



ANNUAL REPORT

2019-20

Innovate, Discover, Transform:
BIOTECHNOLOGY FOR A SUSTAINABLE FUTURE

Prepared By:

Department of Biotechnology

St. Edmund's College, Shillong



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secbiotech@gmail.com

Visit Our Website
www.sec.edu.in



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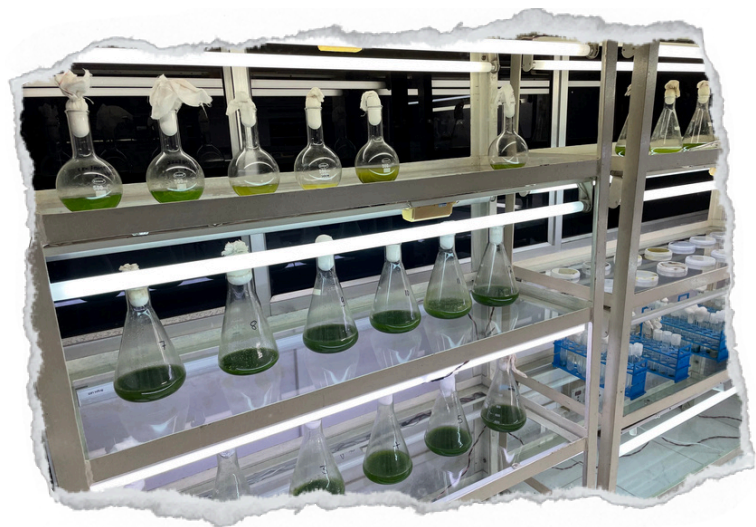
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Background

The Department of Biotechnology at St. Edmund's College, Shillong was established in 2006. The department has made significant progress and achieved several milestones since its inception.

Over the years, the Biotechnology Department at St. Edmund's College has undertaken various research and development projects. These projects have contributed to advancements in areas such as agricultural biotechnology, environmental biotechnology, and industrial biotechnology.

The Biotechnology Department at St. Edmund's College boasts well-equipped laboratories that provide state-of-the-art facilities for conducting research and practical training. The availability of advanced equipment and instruments enables students and faculty to carry out experiments and explore various aspects of biotechnology.



Our Vision:

- To achieve excellence in biotechnology education at the undergraduate level and produce students who are well informed with passionate thinking for implementing the technologies learnt for the larger benefit of the society.

Our Mission :

- To educate students with an up-to-date and modern course undergraduate curriculum affiliated to NEHU along with a futuristic and global approach thereby promoting intellectual and skill development.
- To provide students with basic and applied concepts of biotechnology having interdisciplinary approach so as to prepare them for different career paths they choose to take.



Our Team - Faculty Members



Dr SAMRAT ADHIKARI

Head



Dr Baiakmenlang Manners

Faculty



Dr Gopesh Paul

Faculty



Ms Shekinah Challam

Faculty



Mr Koben John Nongkynrih

Faculty



Mr Erwin Khsiar

Lab Attendant

Our Team - Research Staff



Dr Sunil Kumar
Research Associate

Advanced Level Biotech Hub
(Funded by DBT, Govt. of India)

Present Position

Research Associate
JIPMER, Chandigarh



Mr Yogesh Negi
Senior Research Fellow

Advanced Level Biotech Hub
(Funded by DBT, Govt. of India)

Present Position

PhD Scholar
BITS, Goa



Ms Ninni Suthradhar
Junior Research Fellow

Advanced Level Biotech Hub
(Funded by DBT, Govt. of India)

Present Position

PhD Scholar
CFTRI, Mysore



Mr Bikash Thakuria

Research Assistant
Bioinformatics Centre (Funded by
DBT, Govt. of India)

