BIOENGINEERING AND BIOTECHNOLOGY CLUB OF CBIT

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY TM
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1979

DEPARTMENT OF BIOTECHNOLOGY

VOLUME - 2
2023-24

BIOPULSE

- THE PULSE OF PROGRESS IN BIOTECHNOLOGY

Department Vision and Mission

Department Vision

To excel in education, research, and entrepreneurship in various fields of Biotechnology for contribution to the evolving needs of the society

Department Mission

- To provide an excellent educational experience to the undergraduate students of Biotechnology through quality teaching and advanced curriculum with roots into the fundamentals, that enables students to become leaders in their chosen field of Biotechnology
- To provide vibrant learning and research environment that enables students to focus on lifelong learning to transform into entrepreneurs and renowned researchers
- To instill the spirit of innovation and creativity in young minds through participation in International and National level conferences/hackathons combined with a deep awareness of ethical responsibilities to profession and society

Programs Offered

B.Tech.
The program is designed to suit the needs of the young technology graduates looking to make a mark in a highly competitive market.

Placements
CBIT's Biotech students, riding on the back of the knowledge and skills acquired during the 4 years spent at the campus, have found placement in a number of big companies. These firms include IT giants like Wipro, Tech Mahindra, CTS, and Infosys along with major firms from other sectors, like Biological E. Limited, Deloitte, and Dr. Reddy's.

Students got placed in various companies like Dr. Reddy's Lab, Capgemini, Accenture, Generation Cognizant, Wipro, MuSigma, TCS, Winred Technologies etc.

Department Vision and Mission

B.Tech. (Biotechnology) Program Educational Objectives (PEOs)

The Biotechnology department is dedicated to graduating engineers who

- will demonstrate successful careers in the industry through scientific thinking, interpreting, analyzing experimental results, and pursue higher education, and research in reputed national and international institutes.
- will demonstrate leadership and initiative to advance professional and organizational goals with a commitment to ethical standards of profession, teamwork, and respect for the diverse cultural background.
- will be involved in lifelong /self-learning to keep abreast with the constantly evolving technologies for establishing start-ups and becoming successful entrepreneurs.
- will be committed to the creative practice of engineering and other professions in a responsible manner contributing to the socio-economic development of the society.

B.Tech. (Biotechnology) Program Outcomes (POs)

1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, 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 public health and safety, and 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 IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.
6. The Engineer and Society: Apply to reason 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 Teamwork: 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 the 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 own 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 life-long learning in the broadest context of technological change.

Principal's Message

Dr. C. V. Narasimhulu

Professor and Principal of CBIT

Dear all,

It is with immense pride and pleasure that I welcome you to **Chaitanya Bharathi Institute of Technology (CBIT)**, one of India's premier institutions and a beacon of excellence in technical education. Established in the year **1979**, CBIT has grown to become the pride of both Telugu States, fostering a rich legacy of academic distinction, research excellence, and holistic development.

As an autonomous institution, CBIT is dedicated to achieving its vision of becoming a "Centre of Excellence in Technical Education and Research." Our commitment to academic rigor and innovation is reflected in our consistent recognition, including **NBA accreditation (secured seven times since 1998) and NAAC A++ accreditation (Cycle 3, 2023)**. With a state-of-the-art campus, cutting-edge infrastructure, and a highly experienced faculty, CBIT ensures that students receive quality education that aligns seamlessly with the ever-evolving challenges of Industry 5.0.

Our meticulously designed curriculum integrates key educational frameworks, including AICTE guidelines, the National Education Policy (NEP-2020), and Outcome-Based Education (OBE). This robust academic structure encourages creativity, innovation, critical thinking, and problem-solving skills, ensuring that our students emerge as future-ready professionals.

At CBIT, we recognize that education extends beyond the classroom. We take immense pride in fostering an ecosystem that nurtures entrepreneurial aspirations and industry collaboration. Our **Entrepreneur Development Centre (EDC), start-up incubation initiatives, and strong industry linkages** empower students to translate ideas into impactful innovations. With abundant opportunities for top-tier placements, research endeavors, patent filings, and leadership development, CBIT provides a dynamic platform for students to explore and excel in their chosen fields.

Furthermore, with **56+ vibrant student activity clubs**, we promote holistic learning, ensuring that students not only thrive academically but also develop essential life skills, leadership qualities, and a strong sense of social responsibility.

As an institution committed to pragmatic and outcome-driven education, I emphasize the **"5Ps"—Placements, Publications, Projects, Patents, and Participatory Administration**. These guiding pillars serve as a foundation for our collective growth and success.

I encourage each of you to actively engage in the myriad opportunities available at CBIT, contribute to our rich legacy, and strive for excellence in all your endeavors. Together, let us shape a future of innovation, knowledge, and leadership.

Wishing you an enriching, fulfilling, and joyful learning experience at CBIT!

HOD's Message

Dr. Ashoutosh Panday,
Professor and HOD , Department of Biotechnology, CBIT

Welcome to the Department of Biotechnology at CBIT!

