DTE Code: 4151 www.tgpcet.com

TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Approved by AieTE New Delo and Cow, of Mahansektro) Artilaled to Reshirosont Tolectou Maharsa Nagpur University, Nagpur

AN AUTONOMOUS INSTITUTE

GENESCAPE

BIOTECHNOLOGY

Exploring the Frontiers of Biotechnology and Genetic Innovation

Even semester 2025

VOLUME 2
ISSUE :1

Late Shri. Tulsiramji Gaikwad-Patil

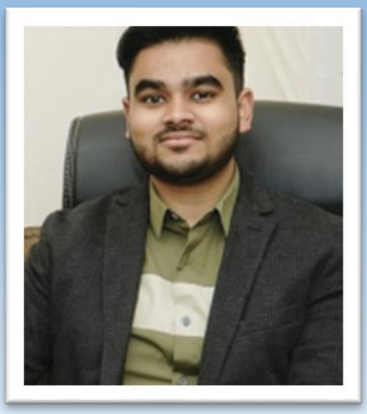
(1st April 1915 - 18th July 1986)

The Gaikwad-Patil Group derives its inspiration from Late Shri. Tulsiramji Gaikwad-Patil, the grandfather of the Chairman of the Group, Dr. Mohan Gaikwad-Patil. A man far ahead of his times, Shri. Tulsiramji Gaikwad-Patil was primarily an agriculturist, but also a true connoisseur with many varied interests. One of his passions was education. This visionary bucked the trend of sending sons into agriculture and ensured excellenteducation for his children and grandchildren. It was his foresight that took the family from being rural landlords to urban, uber-class professionals and entrepreneurs. It would not be far wrong to say that the real foundation of the Gaikwad-Patil Group was laid by Shri. Tulsiramji Gaikwad-Patil ability to look into the future. The GPGI has set its foot prints in the educational sector already and has a vision to become one of the best and most dynamic group of institutions. With the blessing of the our patron Late Shri. Tulsiramji Gaikwad-Patil, The GPGI is setting further its feet into the field of medical education and will cater to varied educational needs of the increasingly bustling region of Vidarbha.

MESSAGE FROM MANAGEMENT DESK

Dr. Mohan Gaikwad Patil
Chairman, GPG

Biotechnology stands at the forefront of innovation, transforming lives through science. We are committed to nurturing talent and fostering research that addresses real-world challenges. Let us strive for excellence and integrity in every experiment and endeavor. Together, we can shape a healthier, more sustainable future.



Mr. Akash Gaikwad Patil
Vice Chairman, GPG

In the era of precision and innovation, biotechnology empowers solutions to global problems. Our institute supports inquisitive minds and ethical research. With dedication and curiosity, let's unlock nature's secrets responsibly. We believe in your potential to make a meaningful impact.

Dr. Anjali Patil Gaikwad
President , GPGI

Biotechnology merges biology and technology to revolutionize healthcare, agriculture, and the environment. At our institution, we encourage curiosity, critical thinking, and collaboration. Pursue your scientific journey with passion and purpose. We are proud to support your aspirations and discoveries.

Dr.Sandeep Gaikwad Patil
Treasurer, GPGI

Biotechnology is more than a discipline—it is a mission to improve life. We applaud your pursuit of knowledge and encourage a spirit of discovery. With strong values and visionary thinking, we can achieve great things. Management wishes you success in all your academic endeavors.

ACADEMIC PATRONS

Dr. P.L. Naktode
Principal

In today's rapidly evolving world, biotechnology stands at the forefront of innovation, offering sustainable solutions to some of the most pressing challenges in healthcare, agriculture, and the environment. Our Department of Biotechnology has consistently demonstrated academic excellence, research innovation, and industry collaboration. The commitment of our faculty to quality education and the enthusiasm of our students towards learning and discovery are truly commendable.

Dr. Pragati Patil
Vice Principal

The Department of Biotechnology has consistently demonstrated excellence in both academics and research. Our faculty members are committed to nurturing innovative thinking and scientific curiosity in students, equipping them to meet the challenges of the 21st century in healthcare, agriculture, environmental sustainability, and industrial biotechnology.With a strong focus on interdisciplinary learning, industry interaction, and hands-on training, the department offers students a well-rounded education that bridges theory and practice.

Message from HOD Desk

Dr. Rohit Kalanake

HOD Biotechnology

Welcome to the Department of Biotechnology at Tukaramji Gaikwad Patil College of Engineering. Biotechnology is a dynamic and ever-evolving field that blends biological sciences with engineering technologies to address real-world challenges in healthcare, agriculture, environment, and industry.At our department, we are committed to nurturing inquisitive minds, fostering innovation, and promoting a strong foundation in both theory and practical applications. With a dedicated team of experienced faculty members, state-of-the-art laboratories, and an industry-oriented curriculum, we aim to empower our students with the knowledge and skills required for successful careers and research opportunities.We strongly encourage collaborative learning, interdisciplinary research, and participation in co-curricular and extracurricular activities. Our goal is not just to educate, but to inspire the next generation of biotechnologists to lead with integrity, creativity, and compassion..

Message from the Editorial Desk

Ms. Sakshi Zade
Chief Editor BT
Department of Biotechnology

Dear Readers, It gives me immense pleasure to present to you the latest edition of our Department of Biotechnology's technical magazine. This issue is a celebration of scientific curiosity, innovation, and the relentless pursuit of knowledge that defines our vibrant academic community. Biotechnology is a field that continues to evolve at a rapid pace, bridging science and technology to solve some of the most pressing challenges in health, agriculture, industry, and the environment. Through this magazine, we aim to showcase the diverse and pioneering work undertaken by our students, researchers, and faculty members. From original research articles and reviews to case studies and interviews, each contribution reflects the intellectual rigor and creative spirit that thrive within our department.This edition also features insights into recent technological advances, thought-provoking opinions, and highlights of departmental achievements. We hope it serves not only as a platform for sharing knowledge but also as an inspiration for aspiring biotechnologists to push the boundaries of science.We express our heartfelt gratitude to all the contributors, reviewers, and editorial team members whose hard work and dedication made this publication possible. We also thank our readers for their continued support and encouragement.

