

State Biotech Hub Infrastructure Facility

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Summary of the progress made by the centre from its inception:

State Biotech Hub, Mizoram University was established in 2010 assistance of Department of Biotechnology (DBT), Govt. of India. So far the Centre has organized 6 National training programmes and conducted workshops for school students, Research scholars, Ph. D students and faculties in State Biotech Hub on areas like Molecular modelling, Molecular Phylogeny & Evolutionary Biology, DNA & Protein isolation, Cancer Mutagenesis and Biomarkers, Microbial Metagenomics. The State Biotech Hub has been conducting introductory workshops for School students as well.

Total funding received so far (Rupees in lakhs):

Financial year	2010 – 11	2011 - 12	2012 - 13	2013 - 14	Total
Amount Received	Rs. 134.72	NIL	Rs. 118.66	Rs.31.98	Rs. 285.36

Infrastructure facilities in the State Biotech Hub:

Instruments facilities:

Sl.No	Instrument Name	Qty
1	Gel Documentation System	1
2	Cary 60 UV-Visible Spectrophotometer	1
3	Bead Beater	1

4	Refrigerated Centrifuge 5810 R	1
5	Ice Flaking machine	1
6	NBS Galaxy Incubator	1
7	NBS Bench Top refrigerated Incubator Shaker	1
8	Spectramax R M2e Microplate Reader	1
9	Optika XDS-3 Inverted PC Microscope	1
10	Oxygen measuring System	1
11	Heating / Water Bath	1
12	PCR System	1
13	Multiporator	1
14	Refrigerated Micro Centrifuge	1
15	Computer HP pro 3330 Desktop	1
16	Laminar Flow (Vertical)	1
17	Laminar Flow (Horizontal)	2
18	DNA Electrophoresis system (3Nos)	1
19	Hot air Oven	1
20	PH Meter	1
21	Proline Variable Vol. 100-1000µl	4
22	Proline Variable Vol. 10-100µl	2
23	Proline Variable Vol. 20-200µl	4
24	Proline Variable Vol. 2-20µl	3
25	Proline Variable Vol. 0.5-10µl	4
26	Proline Multi Channel Vol. 0.5-10µl	1
27	Proline Multi Channel Vol. 5-50µl	1
28	Steel Almirah	1
29	Refrigerator	1
30	6KVA online UPS (One Unit)	1
31	Analytical Balance (One Unit)	1
32	Mini Vertical Electrophoresis	1
33	Transbolt Western blotting System	1
34	Power Supply	1
35	Ultra Low Freezer (-20° C)	1
36	Autoclave (Vertical)	1
37	Spinix TM MC-01	2
38	Rockymax TM	1
	Spare Dimple mat	1
39	Rotospin TM Rotary Mixer	1
	Bar for 50 x 1.5 ml tube	
	Bar for 20 x 15 ml tube	
40	Magnetic Stirrer Hot plate 10 x10 cm	2
41	UV Transilluminator	1
42	Gravi Trap kit	1

List of Instruments under purchase process in 2013.

Sl. No.	Name of the equipment	Model No. & Brand Name	Quantity
1.	Refrigerated circulating water bath	Jeio tech MODEL : RW 1025G	1
2.	Jeio tech Water Bath (korea make)	Jeio tech MODEL: BW-10G	1
3.	Deep Freezer (300 Ltrs)	Blue Star (CHF 300 B)	1
4.	Autoclave	YOMA, ATCV 1824	1
5.	Vacuum Filtration Unit	MILLIPORE	1
6.	Hot Plate	Jeio tech Code No. 6040	1
7.	Weighing Balance	Sartorius, : BSA223S	1
8.	pH Meter	Eutech (ECPH51042S)	1
9.	spectrophotometer fitted with micro-volume accessory	Genova nano / part NO.: 737 501 /	1
10.	Adaptor for fixed angel roter 6 × 85 for centrifuge 5810R	Eppendorf, 5810 R	1
11.	Neubayer Slide	Invitrogen	100
12.	Millipore water filtration system with extra filter	Millipore	1
13.	Stereozoom	Medline CETI	1
14.	Micro Oven	Samsung	2
15.	Professional Camera	Sony	1
16.	GPS System		1
17.	Refrigerator	Samsung 350 litres, double door	1
18.	Tissue Homogenizer	Remi	3 PCS
19.	CO ₂ Gas cylander	-	1
20.	N ₂ Carrier (10L)	Surgical Pvt. Ltd.Taylor Wharton, Model LD10	2
21.	Degenerating Gel Electrophoresis	Bio Rad, 1709105, 1709106, 1709107	1
22.	Micropipette	Biohit	6
23.	UPS System (5 KVA)	Online UPS, New Circuit Breaker	1
24.	PCR (proflex)	Applied Biosystem	1
25.	Rotavapor System with vacuum pump and accessories	BUCHI	1
26.	CentriVap DNA Vacuum Concentration	Fisher scientific	1
27.	Deep freezer -80° C	Fisher scientific	1
28.	Microtome	Leica	1
29.	Refrigerated Microcentrifuge	Thermo Fisher	1
30.	Anaerobic System	Himedia	5
31.	BIOLOG	MicroLog-M	1
32.	Protein Electrophoresis and Blotting	BioRad	1

Library facilities:

Sl.No	Items	Qty
1	GENETICS: ANALYSIS AND PRINCIPLES, ED.3	1
2	DNA AND BIOTECHNOLOGY, ED 3.	1
3	BIOTECHNOLOGY: APPLYING THE GENETIC REVOLUTION	1
4	MOLICULAR BIOLOGY	1
5	PRINCIPLES OF BIOCHEMISTRY, ED 4.	1
6	PLANT BIOTECHNOLOGY: THE GENETIC MANUPULATION OF PLANS ED.2	1
7	BECKERS WORLD OF THE CELL, ED. 8	1
8	MICROBIOLOGY: A LABORATORY MANUAL, ED. 9	1
9	BROCK BIOLOGY OF MICROORGANISMS, ED. 13	1
10	CONCEPTS OF GENETICS WITH MASTERING GENETICS, ED. 10	1
11	MICROBIOLOGY AN INTRODUCTION, ED 11	1
12	EVOLUTIONARY BIOINFORMATICS	1
13	ANIMAL CELL TCHNOLOGY: FROM BIOPHARMACUTICALS TO GENE THERAPY	1
14	PLANT BIOTECHNOLOGY AND GENETICS: PRINCIPLES TECHNIQUES AND APPLICATION	1
15	BIOCHEMISTRY, ED. 4	1
16	PLANT BREEDING AND BIOTECHNOLOGY: SOCIETAL CONTEXT AND THE FUTURE OF AGRICULTURE	1
17	GENETICS: INTERNATIONAL STUDENT VERSION, ED 6	1
18	ROITTS ESSENTIALS IMMUNOIOLOGY, ED. 12	1
19	THE PRACTICE OF STATISTICS IN THE LIFE SCIENCES, ED 2.	1
20	GENETICS: A CONCEPTUAL APPROACH, ED 4.	1
21	INTRODUCTION TO GENBETIC ANALYSIS, ED. 10	1
22	BIOCHEMISTRY, ED.7	1
23	STUDENT COMPANION BIOCHEMISTRY, ED. 7	1
24	GENE BIOTECHNOLOGY, ED. 3	1
25	MOLICULAR BIOLOGY: GENES TO PROTEINS, ED. 4	1
26	LEWINS ESSENTIAL GENES, ED.3	1
27	ANIMAL CELL BIOTECHNOLOGY: METHODS AND PROTOCOLS, ED 2	1
28	PROTEIN BIOINFORMATICS: FORM SEQUENCE TO FUNCTION	1
29	BIOINFORMATICS: SEQUENCE ALIGNMENT AND MARKOV MODELS	
30	COMPREHENSIVE BIOTECHNOLOGY (1-6) VOL SET., ED 2.	1
31	PHYLOGENETICS: THEORY AND PRACTICE OF PHYLOGENETICS SYSTEMATICS, ED 2.	1
32	CURRENT PROTOCOLS IN PROTEIN SCIENCE VOL 1-4	1
33	CURRENT PROTOCOLS IN BIOINFORMATICS 3 VOL. SET	1
34	CURRENT PROTOCOLS IN MOLICULAR BILOGY VOL- 1-6.	1
35	PRACTICAL COMPUTING FOR BIOLOGISTS	1
36	PHYLOGENETIC TREES MADE EASY: A HOW TO MANUAL, ED 4.	1
37	INTRTRODUCTION TO SYSTEMS BIOLOGY	1

38	BIOINFORMATICS: FROM GENOMES TO THERAPIES VOL 1-3 VOL SET	1
39	HANDBOOK OF STATISTICAL BIOINFORMATICS, ED.1	1
40	CURRENT PROTOCOLS IN CELL BIOLOGY VOL 1-4	1

i) Teaching/training activities:

(a) Trainings conducted:

S. No.	Topic	Duration and Date	No. of participants
1.	Bioinformatics- Protein and their structure prediction	23-24 November 2011	50
2.	Trends in Modern Biological Research	02-03 April 2012	50
3.	One - Day program on Basic tools in Modern Biology for college students for B.Sc students of Zirtiri College, Aizawl	04 August 2012	
4.	Advance Studies and Hands-on Training on plant DNA Fingerprinting”(at Bose Institute, Kolkata)	06 August 2012	
5.	Introduction to RNAi technology & NMR: From small to large biomolecules	23 August 2012	
6.	Pharmacogenomics : Polymorphism and Genotype – Phenotype correlation of drug response in Indian Population	16 May 2013	30
7.	A primer to Bioinformatics and Biotechnology to School students	08 June 2013	30
8.	A special workshop on “Advanced techniques in Biotechnology & Bioinformatics” or college teachers.	19-23 th Aug. 2013	20
9.	A training Course on “Introduction to Bioinformatics” for school students.	2 nd Oct. 2013	20
10.	A training Course on “Introduction to Bioinformatics” for RIPANS College Aizawl, students.	26 th Oct. 2013	20
11.	A training Course on “Introduction to Bioinformatics” for M. Sc. students.	5-6 th Nov. 2013	15

b) Overall score of the training programmes according to participants as per feedback taken in the prescribed format:

Scores	5	4	3	2	1
No. of participants assigning the score	60%	20%	20%	-	-

No. of students doing project works (with documentation) :

14 M.Sc Students; 05 M. Phil Students; 15 Ph.D Students

Invited lectures/hands-on trainings offered at other institutions:

Sl. No.	Name of the resource person	Topic	Organised by	Duration & Date
1.	N. Senthil Kumar	Identification and Phylogeny of Insect species through DNA Barcodes in the 3rd International Conference on Climate change and sustainable Management of Natural Resources	ITM University, Gwalior	Feb. 05-07, 2012
2.	N. Senthil Kumar	RAPD Analysis and DNA Barcoding - Lectures and practical demonstrations in the training program on Molecular Techniques and their Application in Veterinary Research	Assam Agricultural University, Guwahati	Feb.18-19, 2012
3.	G.Gurusubramanian	Bt toxins and their potential in insect management. Special Lecture series-PUMIC- Periyar University Microbiology Club	Periyar University Microbiology Club, Dept. of Microbiology, Periyar University, Salem, 30 January, 2013.	30/01/2013
4.	G.Gurusubramanian	Basics and Applications of DNA barcoding of Life. National conference on Innovative Approaches in Biosciences- MICROMEET 2013.	Dept. of Microbiology, Sree Narayana Guru College, Coimbatore, 15 Feb. 2013	15/02/2013
5.	G.Gurusubramanian	Refresher Course in Life Sciences (26 March – 15 April, 2013). Proteins and Proteomics - Principles and Challenges	Departments of Forestry, Botany and Zoology, UGC Academic Staff College, Mizoram University, Mizoram	28/03/2013
		Sequence alignment		12/04/2013
		BLAST, FASTA & MSA		12/04/2013
		Hands on session on BLAST, FASTA & MSA		12/04/2013

Acting as Resource Person (by the coordinator, SBT Hub):