Present Position

Quality Controller
NEPNI, Guwahati

Facilities - Physical



ICT enabled Classrooms with Video Conferencing Facility



Well equipped laboratories

Facilities - Research



Shaker Incubator



Minus 20 Refrigeration



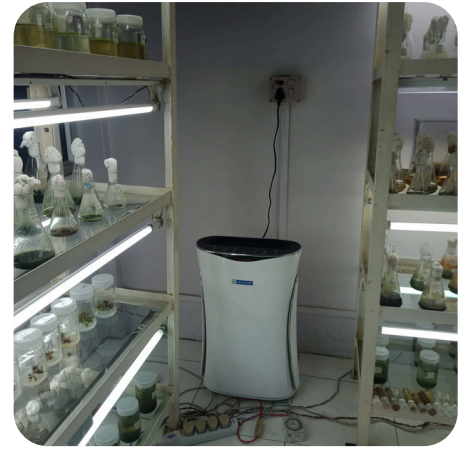
Minus 80 Refrigeration



Laminar Air Cabinet



Lypholizer



Humidifier



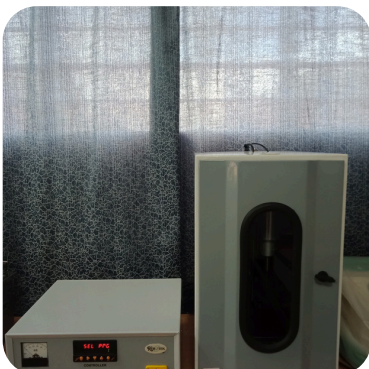
Cyanobacteria Repository



BOD Incubator



ELISA Reader



Ultra Sonicator



Water Sonicator



Centrifuge

Facilities - Research



Thermal Cycler



Dry Heating Block



Spin Centrifuge



Gel Doc Image System



**UV-Vis
Spectrophotometer**



Incubator



Oxygen Electrode



Microscope Image Capture



Waterbath



Ice Cube Machine



Autoclave



**Rotatory Vacuum
Evaporator**

Skill Development program on value addition to bioresources and entrepreneurship in Biotechnology

13/09/2019 To 16/09/2019



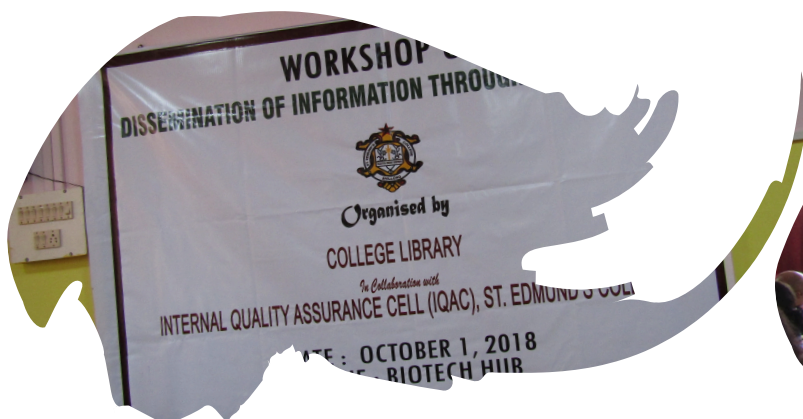
The programme was organised in collaboration with Biotech Park, Lucknow to impart Bio skills and develop entrepreneurship skills for students of the UG streams. The programme focussed on the preparation of a road map for product oriented START up's, which included nurturing of ideas, presentation of workplan and support of incubations Centre for proper deliberations.

Workshops/Seminars/Guest Lectures Organized

Workshop on Skill Development in Biotechnology in North-East India- The Next Level
12/03/2019 To 15/03/2019



National Workshop on Bioinformatics Tools & Techniques
28/06/2019 To 05/07/2019



Faculty Development Programme for Science Teachers
20/09/2019 To 21/09/2019



Seminar on
Career Prospects in Clinical Biotechnology- Industrial perspective
16th October, 2019



Seminar on Recent Trends in Bioinformatics and Computational Biology
28th July 2019

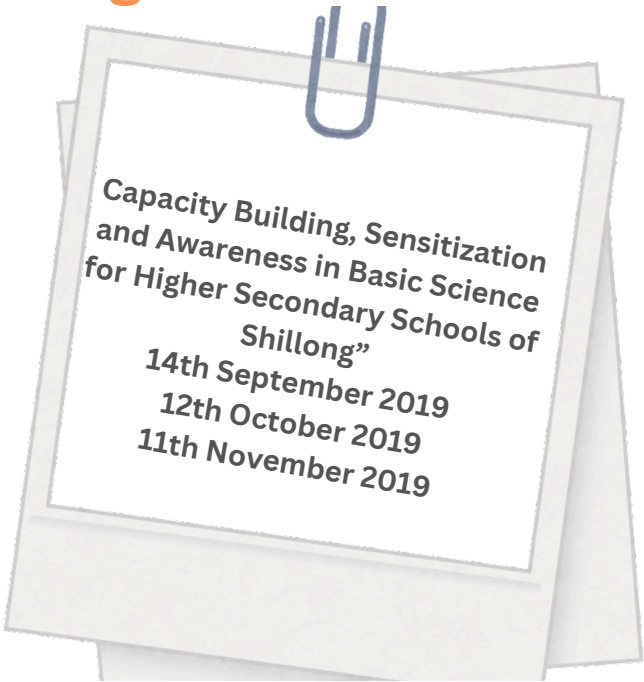


Seminar on Tools & application of Proteomics to solve Biological problems
4th July 2019



Outreach/Inhouse Programmes Organized

**Programme on “Basic Sciences:
Popularization through Interaction,
Practical Demonstrations and
Laboratory Exposure for Rural
Secondary School Students of East
Khasi Hills District of Meghalaya”
7th September 2019
12th October 2019**