Message from the Student Editorial Desk

Ms. Sonal Borkar
Student Chief Editor
Department Of Biotechnology

It gives us immense pleasure to present the latest edition of our departmental technical magazine, a vibrant canvas that captures the innovative spirit, scientific curiosity, and academic excellence of the Biotechnology Department. This magazine is a reflection of the collective efforts of our budding biotechnologists who continue to explore, question, and contribute to the ever-evolving field of life sciences.Through this platform, we aim to showcase not only technical articles and research insights but also creative expressions that highlight the dynamic role of biotechnology in solving real-world problems. We extend our heartfelt thanks to all contributors, faculty mentors, and peers who made this publication possible. We hope this edition inspires readers to think beyond textbooks and engage deeply with the science that shapes our future.
Happy Reading!

Student Editorial Team
Department of Biotechnology

INDEX

Vision

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology, and Management.

Mission

- To strive for rearing standard and stature of the students by practicing high standards of professional ethics , transparency and accountability.
- To provide facilities and services to meet the challenges of Industry and Society.
- To facilitate socially responsive research, innovation and entrepreneurship.
- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To produce competent Scientists, Technologists, Entrepreneurs and Researchers in Biotechnology through quality education.

Mission of the Department

- Impart quality technical education and unique interdisciplinary experiences
- Undertake interdisciplinary research merging science and technology
- Shape biotechnological development under an ethical vision
- Inculcate professional responsibility based on social responsibilities

Program Specific Outcomes

Graduates will be able to

PSO 1: Ability to apply the acquired knowledge and recent techniques to come up with ideas in the domains of Bioprocess Engineering, Bioinformatics and Biopharmaceuticals.

PSO 2: Ability to utilize their proficiency and skills in solving real life problems in Diagnostics Genetic Engineering and Fermentation Technology using recent technologies.

PSO 3: Analyzing the impact of Biotechnology Engineering solutions in the societal and human context to create productive human resource for the country.

Program Outcomes

1.Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2.Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3.Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4.Conduct investigations of complex problems: Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5.Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and software tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

6.The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for, sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12.Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

About Biotechnology

Biotechnology is a fascinating and rapidly evolving field that combines biology with technology to develop innovative products and solutions for the benefit of society. At its core, biotechnology involves the use of living organisms, cells, and biological systems to create or improve products and processes in areas such as healthcare, agriculture, environment, and industry. From producing life-saving drugs like insulin and vaccines to genetically modifying crops for better yield and resistance, biotechnology touches many aspects of our daily lives. It also plays a key role in environmental conservation by developing biofuels and biodegradable materials and in detecting pollutants through biosensors. One of the most exciting aspects of biotechnology is its potential to address global challenges like food security, climate change, and disease outbreaks. With advances in genetic engineering, stem cell research, and bioinformatics, the possibilities for innovation are expanding rapidly. Biotechnology not only contributes to scientific progress but also opens up new opportunities for sustainable development and improved quality of life. As a multidisciplinary science, it brings together biology, chemistry, physics, mathematics, and engineering, making it a dynamic field for research, education, and career growth. In the coming years, biotechnology is set to transform the future with smarter, safer, and more sustainable technologies.

Faculty Details
Department of Biotechnology

S.No	Faculty Name	Qualification
1	Dr. Rohit Kalanake	Ph.D. (Chemical Engineering)
2	Dr. Sapna Lonare	Ph.D. (Biochemistry)
3	Prof. Anup Bagade	M.Tech. (Biotechnology)
4	Prof. Anuradha Khade	M.Sc. (Biotechnology)
5	Prof. Pundalik Sorte	M.Sc. (Microbiology)
6	Prof. Prajakta Arjapure	M.Sc. (Biotechnology)
7	Prof. Soham Deshpande	M.Sc. (Biotechnology)
8	Prof. Sakshi Zade	M.Sc. (Biotechnology)

FACULTY ARTICLES

Sr. No.	Faculty Name	Article Topic
1	Anuradha Khade	Recombinant DNA (rDNA) Technology: A Gateway to Modern Biotechnology
2	Sakshi Zade	CRISPR: Revolutionizing Genetic Engineering
3	Soham Deshpande	Stem Cell Technology: Unlocking the Future of Medicine
4	Anup Bagade	Bioprocess Equipment Design Technology
5	Dr. Rohit Kalanake	Mass Transfer Technology: Essential for Industrial Processes
6	Pundlik Sorte	Microbiology: Exploring the Invisible World

Recombinant DNA (rDNA) Technology: A Gateway to Modern Biotechnology
-Anuradha Khade

Recombinant DNA (rDNA) technology is a powerful tool that allows scientists to manipulate genetic material to create new DNA combinations. This technique involves cutting and joining DNA from different sources using enzymes like restriction endonucleases and DNA ligase. The recombinant DNA is then introduced into a host organism—commonly bacteria—to express the desired gene or produce valuable proteins.One of the major breakthroughs of rDNA technology was the production of human insulin by inserting the insulin gene into E. coli bacteria, making large-scale, affordable treatment possible for diabetic patients. Today, this technology is widely used in medicine (e.g., vaccines, hormones), agriculture (e.g., pest-resistant crops), and industry (e.g., enzyme production).rDNA technology not only enhances our understanding of gene function and expression but also holds tremendous promise for solving global challenges related to health, food, and the environment.

CRISPR: Revolutionizing Genetic Engineering
-Sakshi Zade

CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) is a groundbreaking tool in genetic engineering that enables precise editing of DNA in living organisms. Originally discovered as a natural defense mechanism in bacteria against viral infections, CRISPR has been adapted by scientists to target and modify specific genes with high accuracy. The CRISPR-Cas9 system, which uses the Cas9 enzyme guided by RNA to cut DNA at desired locations, has become the most widely used method due to its simplicity, efficiency, and cost-effectiveness. This technology has revolutionized research in fields such as medicine, agriculture, and biotechnology. It holds immense promise for treating genetic disorders like sickle cell anemia, cystic fibrosis, and certain cancers by correcting faulty genes at their source. In agriculture, CRISPR is used to develop crops with improved yield, disease resistance, and climate adaptability..

