Techniques for Gene Cloning	December 17-21, 2012 (For 5 days)	21	Faculty members, Research Scholars and Clinicians	From different Colleges, R&D Institutes, Universities, Medical Colleges
02	Plant Cell Culture Techniques	March 28-31, 2014 (For 4 days)	25	UG & PG students of the Department	Dept. of MBBT, TU
03	Animal Cell Culture Techniques	March 28-31, 2014 (For 4 days)	20	UG & PG students of the Department	Dept. of MMBT, TU
04	Real time PCR based Gene Expression Studies	March 27-28, 2015 (For 2 days)	06	Teachers & Technicians	Faculty of neighboring Colleges and Downtown University and Technical staff from Defence research Laboratory
05	Immunotechniques	November 3-6, 2015 (For 4 days)	10	UG & PG students of different Institutes	Different Universities and TU
06	Basic Techniques in Microbiology	November 11-16, 2016 (For 6 days)	09	UG students of TU and other Institutes	TU and other Institutes

07	Finishing school on Trends in Food and Biotechnology: Analytical Approach	March 19th - 24 th , 2018	41	M.Sc and M. Tech students	TU and other Institutes
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(b) Seminars/symposium/awareness/outreach programs conducted for host / neighboring schools or institutions:

Serial No.	Topic	Duration and Date	No. of participants	Level of participants
1.	Assessment of quality of instruments	One day (17-07-2012)	20	UG, Darrang College
2.	Lecture on working of instruments	One day, (17-07-2012)	20	UG, Darrang College
3.	Recombinant DNA technology	One day	25	PG, Bodoland University
4.	Introduction to genetic engineering	One day	25	UG, N. L. College
5.	Isolation of bacterial plasmid	One day, 13 th may 2014	15	UG, Darrang College
6.	Demonstration of casting of agarose gel and DNA extraction from gel.	One day, 13 th May, 2014	18	B.Sc. Zoology D.K. College, Mirza
7.	Demonstration of DNA isolation and isolation of genomic DNA followed by casting of agarose gel	One day, 23 rd December, 2014	30	B.Sc. Zoology J.N. College, Boko
8.	Demonstration and hands on training on Dot-blot immunoassay	One day, 27 th March, 2015	43	B.Sc. Biotechnology University of Sc. & Tech. Meghalaya
9.	Molecular Microbiology	One day, 25 th march, 2017	45	UG, PG and PhD scholars of the Department
10.	Careers in Science and Biotechnology	27 th March, 2018	110	UG, PG and PhD scholars of the Department
11	Applications of Biotechnology in Oral health	30 th January 2018 One day	80	Class VIII - Class X Kendriya Vidyalaya, TU

	Oral health	One day		Biotechnology, Darrang College
13.	Basic techniques in Molecular Biology	11 th -13 th February, 2019	19	Class XI and Class XII students of KV, TU

(c) Invited lectures offered at host/neighboring schools or institutions:

Sl. No.	Name of the resource person	Topic	Organized by
1.	Dr. S. K. Ray	Introduction to Genetic Engineering	Biotech Hub, N.L. College
2.	Dr. S.K Ray	Recombinant DNA Technology	BiotechHub, Bodoland University
3.	Dr. N.K. Bordoloi	Assessment of quality of instruments	Kaliabor College
4.	Dr. K. Hazarika	Lecture on working of instruments	Darrang College
5.	Dr. S.P.G.Ponnam	Bioinstrumentation and Biological methods	Darrang College
6.	Dr. S. Baruah	Mucosal Immunology	Darrang College
7.	Dr. S. Baruah	Practical aspects of Immunology	University of Sc.& Tech. Meghalaya
8.	Dr. R. Doley	Biochemistry and Molecular Biology Techniques	Dibrugarh University
9.	Dr. R. Doley	Techniques of Molecular Biology	Biotech Hub, A.D.P. College
10.	Dr. R. Doley	Prospects of Biotechnologist. Career Orientation Talk on Biotechnology	Biotech Hub, Darrang College
	Dr. Pankaj Barah	Synthetic life: myth and reality	B. Baruah College
	Dr. Rupak Mukhopadhyay	PCR and its Applications	Darrang College

(d) Whether any consultancy and mentoring services are being provided to other institutional Biotech hubs, BLiSS, Star College programme etc. in DBT.