Experiential Learning - Research Projects

Title	Name of Students	Duration	Project Guide
Maintenance of cyanobacterial culture	Preet Kumar Gupta	6 months	Dr Samrat Adhikari
Evaluation of anti-oxidative stress response in cyanobacteria culture treated with Congo Red.	Sanchari Bose Sonia Hajong	6 months	Dr Samrat Adhikari
Molecular characterization and cloning of cyanobacteria smtA and smtB genes in E.coli DH-5 α	Barnalee Baruah	6 months	Dr Samrat Adhikari
Protein extraction and purification of azo-reductase enzyme from heterocystous cyanobacteria	Nayanika Kalita	6 months	Dr Samrat Adhikari
A study on the transcriptomics analysis of the smt A & smt B metallothien gene in heterocystous cyanobacteria	Payelina Sanyal Saurav Thapa	6 months	Dr Samrat Adhikari
Meta analysis of oral and lip cancer in south asian countries with special reference to NE region	Sibange Paul	6 months	Dr Samrat Adhikari
Screening of bioactive compounds from Lantana camera & Water chestnut	Indrani Mazumdar Mary Saikia	6 months	Dr Samrat Adhikari

Title	Name of Students	Duration	Project Guide
A study on the effect of Paclitaxel, Docetaxel and Tamoxifen citrate compounds found in Taxus wallichiana on the Estrogen Receptor (ESR) and Beta-tubulin protein in humans using bioinformatics tools.	Devatrisha Purkayastha	6 months	Dr Samrat Adhikari
A bioinformatics approach to study the bioactive metabolites present in Crocus sativus as a potential drug candidate against cancer, using molecular docking and QSAR studies.	Sorforaz Lashkar	6 months	Dr Samrat Adhikari
Homology modelling, docking and functional site study of Laccase enzyme of Pseudomonas putida interacting with the azo dyes.	Priya Bhattacharjee	6 months	Dr Samrat Adhikari
An in silico approach to study the functional domains of azurin from Pseudomonas fluorescens and its effect on various p53 mutants.	Hemov Bora	6 months	Dr Samrat Adhikari
Bioabsorption study of congo red dye in response to various cyanobacteria	Tahmida Mondal Nikita Das A R Choudhury Priyanka Chanda Binita Singh Metsino Chetri	6 months	Dr Samrat Adhikari

Experiential Learning - Summer Internship

Name of the Institute/Companies	Name of Students	Duration	Internship Guide
Epygen Biotech Pvt. Ltd, Navi Mumbai, Maharastra, India saptarishipaul@epxygen.com	Payelina Sanyal Saurav Thapa	15 Days	Dr Saptarishi Paul
Division of Animal Health, ICAR Research Complex for NEH Region, Barapani, Meghalaya akpuro@gmail.com	Priyanka Rabha Himabiar Suchiang Sagarika Doloi Valerien Thawmuit Geeta Ghimre Mebaaiahbn Thangkiew	15 Days	Dr Akelu Puro
Advanced Biotech Hub Department of Botany NEHU, Shillong	Joyeeta Bhattacharjee Bipanki Bhattacharjee Hemov Bora Mridul Kumar Barnali Baruah	15 Days	Prof N. K Churungoo

Experiential Learning - HRD Training

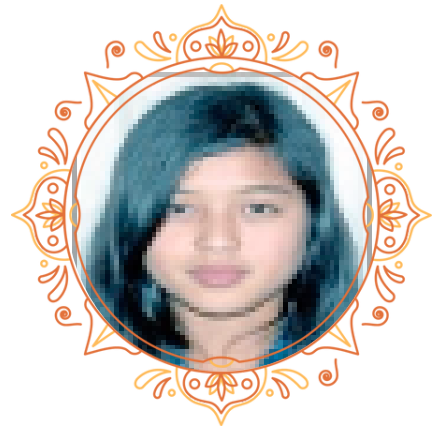
Name of the Participating Institute	Name of Students	Duration	Internship Guide
Institute of Advanced Biotechnology & Bioinformatics (IBAB), Bangalore	Ms Monisha Bhattacharjee	2 month	Dr Samrat Adhikari
Sikkim State Council of Science & Technology, Govt. of Sikkim.	Ms Swastika Gurung	6 months	Dr Samrat Adhikari
Department of Bioinformatics, Lovely Professional University (LPU), Punjab	Ms Fenella D Nonglait	2 months	Dr Samrat Adhikari
Department of Biotechnology, Mizoram University, Mizoram	Ms Batailang Suchiang	6 months	Dr Samrat Adhikari
Department of Zoology, Sikkim Central University, Sikkim	Ms Mahima Gurung Ms Nidhi Paswan	1 month	Dr Samrat Adhikari