Stem Cell Technology: Unlocking the Future of Medicine
- Soham Deshpande

Stem cell technology is a revolutionary field in biotechnology that focuses on using stem cells to repair or replace damaged tissues and organs. Stem cells are unique because they have the ability to develop into different types of specialized cells in the body, such as muscle, nerve, or blood cells. This property makes them invaluable for regenerative medicine, where they can potentially heal diseases like Parkinson's, diabetes, and spinal cord injuries. Researchers also use stem cells to study disease mechanisms and test new drugs. While ethical challenges exist, ongoing advancements in stem cell technology hold great promise for transforming healthcare by offering new treatments that restore normal function and improve patients' quality of life.

Bioprocess Equipment Design Technology
-Anup Bagade

Bioprocess equipment design technology plays a crucial role in the development and optimization of systems used for large-scale production of biological products such as vaccines, enzymes, and biofuels. It involves designing and fabricating reactors, fermenters, mixers, and downstream processing units that provide the ideal environment for microbial or cell growth and product formation. Modern bioprocess equipment incorporates advanced materials, precise control systems, and automation to ensure optimal temperature, pH, oxygen transfer, and sterility conditions. Efficient design not only improves productivity and product quality but also reduces costs and energy consumption. As biotechnology advances, innovations in equipment design continue to enhance scalability and reproducibility, making bioprocessing more sustainable and commercially viable.

Mass Transfer Technology: Essential for Industrial Processes
-Dr. Rohit Kalnake

Mass transfer technology is a fundamental concept in chemical engineering and biotechnology that deals with the movement of mass from one location to another. This technology is crucial in processes where substances such as gases, liquids, or solids are separated, mixed, or transformed. Common examples include distillation, absorption, extraction, and drying.

In industries, mass transfer operations are used to purify chemicals, separate mixtures, and enhance reaction efficiencies. For example, in the pharmaceutical industry, mass transfer helps in extracting active ingredients and in fermentation processes. Similarly, in environmental engineering, it aids in pollution control by removing contaminants from air and water.

The technology[1] relies on principles like diffusion, convection, and phase equilibrium to optimize performance.

Microbiology: Exploring the Invisible World
- Pundlik Sorte

Microbiology is the branch of science that deals with the study of microscopic organisms such as bacteria, viruses, fungi, protozoa, and algae. Though invisible to the naked eye, these microorganisms play a crucial role in various aspects of life and the environment. Microbiologists explore how microbes live, grow, and interact with their surroundings, including their roles in disease, health, and ecological balance. Beneficial microbes are used in food production (like yogurt and cheese), medicine (such as antibiotics and vaccines), and biotechnology (like genetic engineering and waste treatment).

STUDENT ARTICLE

Sr. No.	Student Name	Article Topic
1	Arya Khedkar	CRISPR-Cas9: Revolutionizing Genetic Engineering
2	Swapnil Sonkusare	Organoids: Mini Organs for Research and Therapy
3	Tanushri Mirashe	Synthetic Biology: Engineering Life from Scratch
4	Divya Shirode	CAR-T Cell Therapy: A Personalized Cancer Treatment

CRISPR-Cas9: Revolutionizing Genetic Engineering
-Arya khedkar

CRISPR-Cas9 is a groundbreaking gene-editing technology that enables scientists to precisely alter DNA sequences in living organisms. Derived from a natural defense mechanism in bacteria, CRISPR-Cas9 uses a guide RNA to target specific genes and the Cas9 enzyme to cut DNA at the desired location. This allows for gene knockouts, insertions, or corrections, making it a powerful tool in medical research, agriculture, and biotechnology.One of the most exciting applications is in gene therapy, where CRISPR may correct genetic defects responsible for diseases like sickle cell anemia, cystic fibrosis, and even certain cancers. In agriculture, CRISPR can enhance crop yields, resist pests, and improve nutritional quality.

Organoids: Mini Organs for Research and Therapy
-Swapnil Sonkusare

Organoids are 3D miniaturized versions of organs grown in vitro from stem cells. They mimic the structure and function of real organs such as the brain, liver, or intestine. These biological models have transformed biomedical research by providing realistic platforms for studying disease mechanisms, drug testing, and regenerative medicine.Unlike traditional 2D cell cultures, organoids offer a more physiologically relevant environment. Scientists use them to model diseases like cancer, Alzheimer's, and COVID-19, enabling personalized medicine approaches. Organoids can also reduce reliance on animal testing, making research more ethical and efficient. In the future, they may serve as transplantable tissues to repair or replace damaged organs, though challenges in vascularization and scalability remain.

Synthetic Biology: Engineering Life from Scratch
-Tnushri Mirashe

Synthetic biology combines engineering principles with biology to design and construct new biological systems. It involves redesigning organisms for useful purposes by assembling standardized genetic parts. Applications range from biofuel production to biosensors and therapeutic microbes.For instance, scientists have created bacteria that can produce drugs like insulin or detect toxins in the environment. In agriculture, synthetic biology enables the development of nitrogen-fixing crops that require less fertilizer. The field also explores building synthetic cells or minimal genomes from scratch, pushing the boundaries of what constitutes life.However, synthetic biology raises biosafety and biosecurity concerns. Misuse could lead to harmful synthetic pathogens, emphasizing the need for strong ethical and regulatory oversight.

CAR-T Cell Therapy: A Personalized Cancer treatment
- Divya Shirode

Antigen Receptor T-cell (CAR-T) therapy is a personalized cancer treatment that modifies a patient's own T-cells to target and destroy cancer cells. T-cells are collected from the patient, genetically engineered to express CARs that recognize specific cancer antigens, and then reinfused into the body.CAR-T therapy has shown remarkable success in treating blood cancers like leukemia and lymphoma, with some patients achieving long-term remission. This therapy represents a significant advancement over traditional chemotherapy or radiation, offering targeted, immune-based treatment with fewer side effects.Current research aims to expand CAR-T therapy to treat solid tumors and make it more accessible and cost-effective.