Details	Venue	Date
National Level Seminar on “Application of Medicinal Plants and Their Diversity”	PG & Research Dept. of Botany, Govt. Arts College , Dharmapuri	Jan 06, 2010
IX National level Biological congress on Biotechnology: Great expectations and achievements.	Muthyammal College of Arts & science, Rasipuram	Jan. 09, 2010
National Seminar on Recent perspectives in Nanotechnology.	Hindusthan College, Coimbatore	Jan. 22, 2010
RNAi and its Application in Insect Pest Management.	CES, IISc, Bangalore	Feb. 2010
XXI All India BTISnet (DBT – Bioinformatics) coordinator’s meeting.	CARI, Port Blair	Feb. 03 – 04, 2010

Bioinformatics and its application in MAPs. National level workshop cum training program on Recent advances in Medical and Aromatic plants during.	Dept. of HAMP, Mizoram University	March 2010
Tools and Techniques in Bioinformatics. National workshop on some emerging areas of Biotechnology and Bioinformatics during.	Karimganj College, silchar, Assam	March 2010
Insect-Plant Interactions.	Orientation course, School of Environ. Science, Mizoram University	October 2010
Tools and Techniques in Bioinformatics at National workshop on some emerging areas of Biotechnology and Bioinformatics.	Karimganj College, silchar, Assam	Feb.22, 2011
Bioinformatics and PCR technology.	DBT–Institutional Biotech Hub, RIPANS, Aizawl	April, 2011
Application of Bioinformatics in Medicinal Plant Research at National level workshop cum Training program on Recent Advances in Medicinal & Aromatic Plants	Dept. of Horticulture and Aromatic Plants, Mizoram University, Aizawl	April 19,2011
DNA as Molecular Marker.	Central Agricultural University, Aizawl	Sept. 09, 2011
RNAi interference in Insect Pest Management in the National Seminar on Emerging Trends in Biosciences and Future prospects.	Pachhunga University College, Aizawl	29-30 Nov. 2011.
Bioprospecting and Inventorization of Plant Genetic Resources of NE India for Improvement & Sustainable Production.	DBT Program Support Centre, Indian Institute of Technology Guwahati, Guwahati, India	01 Oct. 2012
Educational opportunities in Food Processing.	national institute of food technology and entrepreneurship Management & indian institute of crop processing technology at aizawl	2 Feb., 2012
Identification and Phylogeny of Insect species through DNA Barcodes in the 3rd International Conference on Climate change and sustainable Management of Natural Resources.	ITM University, Gwalior	Feb. 05-07, 2012
RAPD Analysis and DNA Barcoding - Lectures and practical demonstrations in the training program on Molecular Techniques and their Application in Veterinary Research.	Assam Agricultural University, Guwahati	Feb.18-19, 2012
DNA barcoding as a tool for Rapid identification of plants: a case study study in banana family (Musaceae).	Department of environmental science & Department of Botany, Pachhunga University College, Aizawl	7-8, March, 2013
Attended Crick Symposium – Genetics to molecules to therapies	Beveridge Hall, Senate House, University of London, WC1E 7HU London, United Kingdom	11 March 2013

Attended 1 st Oxford workshop and Symposium (NGS2013)	Wolfson college, Oxford organized by bioteXcel consulting, Oxford (UK)	12- 13 March 2013
Attended EMBL- EBI Careers and Open Day	European Bioinformatics Institute, Cambridge	14 March 2013
Acted as judge for oral presentations in the Annual Student Conference 2013	The Natural History Museum, London, UK	18 - 19 March 2013
Attended seminar on Statistics in trials – Making complexity work	New Hunt's House Lecture Theatre 1, Guy's Campus, SE1 1UL London, United Kingdom.	20 March 2013
Attended Next Generation sequencing conference	Kennedy LT, Institute of Child Health, London, WC1N 1EH London, United Kingdom	March 26, 2013
Attended Identifying casual variants in NGS data: A hands-on workshop for analysis and biological interpretation of human DNA Re-sequencing data	University College, London organized by Ingenuity systems, UK.	27 March 2013
Attended Ensemble workshop on “Browsing Genomes with Ensembl”	University of Cambridge organized by EBI-EMBL, UK	02 April 2013
Attended Ensemble workshop on “Browsing Genomes with Ensembl”	University of Cambridge organized by EBI-EMBL, UK	02 April 2013
Attended British Society for Gene and Cell Therapy (BSGCT) Public Engagement Day 2013	The Windsor Building, Royal Holloway, University of London, TW20 0EX Egham, United Kingdom	17 April 2013
Attended Gene Ontology Annotation Workshop	University College London, UK.	18-19 April 2013
DNA barcoding Technique: a tool for authentic identification of medicinal plants (invited lecture).	Department of Chemistry, Manipur University, Canchipur, Manipur	6-7, May 2013
Introduction to Plant Biotechnology.	State Biotechnology Hub, Department of Biotechnology, Mizoram University	8 June 2013
Presented progress report of State Biotech Hub	Tripura Biotech hub coordinators meeting	24-25 June 2013
Delivered a lecture on DNA Barcoding and Metagenomics in the training program on “ PCR based molecular techniques in Biological research.	Assam Agricultural University, Guwahati	18-20 Sept. 2013
Deleivered a lecture in the workshop on Application of Bioinformatics in Molecular Biology Research	Gurucharan College, Silchar	28-29 Sept. 2013

Outreach programmes conducted:

Serial	Topic	Name of the institution	Duration	Level of
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No.		where conducted	and Date	participants
1.	One - Day program on Basic tools in Modern Biology for college students	Zirtiri College, Aizawl	04 August 2012	B.Sc Botany
2.	One - Day program on Basic tools in Modern Biology for college students	Zirtiri College, Aizawl	11 August 2012	B.Sc Zoology
3.	One - Day program on Basic tools in Modern Biology for college students	Zirtiri College, Aizawl	18 August 2012	B. Sc Chemistry

Major research activities in Biotechnology and its related fields:

a.Type of work carried out:

Sl. No	Title of the research	Persons involved	Achievements/ Status
1.	Simplified method for optimal PCR-ready genomic DNA extraction from buccal swab, Urine, Hair and Blood samples.	Souvik Ghatak N. Senthil Kumar	The Present study was conducted to examine the quality and purity of DNA extracted from four commonly available samples and to determine the influence of the process time of PCR amplification. Here, we demonstrate that the hair and urine samples provided a good alternative for obtaining small amounts of Polymerase chain reaction (PCR)-ready DNA.
2.	Phylogenetic relationship (haplogroups determination) among Northeast Indian Populations based on Mitochondrial D-loop and Cytochrome Oxidase I Gene.	Souvik Ghatak R.Muthukumaran N. Senthil Kumar	In the present study, sequence analysis and restriction digestion of the 1000bp of the hypervariable control region and 700bp Cytochrome Oxidase I gene of the Mitochondrial DNA (mtDNA) was performed to study the natural variations, genetic structure and relationships of the human populations from all the eight North East Indian States, as well as in East India (West Bengal) and South India (Tamil Nadu).
3.	Mitochondrial D-loop and Cytochrome Oxidase I Gene polymorphism and mutation study among the Mizoram Gastric cancer and Normal Population.	Souvik Ghatak R.Muthukumaran G.Gurusubramanian N. Senthil Kumar Satpal Singh Bisht	To investigate the possible role of mtDNA mutations in stomach cancer, we sequenced mitochondrial control region (900bp) and COI region (700) from blood samples of stomach cancer patients in Mizoram, India. We identified in COI gene, 103 mutations in all patients, including 96 point mutations, one single-nucleotide deletions. Eighteen of these mutations resulted in amino acid substitution. These missense mtDNA mutations were distributed in COI gene of Mitochondria. This study revealed a variety of mtDNA mutations and mtDNA polymorphisms in human stomach cancer, some of which might be involved in human stomach

			carcinogenesis. In case of COI gene mutation most of the mutations are C>T or T>C base substitution.
4	Mitochondrial D-loop and Cytochrome Oxidase I Gene polymorphism and mutation study among the Mizoram Breast cancer and Normal Population.	K.LalSangmawia Zothanpuia Souvik Ghatak R.Muthukumaran G.Gurusubramanian N. Senthil Kumar Satpal Singh Bisht	In this study we found that from 10 blood samples from sporadic breast cancer patients and 4 blood samples from normal healthy control exhibited aberrant pattern of mtDNA variation. Mitochondrial displacement loop (mtDNA D-loop) was amplified using PCR amplification. All samples had the same stage of cancer and in similar ethnicity (Mizo population). The sequencing findings were compared with NCBI database (NC_012920.1) as well as normal Mizo population sequencing data. The direct PCR sequencing revealed 8 genetic alterations were detected in breast cancer samples. Different somatic variants including base substitution, deletion were identified. About 35% of genetic alterations were located in HV3 whereas 65% located in HV1. 147A>G, 217T>C, 228T>C, 513C>T, 715T>C, 791GA>G, 845TA>T, 893GC>G somatic mutations were detected in the cancer blood sample. We identified two genetic changes including 147A>G, 228T>C in blood sample of breast cancer which have 100% mutation frequency.
5.	Glutathione S-transferase (GST) gene polymorphisms, cigarette smoking, Tibur consuming and gastric and oral cancer risk among Mizo population, India.	Rebecca Lalmanpuii Souvik Ghatak R.Muthukumaran G.Gurusubramanian N. Senthil Kumar	Tobacco products are a risk factor for gastric and oral cancer. Putative gastric procarcinogens in tobacco smoke include polycyclic aromatic hydrocarbons and heterocyclic aromatic amines that are known substrates of glutathione S-transferases (GSTs). This study examined the influence of functional GST gene (GST T1, GST M1, and GST P1) polymorphisms on the tobacco-gastric and oral cancer association in a population known to be minimally exposed to dietary sources of these procarcinogens.
6.	Diet and alcohol consumption in relation to p53 Exon 5-6 germlines and somatic mutations in breast Cancer among the Mizo population.	Ricky Sapkota Rebecca Lalmanpuii Souvik Ghatak Satpal Singh Bisht N. Senthil Kumar	To investigate the possible role of p53 exon 5-6 germ line and somatic mutations in breast cancer, we sequenced p53 exon 5-6 region (560) from blood samples of breast cancer patients and normal population in Mizoram, India.

7.	Phylogenetic relationship of genus <i>Oryza</i> of Mizoram as revealed by chloroplast matk gene.	Doris Zodinpuii Souvik Ghatak N. Senthil Kumar	Genetic diversity was studied in the chloroplast gene of wild and cultivated rice (Mizoram), for all types of genotype. Phylogenetic relationships were inferred using nucleotide sequences of the chloroplast gene matK for 35 species representing the tribe <i>Oryza</i> species and two outgroup species.
8.	Study of BRCA1. exon 11.1 mutation on Mizoram Breast cancer patient.	Zothanpuia Souvik Ghatak N. Senthil Kumar	To investigate the possible role of BRCA1 exon 11.1 germ line and somatic mutations in breast cancer, we sequenced BRCA1 exon 11.1 region (520) from blood samples of breast cancer patients and normal population in Mizoram, India.
9.	Characterization of soil microbial communities in Mizoram through culture independent methods	Surajit De Mandal N. Senthil Kumar Satpal Singh Bisht G.Gurusubramanian	Survey of microbial community using high-capacity sequencing, environmental samples can be characterized at resolution, ultimately allowing communities to be compared on the basis of their taxonomic or phylogenetic content as well as on functions the microbes carry out. The purpose of this study is to characterize microbial diversity and community structure of Mizoram soils through culture independent methods.
10.	Mitochondrial Markers in Insect Phylogenetics	Catherine Lalruati Zothansangi Khangte Surajit De Mandal G. Gurusubramanian N. Senthil Kumar	Similar morphology and high genetic diversity causes problem for phylogenetic studies of insects. Mitochondrial based marker is used to solve this problem and found that most widely used molecular marker for phylogenetic study. Different types of mitochondrial molecular marker are available in phylogenetic study of insects.
11.	Total phenol content, Antioxidant and Antimicrobial potential of some Traditional medicinal plant of Mizoram	Ajit Kumar Passari Surajit De Mandal Souvik Ghatak N. Senthil Kumar Bhim Pratap Singh	Traditional medicinal plants were screened for their antimicrobial and reducing properties.
12.	Characterization of Oil degrading Microbes	K. Syed Ibrahim J. Bhattacharya	Oil degrading bacteria, isolates were checked for screened for biosurfactant production. Two strains, namely MOB1 and MOB4 were, finally selected their based on their wetting property (Drop collapse assay), of which strain MOB1 showed promising activity. It was also screened for the biofilm inhibiting property which was also seemed to be promising.