RESULTS - University Examination

University Toppers



**Ms Devatrisha
Purkayastha
Second Position**



**Ms. Lawanbiang
lawphniaw
Third Position**



**Mr Sarforaz Lashkar
Fourth Position**



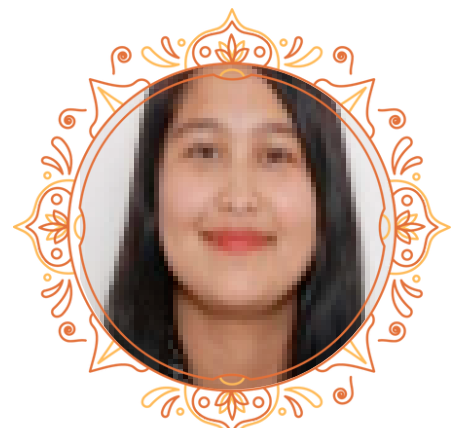
**Fleming L. Nonglait
Sixth Position**



**Ms. Teresa Wansuk
Langtang
Fifth Position**



**Ms. Marylene Wahlang
Eighth Position**



**Ms. Alisha Thapa
Tenth Position**



**Ms. Idameka D. Ryntathiang
Ninth Position**

95 %

SUCCESS

**Appeared: 38
Passed: 36**

Students Progression- UG-PG

Name of the Student	Name of Programme Admitted	Name of the Institute Joined
Seilidor Sohkha Ibakrymen Marbaniang Naphisabiang Kharपुरि Larisa Lyngdoh Jahdial Wanchand Banrapdor Ryndong Salgra P Marak ladameka D Rynthathiang Lawanbiang lawphnaw Unity Pathaw Evaki Areng Liza Nongbri Fleming Nonglait Gideon Shabong	MSc Biotechnology & Bioinformatics	Department of Biotechnology & Bioinformatics, North Eastern Hill University, Shillong
Mary Saikia Sonowal Arundhati Roy	MSc Forensic Science	Dadasaheb University Lucknow
Deva Trisha Purkayastha	Integrated MSc-PhD	IISER, PUNE
Sibange Paul Indrani Mazumdar Nitya Panthi	MSc Biotechnology	Assam Don Bosco University Assam
Soonil Kumari Ram	NSc Biotechnology	REWA University Bangalore
Sorforaz Lashkar	MSc Biotechnology	Jamia Islamia New Delhi

Research Grants

Name of the research project/ endowment	Name of the Principal Investigator	Year of Award	Amount Sanctioned	Duration of the project	Name of the Funding Agency
Establishment of Bioinformatics Centre for Biology Teaching under BTIS NET, India	Dr Samrat Adhikari	2008	₹ 91.0 L	11 years	Department of Biotechnology (DBT), Govt. of India
STAR Status Scheme (6 Departments- Physics, Chemistry, Botany, Zoology, Biochemistry & Biotechnology)	Dr Samrat Adhikari	2017	₹ 117.0 L	3 yrs	Department of Biotechnology (DBT), Govt. of India
STAR College Scheme (4 Departments- Electronics, Mathematics, Environment Science & Computer Science)	Dr Samrat Adhikari	2017	₹ 47.0 L	3 yrs	Department of Biotechnology (DBT), Govt. of India
Advanced Levels Biotech Hub (Phase I)	Dr Samrat Adhikari	2017	₹ 78.55 L	3 yrs	Department of Biotechnology (DBT), Govt. of India



EFFECT OF MERCURY ON THE GROWTH AND BIOCHEMICAL BEHAVIOR OF *NOSTOC MUSCORUM* AND *ANABAENA VARIABILIS*

YOGESH NEGI¹, SUNIL SHARMA², BARIHUN THYRNANG³,
FRANKIE J. LALOO³ AND SAMRAT ADHIKARI^{4*}

¹Senior Research Fellow, Advanced Level Biotech Hub Facility, Department of Biotechnology, St. Edmund's College
Shillong-793003, Meghalaya, India

²Research Associate, Advanced Level Biotech Hub Facility, Department of Biotechnology, St. Edmund's College
Shillong-793003, Meghalaya, India

³UG Student, Department of Biotechnology, St. Edmund's College, Shillong-793003, Meghalaya, India

⁴Associate Professor, Head, Department of Biotechnology, Coordinator, Advanced Level Biotech Hub Facility, St. Edmund's
College, Shillong-793003, Meghalaya, India