REVIEW / RESEARCH PAPERS

Sr.No	First Author	Paper Topic	Journal Name
1	Sapna Lonare	Characterization of AICAR transformylase/IMP cyclohydrolase (ATIC) from Candidatus Liberibacter asiaticus	BBA - Proteins and Proteomics
2	Sakshi Zade	Mushroom-derived bioactive compounds: pharmacological properties and cancer targeting	Discover Oncology
3	Sohan Deshpande	The gut microbiome: an emerging epicenter of antimicrobial resistance	Frontiers in Microbiology
4	Sapna Lonare	Characterization of Cationic Amino Acid Binding Protein from Candidatus Liberibacter Asiaticus	The Protein Journal
5	Pundalik Sorte	Confocal Comprehensive Approach on Sewage Sludge Digestion and Stabilization	The Rubrics Journal of Interdisciplinary Studies
6	Sapna Lonare	Identification and evaluation of potential inhibitor molecules against TcyA	Journal of Structural Biology
7	Sapna Lonare	Comparative Analysis of Inhibitor Binding to Peroxiredoxins from Candidatus Liberibacter asiaticus and Citrus sinensis	Applied Biochemistry and Biotechnology

Faculty papers

BBA - Proteins and Proteomics 1872 (2024) 141015

Contents lists available at ScienceDirect

BBA - Proteins and Proteomics

journal homepage: www.elsevier.com/locate/bbapap

Characterization of AICAR transformylase/IMP cyclohydrolase (ATIC) bifunctional enzyme from *Candidatus* Liberibacer asiaticus

Sapna Lonare [1], Surabhi Rode [1], Preeti Verma, Shalja Verma, Harry Kaur, Md Shahid Alam, Padma Wangmo, Pravindra Kumar, Partha Roy, Ashwani Kumar Sharma*

Department of Biosciences and Bioengineering, Indian Institute of Technology Roorkee, Roorkee 247 667, India

ARTICLE INFO

Keywords:
Candidatus Liberibacer asiaticus
ATIC
AICAR transformylase
IMP cyclohydrolase
In silico study
Cell proliferation activity

ABSTRACT

The bifunctional enzyme, 5-aminoimidazole-4-carboxamide ribonucleotide (AICAR) transformylase/inosine monophosphate (IMP) cyclohydrolase (ATIC) is involved in catalyzing penultimate and final steps of purine de novo biosynthetic pathway crucial for the survival of organisms. The present study reports the characterization of ATIC from *Candidatus* Liberibacer asiaticus (CLasATIC) along with the identification of potential inhibitor molecules and evaluation of cell proliferative activity. CLasATIC showed both the AICAR Transformylase (AICAR TFase) activity for substrates, 10-f-THF (K_m 146.6 μM and V_{max} 0.95 μmol/min/mg) and AICAR (K_m 34.81 μM and V_{max} 0.56 μmol/min/mg) and IMP cyclohydrolase (IMPCHase) activity (K_m 1.81 μM and V_{max} 2.07 μmol/min/mg). The optimum pH and temperature were also identified for the enzyme activity. In-silico study has been conducted to identify potential inhibitor molecules through virtual screening and MD simulations. Out of many compounds, HNRSA, diosbulbin A and lepidine D emerged as lead compounds, exhibiting higher binding energy and stability for CLasATIC than AICAR. ITC study reports higher binding affinities for HNRSA and diosbulbin A (Kd, 12.3 μM and 34.2 μM, respectively) compared to AICAR (Kd, 83.4 μM). Likewise, DSC studies showed enhanced thermal stability for CLasATIC in the presence of inhibitors. CD and Fluorescence studies revealed significant conformational changes in CLasATIC upon binding of the inhibitors. CLasATIC demonstrated potent cell proliferative, wound healing and ROS scavenging properties evaluated by cell-based bioassays using CFIO cells. This study highlights CLasATIC as a promising drug target with potential inhibitors for managing CLas and its unique cell protective, wound-healing properties for future biotechnological applications.

1. Introduction

Despite the significant diversity observed in various life forms ranging from viruses and bacteria to humans, nucleotides remain the universal energy currency for all living systems. Nucleotides are the building blocks of nucleic acids and play an essential role in regulating metabolism. Two kinds of pathways are involved in the biosynthesis of nucleotides: de novo and salvage pathways. The salvage pathway recovers the bases and nucleosides formed during the degradation of RNA and DNA. De novo synthesis is the main pathway required for the formation of inosine monophosphate (IMP) from simple molecule precursors [1] and comprises ten steps in higher organisms. The final two steps are catalyzed by a single polypeptide bifunctional enzyme, 5-Aminoimidazole-4-carboxamide ribonucleotide transformylase/inosine monophosphate cyclohydrolase (ATIC), also known as *purH1* [2]. The penultimate step is catalyzed by 5-aminoimidazole-4-carboxamide ribonucleotide (AICAR) transformylase (AICAR TFase) which transfers the formyl group from the cofactor, (6R) N10-formyl-tetrahydrofolate (10-f-THF) to the exocyclic 5-amino group of AICAR to form 5-formyl-AICAR (FAICAR). Further intermolecular ring cyclization of FAICAR to form the end product IMP is carried out by inosine monophosphate cyclohydrolase (IMPCHase) in the last step of the pathway. Because of its critical role, it is not only an antibacterial or antiviral target but also a potential target for developing anticancer therapeutics [3,4]. Many studies have focused on designing inhibitors against ATIC. Notable findings include the identification of CFAIR as a potent inhibitor of IMPCHase in *Mycobacterium tuberculosis* [5]. Furthermore, two antifolates, BW2315 and BW1540, exhibit selectivity for human ATIC over other folate-dependent enzymes [3]. Also, NSC30171 had shown inhibition against human AICAR transformylase [6]. Similarly, a study

* Corresponding author.
E-mail address: akshrdbt@iitr.ac.in (A.K. Sharma).
[1] The two authors have contributed equally and share the first authorship.

https://doi.org/10.1016/j.bbapap.2024.141015
Received 7 February 2024; Received in revised form 23 March 2024; Accepted 9 April 2024
Available online 12 April 2024
1570-9639/

Discover Oncology

Review

Mushroom-derived bioactive compounds pharmacological properties and cancer targeting: a holistic assessment

Sakshi Zade[1] · Tarun Kumar Upadhyay[1] · Safia Obaidur Rab[2] · Amit Baran Sharangi[2] · Sorabh Lakhanpal[4] · Nadiyah M. Alabdallah[5,6] · Mohd Saeed[7]

Received: 13 November 2024 / Accepted: 11 April 2025
Published online: 02 May 2025

Abstract
Worldwide, cancer is a great cause of death and a public health issue. Cancer has been the leading cause of death in developing nations for many years. Cancers are typically treated with surgery, immunotherapy, chemotherapy, and radiation therapies. However, these techniques have some undesirable side effects, including neurological illness, high toxicity levels, discomfort, and mental stress. Biologically active compounds discovered in mushrooms may be utilized to reduce ill effects and increase the efficacy of the current therapies. Mushrooms have efficient therapeutic activities such as antimicrobial, antitumor, antidiabetic, anticancer, and antioxidant activity. Bioactive compounds like polysaccharides, terpenoids, β-glucan, steroids, polyphenols, flavonoids, proteins, and peptides have precisely well-recognized anticancer activity. In this review paper, we described the biomedical activities of the mushroom against various cancers. The immune-modulating components in mushrooms activate NK cells and macrophages to target cancer cells. Due to immunomodulatory properties of mushroom-derived bioactive compounds in cancer therapy to highlight the need for further research in this area further studies needs to validate in clinical samples.