			The 16S genes of the two strains were amplified and sent for sequencing for identification of the microbes.
13.	Studies on <i>Nostoc punctiforme</i>	K. Syed Ibrahim J. Bhattacharya	The FeSOD (Iron Superoxide dismutase) from the <i>Nostoc punctiforme</i> was purified from the clone that has been expressed in <i>E. coli</i> by Affinity chromatography. Further insilico characterization of the enzymes like FeSOD, Catalase, Ferritin, Flavodoxin, Fur, Glutathione peroxidase, Glutathione reductase, Glutathione S transferase and Glutathione synthetase from <i>Nostoc punctiforme</i> . Primers for the R T-PCR were designed for all the enzymes were designed and analysed.
14.	Processing of sequence and submission to NCBI database	K. Syed Ibrahim N. Senthil Kumar G. Gurusubramanian	Gene sequences of COI, ND1, DLOOP of Ph. D students were processed and submitted to the NCBI database.
15.	Tissue Culture from banana sucker	Thangjam Premabati Th. Robert Singh	Explants were surface sterilized and put into MS medium supplemented with different growth hormones at different concentration for the different stages of regeneration. Regeneration of plantlets and hardening at green house.
16.	Tissue Culture from banana male inflorescence	Thangjam Premabati Th. Robert Singh	Explants were surface sterilized and put into MS medium supplemented with different growth hormones at different concentration for the different stages of regeneration. Regeneration of plantlets is under monitoring.

b. Research publications:

2010-2011

1. Mukesh Kumar Yadav, Bandavari Kishore Babu, Anil Kumar Saxena, **Bhim Pratap Singh**, Kiran Singh and Dilip Kumar Arora. Real time PCR assay based on Topoisomerase-II Gene for detection of *Fusarium udum*. **Mycopathologia (2010)**. DOI 10.1007/s11046-010-9382-6.
2. S. Brindha, Sangzuala Sailo, **N. Senthil Kumar** and G. Gurusubramanian (2010) PROT-PROP: A Java-application to predict protein subcellular location based on amino acid sequences. *Computers in Biology and Medicine* (under review).
3. Vineet Kumar Mishra, Biku Moni Chutia, Ajith Kumar, S. Brindha, **N. Senthil Kumar**, B. P. Singh and G. Gurusubramanian (2010) Comparative characterization of *Bacillus thuringiensis* cry 1 class proteins. *Current Bioinformatics* (Communicated).
4. D.Anitha, Ajithkumar, **N.Senthil Kumar** and G.Gurusubramanian (2011) , Characterization of *Bacillus thuringiensis* isolates and their differential toxicity against *Helicoverpa armigera* populations 51: 107-114

5. **N.Senthil Kumar** and G.Gurusubramanian (2011) Sequence Analysis, In: Bioinformatics and its Application in Animal Science, pp.26-31. Tolengkomba and Shyamsana Singh (Ed.), Bioinformatics infrastructural facility centre, College of Veterinary Sciences and Animal Husbandry, Central Agricultural University, Aizawl, Mizoram. March 10-11, 2011 pp.26-31
6. Atom Anupama Devi and **Robert Thangjam** (2011): *In vitro* regeneration of *Parkia timoriana* DC. (Merr.) using cotyledonary node explants. In: Souvenir cum Abstract Volume of the National Symposium on Recent Advances in Plant Tissue and Biotechnological Researches in India organized by M.N. Institute of Applied Sciences, Bikaner from 4th to 6th February 2010.
7. Lalremsiami Hrahnel and **Robert Thangjam** (2011): *In vitro* regeneration of *Vanda coerulea* Giff. via protocorm like body (PLB) formation. In: Souvenir cum Abstract Volume of the National Symposium on Recent Advances in Plant Tissue and Biotechnological Researches in India organized by M.N. Institute of Applied Sciences, Bikaner from 4th to 6th February 2010.
8. PC Lalrinfela and **Robert Thangjam** (2011): Genome characterization of banana varieties of Mizoram using inter-retrotransposon amplified polymorphism (IRAP) and PCR-RFLP of internal transcribed spacer (ITS) marker. In: Souvenir cum Abstract Volume of the National Symposium on Recent Advances in Plant Tissue and Biotechnological Researches in India organized by M.N. Institute of Applied Sciences, Bikaner from 4th to 6th February 2010.
9. D. Anitha, **N. Senthil Kumar**, D. Vijayan, K. Ajithkumar and G. Gurusubramanian (2011) Characterization of *Bacillus thuringiensis* isolates and their differential toxicity against *Helicoverpa armigera* populations. Journal of Basic Microbiology 51: 107-114.
10. Tejmala, H., Brindha,S., Gurusubramanian, G. and **Senthil Kumar, N.** 2011. In-silico comparison of distal-less protein variation in insects. Science Vision, 11(4):189-197.
11. Lalrotluanga, **N. Senthil Kumar** and G. Gurusubramanian (2011) Evaluation of the Random Amplified Polymorphic DNA assay for the detection of DNA damage in mosquito larvae treated with plant extracts. Science Vision 11 (3): 155-158.
12. R. Laltanpuui, Rita Zomuanpuui, Tejmala Hijam, G. Gurusubramanian and **N. Senthil Kumar** (2011) RAPD- PCR characterization of insecticide resistant and susceptible *Anopheles* species. Science Vision 11 (3): 159-164.
13. Catherine, V., Zothansangi, Gurusubramanian, G. and **Senthil Kumar, N.** (2011) Morphological and molecular studies of six *Junonia* species of butterflies using RAPD-PCR technique. Science Vision, 11(3):141-146.
14. Zothansangi, Catherine, V., **Senthil Kumar, N.** and Gurusubramanian, G. (2011) Genetic variation within two cryptic species of *Cirrochroa* by RAPD-PCR technique. Science Vision, 11(3):141-146.
15. S. Brindha, Sangzuala Sailo, Liansangmawii Chhakchhuak, Pranjal Kalita, G. Gurusubramanian and **N. Senthil Kumar** (2011) Protein 3D structure determination using homology modeling and structure analysis. Science Vision, 11(3):125-133.