ABSTRACT

Cyanobacteria are a highly diversified group of photosynthetic organisms which can be exploited as a potential candidate for bioremediation processes. The present study evaluates the toxic effect of a heavy metal, mercury (Hg^{2+} (II)), on the growth and biochemical aspects of *Nostoc muscorum* and *Anabaena variabilis*. The results depicted negative effects of Hg^{2+} on cyanobacteria by hampering normal growth and physiological activities. The treated cells showed diminishing growth pattern and decrease in the photosynthetic pigments. Significant decline was also revealed in the biomass and lipid content. The LC_{50} value of Hg was determined to be $0.6\mu M$ for both the cultures. Activity of the enzymes involve in nitrogen metabolism such as Glutamine Synthetase (GS), Nitrate Reductase (NR) and Nitrite Reductase (NIR) were studied and showed reduced activity. This decreased activity also correlates with the reduction in the heterocyst frequency as obtained in the results. In contrast, the enzyme superoxide dismutase (SOD) and proline content concerned with stress management in cyanobacterial cells showed significant increase in activity. The result obtained in the present study exemplifies the cytotoxic environment created by the Hg^{2+} ions on the microbial cultures by altering their membrane's physiological functions. Thus, causing leaching of photosynthetic pigments leading to decreased photosynthetic efficiency and consequently restraining growth. The growth inhibiting effect of Hg^{2+} ions was also evident from the reduced activity of enzymes entailed with assimilation and uptake of nitrogen, resulting in decline in heterocyst frequency. Furthermore, the apparent increase in cell's SOD and proline content can be ascribed to the production of reactive oxygen species (ROS) due to heavy metal stress created by the Hg^{2+} ions.

KEYWORDS: Cyanobacteria, Hg^{2+} , Heavy metal stress, Growth, Biochemical assays, antioxidant



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KEYWORDS: Cyanobacteria, Hg^{2+} , Heavy metal stress, Growth, Biochemical assays, antioxidant



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A study on the differentiation of filamentous cyanobacterial isolates using DNA fingerprinting approach

Yogesh Negi, Sunil Shanna, Ninni Sutradhar, Samrat Adhikari*

Department of Biotechnology, Advanced Level Institutional Biotech Hub, St. Edmund's College, Shillong-793003, Meghalaya, India

Received, 7 May 2019 revised, 20 September 2019 accepted 30 September 2019

The present study investigates the implication of DNA fingerprinting in discrimination of class isolates collected from a spread of habitats in south west Khasi Hills district of Meghalaya, India. Five totally different primers i.e., M13, enterobacterial repetitive intergenic consensus (ERIC), short tandem repetitive repeats (STRs) 1A & B and long tandem repetitive repeats (LTRs), derived from repetitive sequences gift within the ordering of true bacteria, were utilized. The generated knowledge was then evaluated for fingerprinting exploitation procedure and unweighted pairgroup method of arithmetic average (UPGMA) based dendrograms. Clear and variable stripe patterns were obtained for every of the targeted genomic regions used, LTRR being the sole exception. The stripe patterns delineate the existence of 2 basic distinct populations of true bacteria among the 19 isolates. The UPGMA cluster analyses in addition, disclosed the presence of numerous lineages among the isolates. On examination the resolution capability of the four genomic regions studied, it had been seen that, with the exception of LTRR, all the opposite regions hold smart resolution and therefore the ability to differentiate between numerous class populations. The results of the current study indicate the incidence of genetic variants among the 19 morphologically identical isolates of filiform cyanobacteria. Additionally, the study additionally explicates the quality of DNA fingerprinting supplemented with UPGMA cluster analysis as a speedy, economical and value effective tool for differentiating among morphologically identical populations.

Keywords: Cyanobacteria; genetic diversity; DNA fingerprinting; UPGMA cluster analysis

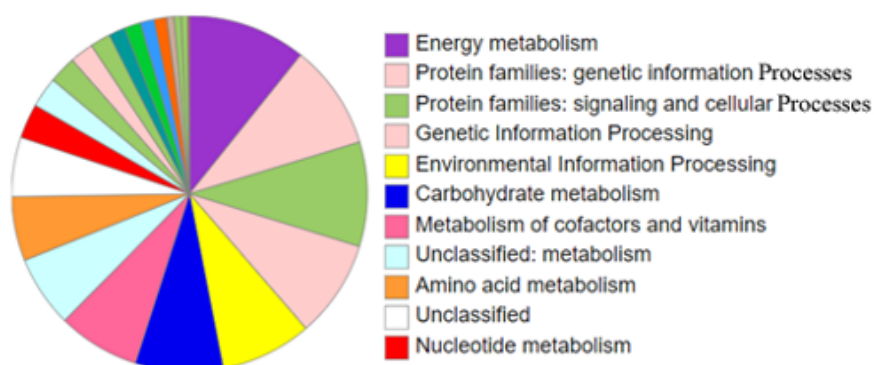
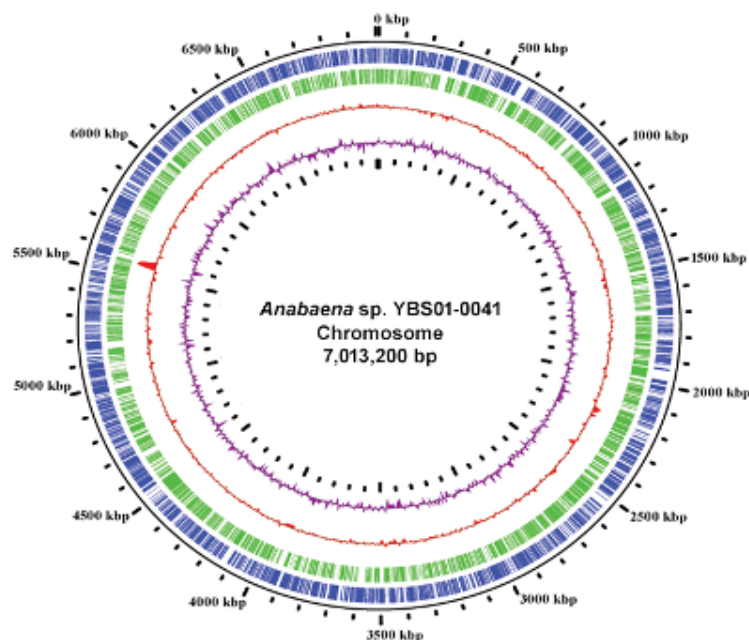
Introduction