Keywords Mushrooms · Cancer · Antioxidant · Anti-tumor · Bioactive compounds

1 Introduction

Cancer is a major public health hazard affecting the entire human beings worldwide especially in recent times. In 2022, the United States anticipated to record 1,918,030 new cancer cases and 609,360 cancer deaths, particularly lung cancer, the main cause of cancer death, resulting in nearly 350 deaths each day [1]. The most probable cause is cancer due to global mortality, cancer accounts for one out of every six fatalities [2]. In males, the greatest cause of death is due to the lung, prostate, and colorectum whereas lung, breast, and colorectum are the common causes of death in women [1]. Novel medical technologies and synthetic medications have advanced our approach to

✉ Tarun Kumar Upadhyay, tarun_bioinfo@yahoo.co.in; Safia Obaidur Rab, srab@kku.edu.sa; Amit Baran Sharangi, profabsbckv@gmail.com; Sorabh Lakhanpal, sorabh.lakhanpal@lpu.co.in; Mohd Saeed, mo.saeed@uoh.edu.sa | [1]Department of Biotechnology, Parul Institute of Applied Sciences and Research and Development Cell, Parul University, Vadodara 391760, Gujarat, India. [2]Department of Clinical Laboratory Sciences, College of Applied Medical Science, King Khalid University, Abha, Saudi Arabia. [3]Department of Plantation, Spices, Medicinal and Aromatic Crops, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, West Bengal, India. [4]School of Pharmaceutical Sciences, Lovely Professional University, Phagwara 144401, India. [5]Department of Biology, College of Science, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, 31441 Dammam, Saudi Arabia. [6]Basic & Applied Scientific Research Centre, Imam Abdulrahman Bin Faisal University, P.O. Box 1982, 31441 Dammam, Saudi Arabia. [7]Department of Biology, College of Science, University of Hail, Hail, Saudi Arabia.

Discover Oncology (2025) 16:654 | https://doi.org/10.1007/s12672-025-02371-z

Discover

frontiers | Frontiers in Microbiology

TYPE Review
PUBLISHED 20 May 2025
DOI 10.3389/fmicb.2025.1593065

Check for updates

OPEN ACCESS

EDITED BY
Avinash Karpe,
Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia

REVIEWED BY
Selvaraj Anthonymuthu,
University of California, Irvine, United States
Noble K. Kurian,
B. S. Abdur Rahman Crescent Institute of Science and Technology, India

*CORRESPONDENCE
Vinothkannan Ravichandran
vinothbt@gmail.com;
pravichandran@mum.amity.edu
Adline Princy Solomon
adlineprincy@saastra.ac.in

†These authors have contributed equally to this work

RECEIVED 14 March 2025
ACCEPTED 29 April 2025
PUBLISHED 20 May 2025

CITATION
Deshpande SP, Sujith S, Jobby R, Rajasekharan SK, Ravichandran V and Solomon AP (2025) The gut microbiome: an emerging epicenter of antimicrobial resistance?
Front. Microbiol. 16:1593065.
doi: 10.3389/fmicb.2025.1593065

The gut microbiome: an emerging epicenter of antimicrobial resistance?

Soham Pravin Deshpande[1†], Swathi Sujith[2†], Renitta Jobby[1,3], Satish Kumar Rajasekharan[4], Vinothkannan Ravichandran[1,3,5*] and Adline Princy Solomon[2*]

[1]Amity Institute of Biotechnology, Amity University Maharashtra, Mumbai, India, [2]Quorum Sensing Laboratory, Centre for Research in Infectious Diseases (CRID), School of Chemical and Biotechnology, SASTRA Deemed to be University, Thanjavur, India, [3]Amity Centre of Excellence in Astrobiology, Amity University Maharashtra, Mumbai, India, [4]Department of Biotechnology, School of Bioengineering, SRM Institute of Science and Technology, Chennai, India, [5]Amity Centre of Excellence in Drug Discovery and Development, Amity University Maharashtra, Mumbai, India

The human gut is one of the most densely populated microbial environments, home to trillions of microorganisms that live in harmony with the body. These microbes help with digestion and play key roles in maintaining a balanced immune system and protecting us from harmful pathogens. However, the crowded nature of this ecosystem makes it easier for harmful bacteria to acquire antimicrobial resistance (AMR) genes, which can lead to multidrug-resistant (MDR) infections. The rise of MDR infections makes treatments harder, leading to more extended hospital stays, relapses, and worse outcomes for patients, ultimately increasing healthcare costs and environmental strain. Since many MDR infections are challenging to treat, nosocomial infection control protocols and infection prevention programmes are frequently the only measures in our hands to stop the spread of these bacteria. New approaches are therefore urgently required to prevent the colonization of MDR infections. This review aims to explore the current understanding of antimicrobial resistance pathways, focusing on how the gut microbiota contributes to AMR. We have also emphasized the potential strategies to prevent the spread and colonization of MDR infections.

KEYWORDS
gut microbiome, antimicrobial resistance, multidrug resistance, screening of AMR, microbiome

1 Introduction

The gut microbiome, a complex ecosystem in the gastrointestinal tract, harbours trillions of commensals, symbiotic organisms, including bacteria, viruses, fungi, archaea, and eukaryotes. These organisms contribute intestinal integrity, immunity, metabolism, digestion, mental health, and pathogen defence to the host (Anto and Blesso, 2022; Lane and Yadav, 2020). The microbial composition of each individual is unique and stable, but the significant phyla remain the same, and an individual will conserve over 60% of the gut microbial phylotypes for 2 years (Manichanh et al., 2010). The microbiome encodes nearly three million genes that produce hundreds of metabolites, outnumbering the roughly 23,000 genes in the host genome (Valdes et al., 2018). However, this ecosystem can serve as a reservoir and epicenter for developing antimicrobial resistance (AMR).