TU IBT Hub actively supporting Biotech Hub, Darrang College by helping with teaching and practical classes. A seminar on Careers in Science and Biotechnology and an outreach program on

were visited Darrang College Biotech Hub many times for theoretical lectures. Faculty from the department also visited Biotech Hub, ADP College, Biotech Hub, B. Baruah. College, Biotech Hub, Kaliabor College and Biotech Hub, Bodoland University for teaching and theoretical lectures. Students of the neighbouring Colleges including Darrang College and Kaliabor College were exposed to advanced facilities and instrumentation. Also, one workshop on microbiology was arranged for the B.Sc students of Darrang College. TU, Biotech Hub is also mentoring Kendriya Vidyalaya Tezpur University by providing teaching, technical and practical support in the form of outreach program.

12. Whether any entrepreneurship trainings have been conducted/activities initiated in neighboring NER areas:

The **Seminar on ‘Careers in Science and Biotechnology-** Dr. *Suman Govil*, Former Senior Adviser, DBT and Dr. Smita Jain, Associate Director, India BioSciences, NCBS delivered the invited lectures focusing various career opportunities for students. Interactive session was also organized and students were actively participated. The seminar helped the students to know about **various career opportunities**.

13. Impact on socio-economy of Biotech Hub in the State/Region for last 10 years:

- ✓ Trained manpower in diagnostics and hence employability
- ✓ Trained manpower in plant tissue culture expertise that has relevance to regions horticulture development
- ✓ Expertise in genetic engineering tools through workshops conducted by the Hub, which enhances the teaching and research capability of faculty and clinicians
- ✓ By conducting a seminar in career opportunities in biotechnology and related areas, the undergraduate students were exposed to job opportunities in areas other than R&D
- ✓ Outreach programs for school children (Health camps, teaching and training) provided a better insight into the learning opportunities in various aspects of Science

14. Difficulties/hurdles faced in the implementation of the program.

No major hurdle faced

15. Future action plan of the Biotech Hub (500 words):

(i) Research Activities (please provide specific research plan relevant to the state specific needs, its objectives and intended outcomes)

The broad area is disease biology and specific area is Cancer Biology and Genomics of disease with focus on cancer and autoimmunity immunotherapy/chemotherapy. This will be in cooperation with three departments of the university, MBBT, Chemical Sciences and Computer Sciences.

cancer (**published**) evidenced increased ectopic expression of HLA-G with HPV positivity. Our findings hint that HPV positive tumors manipulate the expression of SOCS and IL-10 for immune evasion and to support the growth of HNSCC tumors. Also, HPV harnessed HLA-G modulated pathways to drive inflammatory mechanism for its growth and regulate the expression of SOCS to mediate immune subversion. Hence, we propose to investigate the mechanism of immunoregulatory pathways through which viruses, more specifically the HPV dysregulate SOCS expression. Considering the role of miRNAs in regulation of SOCS and HLA-G, It will interesting and to speculate the role of different miRNAs in SOCS regulation and HPV mediated regulation of miRNA expression to manipulate SOCS pathway.

Type I interferons play an important role in SOCS regulation and expression. Considering this, we are also interested in looking at type 1 IFN pathway in Head and Neck tumors with respect to HPV positivity and in Autoimmunity.

(ii) Training / outreach / workshops

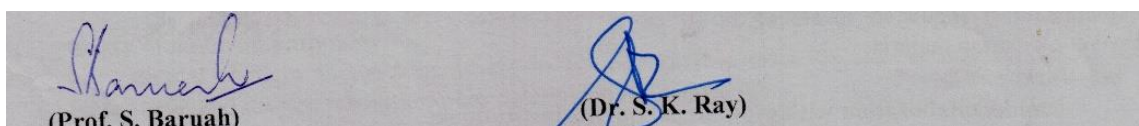
- ❖ The focus will be on advanced trainings in theoretical and advanced areas of genomics of disease and in assays like flow cytometry, fluorescent microscopy etc. for undergraduate and post graduate students.
- ❖ Outreach programs on basic and advanced instrumentation for neighboring colleges and schools

(iii) Any plan of Net-working with other DBT supported programs

We will continue to work with DBT supported teaching program operational at Department of MBBT, STAR Colleges, Biotech Hubs and BLIss Schools of the region.

(iv) Support to the neighboring institutions

Biotech Hub, Tezpur University will be continuously supporting the neighboring Biotech Hubs, Neighboring Colleges, Schools and other Institutes by providing infrastructure and facility and organizing various outreach and training programs. Biotech Hub, TU will also extend its support to teaching and training activities of neighboring Institutions as per the mandate.



The image shows two handwritten signatures in blue ink on a light grey background. The signature on the left is for Prof. S. Baruah, and the signature on the right is for Dr. S. K. Ray. Below each signature is its corresponding name in black text.

(Name & signature of Coordinators)