The phylum cyanobacteria represents the largest sub-groups of Gram negative microorganisms characterized by the ability to perform photosynthesis. Besides being oxyphototrophic, some of the cyanobacteria are also endowed with the capability of fixing atmospheric nitrogen¹⁻⁶. An additional aspect of cyanobacteria being a subject of research interest lies in the fact that they are amongst the ancient evolutionary lineages of phototrophs believed to have originated during the early Pre-cambrian super con of the geological time scale (approx 2.6-3.5 Bya)⁷⁻⁹. With immense potential, cyanobacteria offer diverse applications in bioremediation, biofertilizers, bio-monitoring of soil fertility and water quality⁵⁻¹².

Conventional approaches for identification of cyanobacteria have mostly relied on morphological characters; which, however, tends to suffer from uncertainties and is often misleading¹³⁻¹⁷. Furthermore, assessment of genetic diversity among cyanobacterial

population has also been problematic owing to their small size and non distinctive phenotypic characteristics (Rasmussen and Svenning). With the advancement in the field of molecular biology, a number of techniques have been made available for identification, delineation and studying genetic diversity of cyanobacteria. In this context, 16S rRNA sequence analysis, restriction fragment length polymorphism (RFLP), random amplified polymorphic DNA (RAPD) and amplified ribosomal DNA restriction analysis (ARDRA) analyses have been successfully employed for molecular characterization, identification and resolving taxonomic and phylogenetic issues among the various cyanobacterial taxa¹⁸⁻²⁵. With regard to investigation of genetic diversity, PCR based DNA finger printing have been considered as a valuable tool²⁷⁻³¹. Furthermore, in comparison to the other available techniques, such as 16S rRNA and whole genome sequence analysis, which are commonly used for assessment of microbial diversity, DNA finger printing is a cost effective technique and can be routinely used. In this context, the repetitive sequences, which constitute an important part of

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The filamentous, heterocystous cyanobacterium, *Anabaena* sp is an important model organism for biotechnological research. Considering its significance, the entire genome of *Anabaena* sp. YBS01-0041 collected from Shangpung area Jaintia Hills district of India was sequenced and its characteristics features were determined. The size of the genome was found to be approximately 7.0 Mbp close enough to *A. variabilis* ATCC-29413 (genome size of 7.1 Mbp). The genome of *Anabaena* sp. YBS01-0041 was found to contain 5857 number of genes, of which 3021 genes represented the coding fractions. 4 sets of rRNA and 48 tRNA were also detected in the genome. Numerous tandem repeats (TRs) and insertion sequences (ISs) were as well detected across the genome and analyzed. Phylogenetic analysis revealed the close relatedness of *Anabaena* YBS01-0041 with *A. variabilis* ATCC-29413. Furthermore, functional annotation of the coding genes present in the genome was also carried out to categorize the genes based on their functions. In addition, the genome was also found to contain certain potential CRISPR locus along with associated Cas which may have an important role in conferring immunity to the organism.

Faculty Participation in Career Enhancement Programs



DR SAMRAT ADHIKARI

Dr S Adhikari was nominated by DBT, Govt. of India to deliver a invited talk by DBT Govt. of India at Pondicherry University, Pondicherry

Dear Dr Adhikari,

I am pleased to extend my heartiest wishes to your college for having attained the "Star Status" in your journey under the Star College Scheme. As you are aware, the Department has been organizing mentor-ship meets, advisory committee meetings and coordinators' meeting to nourish the colleges supported under this scheme.