AMR, a global health concern of since the mid-20th century, is the development of resistance by microorganisms to the antimicrobial medications that are used to treat them, reducing clinical efficacy and increasing treatment costs (Pendere et al., 2013; Perelman et al., 2015). Since antibiotics are not pathogen-specific and are prescribed to treat infections leading to overdose,

The Protein Journal
https://doi.org/10.1007/s10930-024-10233-w

Check for updates

Characterization of Cationic Amino Acid Binding Protein from *Candidatus* Liberibacter Asiaticus and in Silico Study to Identify Potential Inhibitor Molecules

Sapna Lonare[1] · Deena Nath Gupta[1] · Harry Kaur[1] · Surabhi Rode[1] · Shalja Verma[1] · Mrugendra Gubyad[2] · Dilip Kumar Ghosh[2] · Pravindra Kumar[1] · Ashwani Kumar Sharma[1]

Accepted: 2 September 2024

Abstract
Cationic amino acid binding protein (CLasArgBP), one of the two amino acid binding receptor in *Candidatus* Liberibacter asiaticus (CLas), is predominately expressed in citrus psyllids as a part of ATP-binding cassette transport system. The present study describes characterization of CLasArgBP by various biophysical techniques and in silico study, to identify potential inhibitor molecules against CLasArgBP through virtual screening and MD simulations. Further, *in planta* study was carried out to assess the effect of selected inhibitors on Huanglongbing infected Mosambi plants. The results showed that CLasArgBP exhibits pronounced specificity for arginine, histidine and lysine. Surface plasmon resonance (SPR) study reports highest binding affinity for arginine (Kd, 0.14 μM), compared to histidine and lysine (Kd, 15 μM and 26 μM, respectively). Likewise, Differential Scanning Calorimetry (DSC) study showed higher stability of CLasArgBP for arginine, compared to histidine and lysine. N(omega)-nitro-L-arginine, Gamma-hydroxy-L-arginine and Gigartinine emerged as lead compounds through in silico study displaying higher binding energy and stability compared to arginine. SPR reports elevated binding affinities for N(omega)-nitro-L-arginine and Gamma-hydroxy-L-arginine (Kd, 0.038 μM and 0.061 μM, respectively) relative to arginine. DSC studies showed enhanced thermal stability for CLasArgBP in complex with selected inhibitors. Circular dichroism and fluorescence studies showed pronounced conformational changes in CLasArgBP with selected inhibitors than with arginine. *In planta* study demonstrated a substantial decrease in CLas titer in treated plants as compared to control plants. Overall, the study provides the first comprehensive characterization of cationic amino acid binding protein from CLas, as a potential drug target to manage HLB disease.

Keywords Huanglongbing · *Candidatus* Liberibacter asiaticus · Cationic amino acid binding protein · Surface plasmon resonance · Differential scanning calorimetry · TaqMan-qPCR

1 Introduction

ATP-binding cassette (ABC) transporters, one of the largest protein family are found in all living organisms, from microorganisms to human beings. They facilitate the uptake of nutrients and elimination of waste and toxins [1]. Bacterial ABC transporters comprise transmembrane and solute binding domains. They enable unidirectional transportation of extracytosolic molecules into the cytoplasm against their concentration gradient by the hydrolysis of ATP molecule. ABC importers along with the solute binding protein (SBP) transport small molecules like amino acids, sugars, peptides, vitamins, etc. into the cell [2]. Amino acids play critical roles in key biological processes such as protein synthesis, respiration, cell wall production, etc. Given the importance of amino acids in bacterial growth and survival, meticulous regulation of amino acid transport across cellular membranes is critical for maintaining precise control over amino acid homeostasis [3]. Crystal structures of related ABC transporter amino acid binding proteins, exhibiting diverse

✉ Ashwani Kumar Sharma
ashwani.sharma@bt.iitr.ac.in; akshrdbt@yahoo.co.in

[1] Department of Biosciences and Bioengineering, Indian Institute of Technology Roorkee, Roorkee 247667, India
[2] Plant Virology Laboratory, ICAR Central Citrus Research Institute, Nagpur, India

Published online: 21 September 2024

Springer

THE RUBRICS JOURNAL OF INTERDISCIPLINARY STUDIES
International, Indexed and Peer Reviewed e-Journal
ISSN 2454–1974
THE RUBRICS
Journal of Interdisciplinary Studies
Volume 7 Issue 2 March 2025
www.therubrics.in

Confocal Comprehensive Approach on Sewage Sludge Digestion and Stabilization: A Review

[1]Pundalik Sorte, [*2]Pratik Bezalwar, [3]Avinash Chakinarpuwar, [4]Sharad Lakhekar, [5]Mahendra Akkalwar and [6]Shivaji Falke

[1,2,3,4]Chintamani College of Arts and Science Gondpipri Dist. Chandrapur (MS), India.
[6]Rajiv Vidnyan Va Vanijya Mahavidyalaya Zari-Jamani Dist. Yavatmal (MS), India.

Abstract:

The production of sewage sludge (biosolids) is rapidly rising as a result of global industrialization, urbanization, and population growth. To lessen the adverse effects of its application or disposal, the sludge must be properly handled and managed environmentally. The various uses of sewage sludge for sustainable agriculture are the focus of this review. With an emphasis on the beneficial applications of sewage sludge or biosolids, the dispersed literature is used to critically evaluate the applications of biosolids to support sustainable practices. Sewage sludge, also known as biosolids, is a result of effluent treatment facilities, sewage effluent, and municipal wastewater. Global urbanization, population growth, and industry are all contributing to a sharp increase in the creation of sewage sludge, or biosolids. The sludge must be treated and managed environmentally to minimize the negative impacts of its application or disposal. This review focuses on the different applications of sewage sludge for sustainable agriculture. The scattered literature is utilized to critically assess the uses of biosolids to support sustainable practices, with a focus on the advantageous applications of sewage sludge or biosolids. Municipal wastewater, sewage effluent, and effluent treatment plants all produce sewage sludge, also referred to as biosolids. The various uses and potential drawbacks of using biosolids or sewage sludge as a resource are thus highlighted in this review. To increase the viability of such uses, attempts have been undertaken to pretreat sewage sludge or biosolids. Therefore, in order to formulate biosolids or sewage sludge as a resource for sustainable development, the present review has explored various features of these materials, their applications, and potential constraints.