2012

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45. S. Kanakala and Bhim Pratap Singh (2013). Plectosphaerella cucumeria – occurrence as a new root rot pathogen and p-solubiliser in north-eastern India. *Archives of Phytopathology and Plant Protection*: DOI:10.1080/03235408.2013.782674.
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C. Collaboration with other departments/institutions:

Sl. No.	Dept./Institution collaborated	Nature of collaboration	Duration
1.	Centre for Ecological Sciences, Indian Institute of Sciences, Bangalore	Research on Molecular Phylogenetics	3 years
2.	Natural History Museum, London	Research on Environmental Metagenomics	1 year
3.	Assam University, Silchar and PSG College of Technology, Coimbatore	Research on anti-cancer protein and their over-expression.	3 years
4.	Mizoram State Cancer Institute, Aizawl, Mizoram ; University of Kolkatta and ACTREC, Mumbai	Research on Cancer Genomics	3 years

Manpower Recruitment Details:

Sl. No	Name	Designation	Date of Joining	Date of Completion /Date of Resignation
1	K. Syed Ibrahim	Research Associate (RA)	11-01-2011	Continuing
2	Souvik Ghatak	Senior Research Fellow	12-07-2012	Continuing
3	Surajit de mandal	Senior Research Fellow	12-07-2012	Continuing
4	Thangjam Premabhati	Junior Research Fellow	08-02-2012	Continuing
5	Subhajit Mukherjee	Technical Assistant	12-07-2012	Continuing
6	David K. Zorinsanga	Lab Attendant (LA)	05-11-2011	Continuing
7	David Rosangliana	Lab Attendant (LA)	05-11-2011	Continuing
8	Lalawmpuia Pachuau	Lab Attendant (LA)	14/9/2011	Continuing
9	John Lalbiakliana	Traineeship	08-01-2012	31.01.2013
10	Lalrempuii	Traineeship	12-08-2012	Continuing
11	Lalhmagaihzuai ralte	Traineeship	12-08-2012	Continuing
12	Lalhlimpuia Pachuau	Traineeship	01-09-2013	Continuing
13	Bethseby L. Sailo	Studentship	10-03-2012	Continuing
14	Laldinpuii Renthlei	Studentship	10-03-2012	Continuing
15	F. Lalrinhlui	Studentship	10-03-2012	Continuing

16	Zothanpuia	Studentship	10-01-2012	Continuing
17	C. Lalhriatrenga	Studentship	10-01-2012	Continuing

Training/ workshop/meeting attended by members of State Biotech HUB:

- 1) **Dr. N. Senthil Kumar** attended the **Refresher course on Modern biotechnological techniques** during Jan. 10 – 22, 2011 at Manipal Life Sciences Centre, Manipal University.
- 2) **Dr. N. Senthil Kumar** attended the **XXII All India BTISnet (DBT – Bioinformatics) coordinator’s meeting at Pondicherry University**, Pondicherry during Feb. 03 – 04, 2011.
- 3) **Dr. N. Senthil Kumar** attended the **4th Annual NEBInet (DBT- Bioinformatics) Coordinators Meeting at NERIST, Arunachal Pradesh** during Nov.12-13, 2011.
- 4) **Mr Souvik Ghatak** SRF of State Biotech Hub attended **“Training Corse : Bioinformatics – Protein and their Structure Prediction”**, Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by Department of Biotechnology, Mizoram university, Mizoram, held on November 23 – 24, 2011.
- 5) **Dr. N. Senthil Kumar** attended the **XXIII All India BTISnet (DBT – Bioinformatics) coordinator’s meeting at University of Jammu, Jammu** during Feb. 03 – 04, 2012.
- 6) **Mr Souvik Ghatak** SRF of State Biotech Hub attended national workshop on **“Advanced Molecular Biology Techniques”**, Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by Institutional Biotech Hub, Department of Biotechnology, Gauhati University, Guwahati, Assam, India, held on November 19 – 25, 2012.
- 7) **Mr Souvik Ghatak** SRF of State Biotech Hub attended national workshop on **“Medical Molecular Biology Techniques”**, Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by Department of Biotechnology, Assam University, Assam, India, held on November 26 – 29, 2012.
- 8) **Mr Souvik Ghatak** SRF of State Biotech Hub attended international workshop on **“ICGC – 2013, 1st Indian Cancer Genetics Conference and Training Workshop”** Sponsored by Indo – UK Genetic Education Forum, Cardiff UK; Organized by ACTREC & Tata Memorial Hospital, Mumbai, held on January 22 – 31, 2013.
- 9) **Mr Souvik Ghatak** SRF of State Biotech Hub attended national workshop on **“ The Barcoding and PCR Techniques”** Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by State Biotech Hub, Tripura University, Agartala, Tripura, held on February 22 – 26, 2013.
- 10) **Dr. K. Syed Ibrahim RA** of State Biotech Hub attended as a resource person in national workshop on **“ Structure Determination of Macromolecules”** Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by DBT-BIF centre, Department of Biotechnology, Mizoram University, Aizawl, held on March 26 – 28, 2013.
- 11) **Mr Souvik Ghatak** SRF of State Biotech Hub attended national workshop on **“ Structure Determination of Macromolecules”** Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by DBT-BIF centre, Department of Biotechnology, Mizoram University, Aizawl, held on March 26 – 28, 2013.
- 12) **Mr Subhajit Mukherjee** Technical assistant of State Biotech Hub attended national workshop on **“Structure Determination of Macromolecules”** Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by DBT-

BIF centre, Department of Biotechnology, Mizoram University, Aizawl, held on March 26 – 28, 2013.