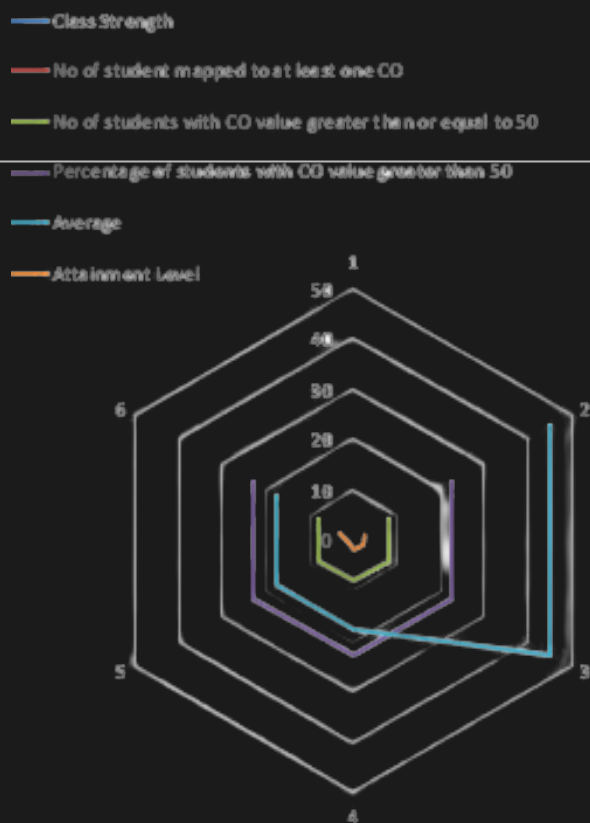
We have scheduled one such meeting at **Pondicherry University** on **18-20 April, 2019** and invite your good self/ your colleague (nominated by you) to come and deliver an enriching talk on your passage in the Star College Scheme and thereby share your experiences that shall guide our beneficiary college in their journey.

We have organised a **Panel Discussion** on "**The Star College Support: Strengthening to Star Status**" in the upcoming **5th Meeting of the Task Force on Star College Scheme CUM Coordinators' Meet** that shall have several distinguished academicians as panelists. We request you to participate and present your success story under the Star Scheme thereby providing a mentor-ship for the colleges and guiding them as to how they can implement innovative programmes under Star College Scheme for the benefit of undergraduate science programmes. Your talk has been scheduled as per the attached agenda.

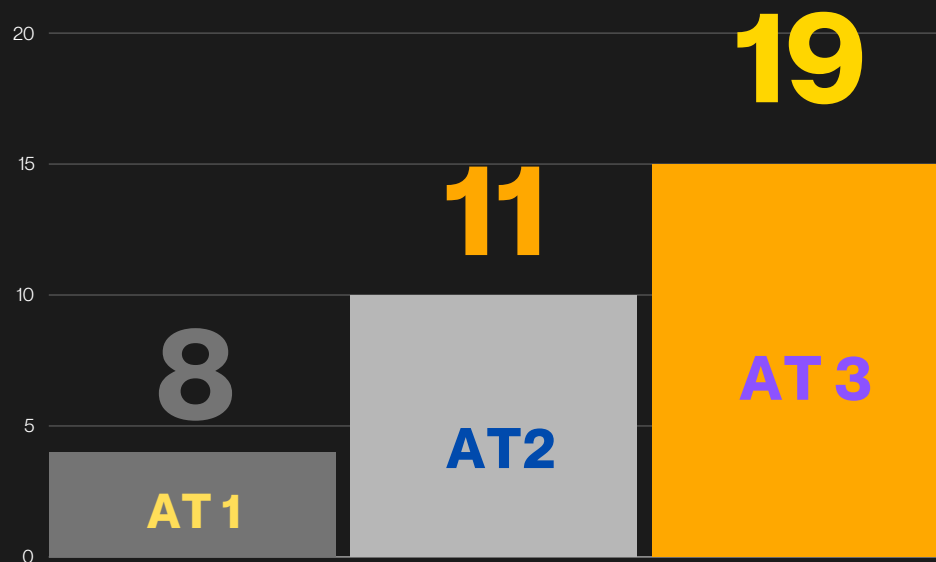
Outcome Based Education ↘

Learning Outcome

The learning outcome for sixth-semester students is evaluated based on the Course outcome and programme outcome framed as per the UGC LOF guidelines and Bloom's learning indicators. The student's performance was analyzed based on direct and indirect assessment with 3 being the highest attainment level followed by 2 as medium and 1 being the least. The graphical representation is appended



CO-PO Mapping



AT - Attainment Level

Past pupils' Reminiscence

I have cherished memories of the screening day when the department assessed candidates for the biotechnology bachelor's program. The three years from 2016 to 2019 were filled with joy and academic growth. It was a period of studying microbes and building strong bonds with my fellow batchmates, making it the most enriching and rewarding years of my life.

I extend my gratitude to Dr. SAMRAT ADHIKARI, the Head of the Department of Biotechnology, for his invaluable help, advice, and mentorship. His talent in recognizing and nurturing talent is commendable. I am grateful for the opportunity to engage in scholarly research, which equipped me with skills that continue to benefit me in my academic journey.