Keywords: *Sewage Sludge, Sustainable Practices, Sewage Treatment*

Journal of Structural Biology 215 (2023) 107992
Contents lists available at ScienceDirect
Journal of Structural Biology
journal homepage: www.elsevier.com/locate/yjsbi

Research Article

Identification and evaluation of potential inhibitor molecules against TcyA from *Candidatus* Liberibacter asiaticus

Sapna Lonare [a], Monica Sharma [a], Vikram Dalal [a], Mrugendra Gubyad [b], Pranav Kumar [a], Deena Nath Gupta [a], Akshay Pareek [a], Shailly Tomar [a], Dilip Kumar Ghosh [b], Pravindra Kumar [a], Ashwani Kumar Sharma [a,*]

[a] Department of Biosciences and Bioengineering, Indian Institute of Technology Roorkee, Roorkee-247667, India
[b] Plant Virology Laboratory, ICAR Central Citrus Research Institute, Nagpur, India

ARTICLE INFO

Keywords:
Huanglongbing
Candidatus Liberibacter asiaticus
X-ray crystallography
Surface plasmon resonance
TaqMan-qPCR

ABSTRACT

Of the two putative amino acid binding periplasmic receptors of ABC transporter family in *Candidatus* Liberibacter asiaticus (CLas), cystine binding receptor (CLasTcyA) has been shown to mainly express in phloem of citrus plant and is a target for inhibitor development. The crystal structure of CLasTcyA in complex with substrates has been reported earlier. The present work reports the identification and evaluation of potential candidates for their inhibitory potential against CLasTcyA. Among many compounds, selected through virtual screening, and MD simulation, pimozide, clidinium, sulfisoxazine and folic acid showed significantly higher affinities and stability in complex with CLasTcyA. The SPR studies with CLasTcyA revealed significantly higher binding affinities for pimozide and clidinium (Kd, 2.73 nM and 70 nM, respectively) as compared to cystine (Kd, 1.26 μM). The higher binding affinities could be attributed to significantly increased number of interactions in the binding pocket as evident from the crystal structures of CLasTcyA in complex with pimozide and clidinium as compared to cystine. The CLasTcyA possess relatively large binding pocket where bulkier inhibitors fit quite well. *In planta* studies, carried out to assess the effect of inhibitors on HLB infected Mosambi plants, showed significant reduction in CLas titre in plants treated with inhibitors as compared to control plants. The results showed that pimozide exhibited higher efficiency as compared to clidinium in reducing CLas titre in treated plants. Our results showed that the inhibitor development against critical proteins like CLasTcyA can be an important strategy in management of HLB.

1. Introduction

Citrus greening, often known as Huanglongbing (HLB), is the most devastating disease of citrus family plants in the world. It is caused by an unculturable phloem-restricted Gram-negative bacterium, *Candidatus* Liberibacter asiaticus (CLas). The CLas is transmitted by the Asian citrus psyllid, *Diaphorina citri*. CLas is the most widespread and virulent strain (Bove, 2006) that affects citrus plants. The infected plants gradually develop the symptoms such as yellow leaves, twig dieback, premature defoliation, and fruit abortion followed by eventual death of plants (Bove, 2006). CLas infection causes callose accumulation in the phloem, which indicates that many HLB symptoms may be caused by impaired phloem transport (Koh et al., 2012). The current management strategies include treating the plants with insecticides, biologically and chemically controlling the psyllid population and removing the infected plants. However, these strategies are unable to stop the spread of HLB (Duan et al., 2009). Therefore, it is necessary to develop an effective strategy to control and manage the HLB disease. The most potential strategies to control HLB disease might be to develop potential inhibitor molecules against essential proteins of CLas, critical for the survival of bacteria (Duan et al., 2009).

ABC transporter protein families are present from microorganisms to human beings (Dassa et al., 1999). They play an important role in transporting the solute across the cell membrane and hence are target for inhibitor development. CLas genome analysis showed the presence of two putative amino acid binding proteins belonging to ABC transporter family. Of the two, one is specific for cationic amino acid binding protein while other is for putative cystine binding protein. The studies showed

* Corresponding author.
E-mail address: ashwani.sharma@bt.iitr.ac.in (A. Kumar Sharma).

https://doi.org/10.1016/j.jsb.2023.107992
Received 20 March 2023; Received in revised form 19 June 2023; Accepted 29 June 2023
Available online 30 June 2023

Applied Biochemistry and Biotechnology (2024) 196:5334–5353
https://doi.org/10.1007/s12010-023-04798-y

ORIGINAL ARTICLE

Check for updates

Comparative Analysis of Inhibitor Binding to Peroxiredoxins from *Candidatus* Liberibacter asiaticus and Its Host *Citrus sinensis*

Deena Nath Gupta[1] · Sapna Lonare[1] · Ruchi Rani[1] · Ankur Singh[1] · Dilip Kumar Ghosh[2] · Shailly Tomar[1] · Ashwani Kumar Sharma[1]

Accepted: 9 December 2023 / Published online: 29 December 2023

Abstract

The peroxiredoxins (Prxs), potential drug targets, constitute an important class of antioxidant enzymes present in both pathogen and their host. The comparative binding potential of inhibitors to Prxs from pathogen and host could be an important step in drug development against pathogens. Huanglongbing (HLB) is a most devastating disease of citrus caused by *Candidatus* Liberibacter asiaticus (CLa). In this study, the binding of conoidin-A (conoidin) and celastrol inhibitor molecules to peroxiredoxin of bacterioferritin comigratory protein family from CLa (CLaBCP) and its host plant peroxiredoxin from *Citrus sinensis* (CsPrx) was assessed. The CLaBCP has a lower specific activity than CsPrx and is efficiently inhibited by conoidin and celastrol molecules. The biophysical studies showed conformational changes and significant thermal stability of CLaBCP in the presence of inhibitor molecules as compared to CsPrx. The surface plasmon resonance (SPR) studies revealed that the conoidin and celastrol inhibitor molecules have a strong binding affinity (K_D) with CLaBCP at 33.0 μM, and 18.5 μM as compared to CsPrx at 52.0 μM and 61.6 μM, respectively. The docked complexes of inhibitor molecules showed more structural stability of CLaBCP as compared to CsPrx during the run of molecular dynamics-based simulations for 100 ns. The present study suggests that the conoidin and celastrol molecules can be exploited as potential inhibitor molecules against the CLa to manage the HLB disease.