- 13) **Mr Surajit De Mandal**, SRF of State Biotech Hub attended national workshop on “ **Structure Determination of Macromolecules**” Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by DBT-BIF centre, Department of Biotechnology, Mizoram University, Aizawl, held on March 26 – 28, 2013.
- 14) **Mr Souvik Ghatak** SRF of State Biotech Hub attended as a resource Person in the Training on “ **A Primer in Bioinformatics and Biotechnology to School Students**” Sponsored by Department of Biotechnology, Ministry of Science and Technology, Government of India; Organized by DBT STB-HUB, Department of Biotechnology, Mizoram University, Aizawl, held on June 08, 2013.
- 15) **Mr. Surajit De Mandal**, SRF of State Biotech Hub attended DBT sponsored workshop on “**Next Generation Sequencing and Genome Information of Parasite Biodiversity of medicoveterinary significance in North-East India**” in the Department of Zoology & Bioinformatics Centre, North-Eastern Hill University, Shillong 793 022 during June 17 - 21, 2013.
- 16) **Mr. Souvik Ghatak** , SRF of State Biotech Hub participate as a Delegate and Oral Presenter in “**BIOINFOGEN – 2013, National Conference on Bioinformatics in Genetic Diagnosis & Research**”, Sponsored by ICMR, New Delhi, India; Organized by Genetic Metabolic unit, Department of Paediatrics, PGIMER, Chandigarh, India, held on September 6 – 8, 2013.
- 17) **Mr. Surajit De Mandal**, SRF of State Biotech Hub attended DBT, CSIR sponsored workshop on “**Microbial Diversity And Bio-remediation Technology**” (MIDBIT- 2013) in National Institute of Technology, Rourkela, Odisha, India during Sept 11-13, 2013.

Types of services provided:-

(a) No. of students/workers utilizing the facilities:

Twenty II year M.Sc Biotechnology and Zoology students completed their project work using the State Biotech Hub facilities. Ten Research Scholars/ PhD students and Project Fellows of the School of Life Science departments are using the lab. Facilities for their project / research work.

(b) Other services provided (like diagnostic, consultancy etc.), if any:

Development of training manuals	K. Syed Ibrahim N. Senthil Kumar G. Gurusubramanian	Content for the trainings to be conducted in near future has been prepared. A draft content book containing the basic and advanced procedures for using and interpreting Bioinformatic tools has also been prepared.
Other works	K. Syed Ibrahim N. Senthil Kumar G. Gurusubramanian	Other works like handling classes for Pre PhD students, assistance to the M. Phil and Ph.D scholars. Delivered special lectures in the workshop.

(c) Services provided to other Biotech Hubs:

- In collaboration with Institutional Biotech Hubs at Pachunnga University College and Zirtiri College, projects have been carried out on DNA barcoding and Molecular Phylogenetics

Traineeship

Sl. No	NAME	Qualification	DATE OF JOINING	Title
1.	John Lalbiakliana	M.Sc Botany	01.08.2012	Isolation of VIP gene from <i>Bacillus thuringiensis</i>
2.	Lalrempuii	M.Sc. Zoology	08.12.2012	Hesperidin, an antioxidant flavonoid prevents Tuibur (Nicotine) induced stress in Heart, Spleen and Muscle. Therefore the aim of this is to explore the effects of HES on the lipid peroxidation status and the activity of the enzyme antioxidant: catalase, SOD, GHSPx, reduced glutathione (GSH) in the heart, spleen and muscle of the Rats treated with Tuibur.
3.	Lalmangaihuali	M.Sc.Zoology	08.12.2012	Barcoding of wild silk moth, <i>Actias meanas</i> and <i>Samia canningi</i>
4.	Lalhlmpuia Pachuau	M.Phil. Biotechnology	08.12.2012	Barcoding of butterfly Nymphalid family in Mizoram.
5.	Benjamin	M.Sc Biotechnology	01.10.2012	Identification of malarial vector species through PCR and sequencing of Plasmodium genes for phylogenetic analysis.
6.	Albana Senachawngthu	M.Sc Biotechnology	01.10.2012	
7.	Loknath Samanta	M.Sc Biotechnology	01.07.2013	Cloning and overexpression of oxidative stress responses gene of cyanobacterium <i>Synechococcus</i> PCC 7942.

Studentship:

Sl. No	NAME	Qualification	DATE OF JOINING	Title
1.	Bethseby L. Sailo	M.Sc IV Sem	03.10.2012	Isolation and characterization of lipase producing bacteria from kitchen exhausts and soil sample taken from slaughter house, flour mill and dairy industry.
2.	Laldinpuii Renthlei	M.Sc IV Sem	03.10.2012	Isolation and Biochemical characterization of protease producing bacteria from kitchen exhausts and soil sample taken from slaughter house, flour mill, dairy industry
3.	F. Lalrinhlui	M.Sc IV Sem	03.10.2012	Characterization of genetic diversity of different species of bamboo found in Mizoram using RAPD and ISSR markers.
4.	Zothanpuia	M.Sc IV Sem	03.10.2012	Mutation studies using BRCA1 and COI genes.
5.	C. Lalhriatrenga	M.Sc IV Sem	03.10.2012	Heterologous over expression, and functional characterization of two MnSODs from <i>Nostoc punctiforme</i> ATCC 29133

No. of courses supported (provided with infrastructure & facilities):

UG: - PG: 01 M.Phil: 01 Ph.D.: 01

Databases/ Software packages developed under the help of State Biotech Hub:-

- a. A Database on **Butterflies of Mizoram** was developed using VB 2008 and SQL server 2005 (Client-Server technology).
- b. A Database on **Snakes of Mizoram** was developed using PHP, Apache and MySQL Server (Web -Server technology).
- c. A Database on **Banana of North East India** and **Medicinal plants of Mizoram** is developing using PHP, Apache and MySQL Server (Web -Server technology).
- d. **PROT-PROP**: A Java- application to predict the subcellular location of a protein based on physiochemical properties. www.mzu.edu.in/schools/biotechnology.html
- e. **GC-Graphing**: A Java-application to plot GC contents of Intergenic and Intragenic regions of genome. www.mzu.edu.in/schools/biotechnology.html

Impact shown by the State Biotech Hub on the growth of biotechnology and allied areas:-

State Biotech Hub facility has been used in generating sequence data of various species of Mizoram and the following sequences have been deposited in NCBI:

Internal transcribed spacer-2 (ITS2) sequencing of ribosomal DNA done in:

- 24 fungal isolates from Mizoram soils has been done (NCBI Accession No. HQ596902-25)
- 8 *Anopheles* species has been completed (NCBI Accession No.'s JN643725-28 and JN710012 - 15).