I also want to thank the faculty members, Dr. BAIK MENLANG MANNERS, Dr. GOPESH PAUL, KO BEN JOHN NONGKYNNRIH, and SHEKINAH CHALLAM, for their unwavering guidance.

The essence of academic life lies in the shared moments and experiences that shape us. These moments are incomplete without the friendships we cultivate along the way.

The memories of my time at St. Edmund's will forever hold a special place in my heart. I will always cherish them dearly.



Mr Sorforaz Lashkar



Mr Rikiroplang Pyngrope

It gives me great pleasure to be able to provide this feedback about the Department of Biotechnology, St. Edmund's College Shillong. The department has always been at the forefront not only in terms of imparting quality education to the students but also in providing opportunities for students to excel in fields such as research and development. The department has also provided hands-on training to students in computer applications and has also nurtured students to be the best in terms of studies and also in life. The department has an excellent infrastructure and up to date equipments that are required by students pursuing life science and research. In addition the faculties of the Department are extremely professional in their work and are not only mentors in terms of education but are mentors that impart valuable lessons in life as well. In conclusion I can proudly say that I am proud to have been a part of the Department of Biotechnology St. Edmund's College as it has greatly influenced and shaped me to be the person I am today.

Strengths

- Dedicated Faculty
- Good Student to equipment ratio
- Well equipped infrastructure
- Good Student to teacher ratio
- Well equipped R&D facilities
- DBT STAR STATUS Department
- Major funding from various government and non government agencies
- High rate of student placements in prestigious organizations and research institutions

S

Weaknesses

- Rigidity in Curriculum Design
- Industry- academia interface
- Limited Alumni participation
- Time constraints for research due to academic engagement

W

- Bolster Research Capabilities
- Keeping pace with the fast-evolving biotech landscape and integrating new technologies into the curriculum and research.
- More skill development activities
- Bioentrepreneurs
- Student Internships

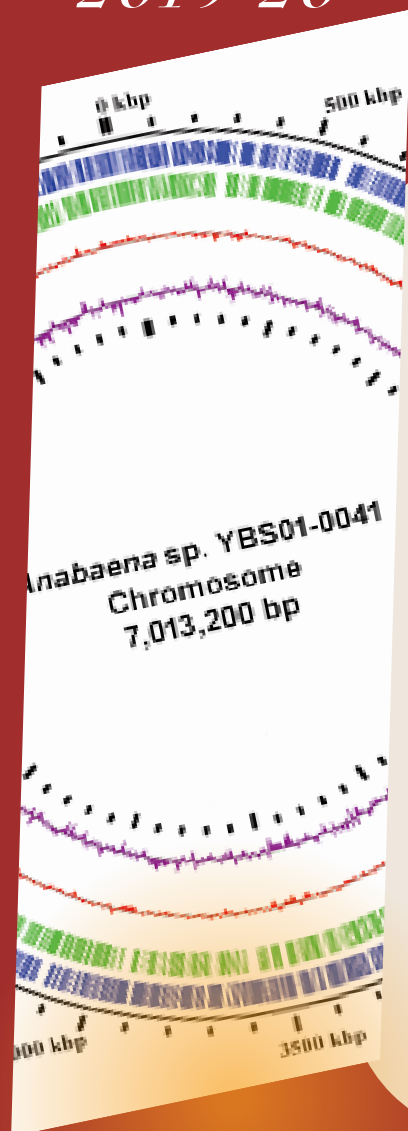
C

Challenges

O

- MOA's with universities/industry
- Opportunities for strategic partnerships with biotech firms and pharmaceutical companies for joint research and internships.

Opportunities

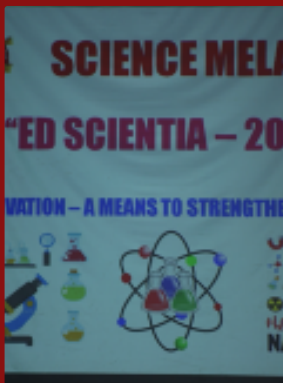


With an aim to address the need to provide a platform for knowledge exchange, skill enhancement, and collaborating among researchers, students and professionals in the field of Bioinformatics the Department of Biotechnology organised a National Workshop on Bioinformatics Tools and Techniques. The Workshop was able to bridge the gap between theoretical knowledge and practical application in bioinformatics. By uniting minds from diverse backgrounds, the workshop was able to foster a collaborative environment that enhances the skills and knowledge of all participants, driving forward the field of bioinformatics and its applications in modern science.

IMPACT

It enhances their understanding of cutting-edge bioinformatics tools, improves technical skills, and promotes interdisciplinary learning. Exposure to expert insights and hands-on training elevates their academic and research capabilities. Such workshops also build professional networks, inspire innovative thinking, and prepare students for advanced research and career opportunities in bioinformatics and related fields

Glimpses of activities



Glimpses of activities