Keywords Peroxiredoxins · Inhibitor molecules · Circular dichroism · Differential scanning calorimetry · Surface plasmon resonance · Molecular dynamics simulations

NATIONAL LEVEL EVENT

BIOFUSION 2025

Aim:

The aim of **BIOFUSION–2K25** was to promote creativity, innovation, research aptitude, scientific thinking, and technical skills among undergraduate and postgraduate students from multidisciplinary fields like Life Sciences, Biotechnology, Microbiology, Biochemistry, Pharmacy, and Engineering

Program details

The **Department of Biotechnology** organized **BIOFUSION–2K25**, a National Level Technical Event, on **18th April 2025** at **TGPCET, Nagpur**. The event attracted UG and PG students from Biotechnology, Life Sciences, Microbiology, Biochemistry, Pharmacy, and Engineering. It commenced with **ceremonial lamp lighting** and a **soulful prayer**. **Dr. Milind Shinkhede**, Vice Principal of Dada Ramchandra Bhakru Sindhu Mahavidyalaya, graced the occasion as Chief Guest and delivered an inspiring inaugural address. **Dr. P. L. Naktode**, Principal, TGPCET, gave the opening remarks, highlighting the importance of research and innovation. The event featured activities like **Paper Presentation**, **Model Mania**, **Idea Pitching**, **E-Sport, poster presentation** and **Agar Art**, fostering creativity and scientific thinking.

Objectives of program:

- To cultivate and showcase students' research, innovation, and scientific communication skills.
- To promote interdisciplinary learning through technical competitions.
- To encourage collaboration, critical thinking, and real-world problem-solving among students.
- To bridge academic learning with practical applications through creative competitions.

Some glimpse :

Successful BIOFUSION 2K25

NATIONAL SCIENCE DAY

Aim

The primary aim of the National Science Day event was to **foster scientific awareness and creativity among students by encouraging them to explore and express key concepts in biotechnology through handmade poster.**

Program details

National Science Day is celebrated every year in India to commemorate the discovery of the *Raman Effect* by the great Indian physicist Sir C.V. Raman. This year, the Department of Biotechnology at Tulsiramji Gaikwad-Patil College of Engineering and Technology organized a special event on **8th March 2025** to mark the occasion with the theme **"Biotechnology for a Sustainable Future.**

Objectives of program:

a) To promote awareness about the importance of science and biotechnology in everyday life
b) To provide a platform for students to express their scientific knowledge creatively
c) To inspire young minds toward research and innovation in the field of biotechnology

Winners of National Science Day

STUDENTS PARTICIPATION/ACHIEVEMENTS

VISVESVARAYA NATIONAL INSTITUTE OF TECHNOLOGY, NAGPUR

JANJATIYA GAURAV VARSH (JJGV) CELELBRATION 2025

CERTIFICATE OF ACHIEVEMENT

This certificate is awarded to Ms. DISHA ANIL WATH *for the outstanding achievement in* POSTER COMPETITION (2nd) on 20/01/2025. *Your dedication, hardwork, and commitment to excellence have made a significant impact, and we are proud to recognize your accomplishments.*

Dr. Ajit P. Rathod
Nodal officer

Dr. Ratnesh Kumar
Dean (Students Welfare)

Disha wath secured 2nd prize at VNIT in poster competition

Winner of National science day

Oral poster presentation at Bagalkot, Karnataka

International conference attended by 8th semester students at Bagalkot, Karnataka

BIOFUSION 2K25

Glimpse of BIOFUSION 2K25

Dr. Kiran Bhuyar presented the prizes to the winners.

MEDIA COVERAGE

LOKMAT TIMES

Guest lecture on cotton devp and improvement organised

Nagpur: The Department of Biotechnology of TGPCET organised a guest lecture on Cotton Improvement and the Development of Transgenic Cotton on the occasion of National Science Day 2K25.

The lecture was delivered by Dr. Rakesh Kumar, Senior Scientist, ICAR-Central Institute of Cotton Research. During the session, Dr. Rakesh Kumar explained the history of Bt cotton, how Bt cotton was developed, and the role of Agrobacterium tumefaciens in gene transfer for creating genetically modified cotton plants.

Following the lecture, a Poster Presentation Competition was also organized. Dr. Kalpit Kausare served as the Internal Judge, and Dr. Rakesh Kumar was the External Judge.

A guest speaking on cotton improvement.

A total of 21 posters were presented by students, covering various biotechnology-related topics. The winners were Disha and Group, Rutika and Group and Swapnil and Group.

Nagpur First
Page No. 4 Mar 22, 2025
Powered by: epaper.com

Hand On Training on Molecular Biology Techniques

by Khabarbat™ — February 25, 2025 in Education

Guest Lecture on Recent Trends in Animal Tissue Culture Organized at Tulsiramji Gaikwad-Patil College

by Khabarbat™ — February 6, 2025

Guest Lecture on Recent Trends in Animal Tissue Culture Organized at Tulsiramji Gaikwad-Patil College

'बायाफ्यूजन–2K25' राष्ट्राय ताात्रक कायक्रमाच TGPCET, नागपूर येथे यशस्वी आयोजन

by Khabarbat™ — May 23, 2025 in Education, local News

Guest Lecture on 3D Printing and Innovative Product Development

by Khabarbat™ — February 25, 2025 in Education, Vidarbha

DEPARTMENT SOCIAL MEDIA

- **Instagram**

biotechnology.tgpcetofficial

- **Facebook**

https://www.facebook.com/profile.php?id=61557353055089 5&mibextid=rS40aB7S9Ucbxw6v

- **YouTube**

https://youtube.com/@biotechnology.tgpcetofficial?si=AzfDMQEpv6dTCV8q