DNA Barcoding (COI gene) sequencing done in:

- 14 butterfly species (NCBI Accession No. JN609220-23 and JN797782-91)
- 10 *Anopheles* species (NCBI Accession No.'s JN596970-74, JN832671-75)
- 6 species of dragon fly (NCBI Accession No.'s JN817424-29)

NBS-LRR resistance protein gene,

- 13 banana varieties (NCBI Accession No. HQ722029-41)
Bt crystal protein
- Btcry1 (NCBI Accession No. JN596969)
- Btcry2A (NCBI Accession No. JN215465)

Wild silk Moth

Antheraea assama (16S - KF164816, **COI** - KC968963, **ITS2** - KC879662, **Dloop** - KC879676, ND1 - KC759168)

Salassa tonkiniana (16S - KF164814, **COI** - KF164825, **ITS2** - KC879674, **Dloop** - KC879688, ND1 - KC759180)

Attacus atlas (16S - KF164815, **COI** - KC968962, **ITS2** - KC879675, **Dloop** - KC879689, ND1 - KC759181)

Actias maenas (16S - KF164819, **COI** - KC968958, KC953839, **ITS2** - KC879663, **Dloop** - KC879677, ND1 - KC759169)

Antheraea helferi (16S - KF164818, **COI** - KF164826, **Dloop** - KC879685, ND1 - KC759177)

Antheraea frithi (16S - KF164817, **COI** - KC968959, **ITS2** - KC879666, **Dloop** - KC879680, ND1 - KC759172)

Antheraea mylitta (16S - KF164820, **COI** - KC968964, **ITS2** - KC879664, **Dloop** - KC879678, ND1 - KC759170)

Archaeoattacus edwardsii (16S - KF164821, **COI** - KF164827, **ITS2** - KC879667, **Dloop** - KC879681, ND1 - KC759173)

Actias selene (16S - KF164822, **COI** - KC968960, **ITS2** - KC879672, **Dloop** - KC879686, ND1 - KC759178)

Salassa lemaii (16S - KF164823, **COI** - KC968961, **ITS2** - KC879670, **Dloop** - KC879684, ND1 - KC759176)

Cricula trifenestrata (16S - **KF164824**, **Dloop** - KC879687, ND1 - KC759179)

Loepa katinka (**COI** - KF164828, **ITS2** - KC879668, **Dloop** - KC879682, ND1 - KC759174)

Loepa sikkima (**ITS2** - KC879669, **Dloop** - KC879683, ND1 - KC759175)

Samia Cynthia (**ITS2** - KC879665, **Dloop** - KC879679, ND1 - KC759171)

Samia canningi (**COI** - KC953840)

Butterfly COI submitted in NCBI

- | | |
|---|--|
| 1) <i>Parantica aglea</i> (KC306718) | 11) <i>Vindula erota</i> (KC968944) |
| 2) <i>Danaus chrysippus</i> (KC306719) | 12) <i>Acraea issoria</i> (KC968945) |
| 3) <i>Euploea mulciber</i> (KC306720) | 13) <i>Cirrochroa tyche</i> (KC968946) |
| 4) <i>Euploeasylvester</i> (KC306721) | 14) <i>Argyreus hyperbius</i> (KC968947) |
| 5) <i>Parantica sita</i> (KC306722) | 15) <i>Cirrochroa aoris</i> (KC968948) |
| 6) <i>Parantica melaneus</i> (KC306723) | 16) <i>Cethosia cyane</i> (KC968949) |
| 7) <i>Danaus genutia</i> (KC306724) | 17) <i>Vagrans egista</i> (KC968950) |
| 8) <i>Euploea midamus</i> (KC306725) | 18) <i>Vindula erota</i> (JN797791) |
| 9) <i>Tirumala septentrionis</i> (KC306726) | 19) <i>Cynitia lepidia</i> (JN797790) |

- | | |
|----------------------------------|-------------------------------------|
| 10) Tirumala limniace (KC306727) | 20) Junonia almana (JN609221) |
| 21) Lethe rohria (JN797788) | 22) Lexias pardalis (JN797787) |
| 23) Lethe confusa (JN797789) | 24) Kallima inachus(JN797785) |
| 25) Euthalia phemus (JN797784) | 26) Junonia hierta (JN609220) |
| 27) Euthalia aconthea (JN797782) | 28) Junonia iphita (JN609223) |
| 29) Junonia lemonias (JN698955) | 30) Juonia atlites (JN609222) |
| 31) Papilio polytes (KC810960) | 32) Jamides celeno (KC810959) |
| 33) Papilio memnon (KC810961) | 34) Ancistriodes nigrita (KC810958) |
| 35) Saranges dashara (KC810957) | 36) Graphium antiphates (KC810962) |
| 37) catopsila pomona (KC810963) | 38) Athyma ranga (KC810965) |
| 39) Graphium macareus (KC810966) | 40) Neptis miah (KC810964) |

Butterfly NDI submitted in NCBI

- | | |
|----------------------------------|-----------------------------------|
| 1) Vindula erota (KC968950) | 2) Argyreus hyperbius (KC968951), |
| 3) Cirrochroa aoris(KC968952) | 4) Cethosia cyane (KC968953), |
| 5) Vagrans egista (KC968954) | 6) Cethosia biblis (KC968955) |
| 7) Phalantha phalanta (KC968957) | |

Future activities and proposed action plan:

- To continue spreading awareness, knowledge sensitization by imparting hands-on training in the areas of Biotechnology and Bioinformatics to the students from various Schools, Colleges, Universities.
- Strengthening of research activities through the use of Biotechnology and Bioinformatics tools.
- To organize national and international conferences, seminars and lecture series of eminent scientists to provide scientific platform to the students and teachers to have interface with recent trends Bioinformatics and Biotechnology.
- Fostering partnership, collaborative research, industry institute partnership and entrepreneurship development to achieve better research outputs leading to applied and product based science.
To achieve the status of centre for advanced studies in Biotechnology and bioinformatics.