Established in the year 2005, the Department of Biotechnology at Chaitanya Bharathi Institute of Technology (CBIT) has been at the forefront of providing exceptional education, pioneering research, and hands-on training in diverse and evolving domains of biotechnology. With a strong commitment to academic excellence and innovation, we equip our students with cutting-edge knowledge and practical expertise in core disciplines such as **Plant, Animal, Industrial, Environmental, and Medical Biotechnology**, alongside specialized fields like **Computational Biology and Bioprocess Engineering.**

Recognizing the interdisciplinary nature of biotechnology and its far-reaching applications, our department has embraced modern, transformative domains that are shaping the future of the industry. These include **Biomaterials, Tissue Engineering, Biosimilars, Drug Design & Delivery, Nanobiotechnology, and Structural Biology.** Our focus on advanced analytical instrumentation and emerging technologies bridges the crucial gap between academic research and industrial application, ensuring that our students remain at the forefront of scientific advancements.

To foster experiential and participatory learning, our students gain firsthand exposure to the real-world biotechnology landscape through visits to prestigious research organizations and industry leaders such as **CSIR-CCMB, IICT, CDFD, NIAB, Dr. Reddy's Laboratories, and IISc Bangalore.** These immersive experiences enable students to engage with cutting-edge research, interact with industry professionals, and understand the latest technological innovations.

Beyond academics, our department places a strong emphasis on **career development and leadership growth**. Students benefit from a dynamic ecosystem of **industry internships, research collaborations, national and international seminars, technical workshops, club activities, and career fairs.** These opportunities not only enhance their technical competencies but also cultivate critical thinking, problem-solving, and entrepreneurial skills essential for thriving in the biotechnology industry.

Furthermore, we take immense pride in our faculty and students' active participation in societal and environmental initiatives. Through **sustainable research, community-driven projects, and entrepreneurial ventures**, our department remains steadfast in its mission to create a positive impact on the world. By nurturing a spirit of innovation, ethical responsibility, and scientific inquiry, we empower our students to become future leaders, researchers, and entrepreneurs who drive meaningful change in biotechnology and beyond.

At the Department of Biotechnology, CBIT, we are dedicated to fostering a **culture of excellence, curiosity, and transformative learning**. We invite you to embark on this exciting journey of discovery and innovation with us and become a part of a community that is shaping the future of biotechnology.

Wishing you a rewarding and enriching academic experience!

Importance of the Bioengineering and Biotechnology Club of CBIT (BBCC)

In a time when biotechnology is transforming healthcare, sustainability, and industry, the Bioengineering and Biotechnology Club at CBIT serves as a strong platform for scientific growth and innovation. The club encourages students to explore new ideas, develop practical skills, and understand the real impact of biotechnology. It offers hands-on learning through workshops and training in areas such as CRISPR, bioinformatics, molecular biology, and bioprocess engineering. Students also benefit from research opportunities, industry interactions, and mentorship that help them prepare for higher studies and careers in the biotech sector.

By combining theoretical concepts with real-world application, the club helps members gain the confidence needed to work in laboratories, research groups, and industrial environments. Along with technical learning, the club promotes leadership, teamwork, and problem-solving. Students participate in hackathons, innovation challenges, and early-stage startup programs, where they learn to convert ideas into workable solutions.

The club also introduces students to current advances like biomaterials, synthetic biology, computational biology, and regenerative medicine. Networking sessions with researchers, industry professionals, and alumni give members insight into careers in biotechnology, healthcare, pharmaceuticals, and environmental sciences. The club supports students aiming for research, industry roles, or entrepreneurship by guiding them through scholarships, internships, placements, and academic opportunities.

Beyond campus, the club creates global exposure through participation in events such as iGEM and collaborations with international scientists. It also encourages social responsibility through projects involving biowaste management, water purification, and public health outreach. At its heart, the club is a space for curiosity, creativity, and collaboration. Students not only learn but also contribute to meaningful advancements in science. Whether someone is interested in medical innovation, sustainability, or building a biotech startup, the club provides the support and opportunities needed to grow and make a difference.

Faculty Coordinator's Message

Dr. G. Vijaya Laxmi
Associate Professor
Department of
Biotechnology, CBIT

It is with great enthusiasm that I introduce you to the Bioengineering & Biotechnology Club at Chaitanya Bharathi Institute of Technology (CBIT), a vibrant and dynamic platform dedicated to fostering innovation, research, and hands-on learning in the ever-evolving fields of biotechnology and bioengineering.

As the Faculty Coordinator, Dr. G. Vijaya Laxmi, I take immense pride in guiding and mentoring students as they explore groundbreaking domains such as Biomaterials, Tissue Engineering, and Nano-biotechnology. Our club serves as an intellectual hub where curiosity meets creativity, allowing students to bridge the gap between theoretical knowledge and practical applications.

Through interactive workshops, insightful seminars, industrial visits, and research-driven internships, we provide students with unparalleled exposure to cutting-edge technologies and real-world challenges. These initiatives not only enhance academic learning but also equip students with essential problem-solving skills, technical expertise, and industry-relevant experience, ensuring they are well-prepared to thrive in their careers.

Beyond academics, our club strongly emphasizes leadership, teamwork, and entrepreneurial spirit. We encourage students to take the initiative in driving research projects, collaborative innovations, and socially impactful solutions. Whether you are passionate about scientific discovery, technological advancements, or pioneering your own biotech startup, this club is the ideal environment to learn, explore, and grow.

By joining the Bioengineering & Biotechnology Club, you will become part of a forward-thinking community dedicated to shaping the future of biotechnology. Together, we will embark on an inspiring journey of knowledge, exploration, and innovation, working towards breakthroughs that positively impact society and the global scientific community.

We invite you to be a part of this exciting venture—connect, collaborate, and contribute to the ever-expanding world of biotechnology.

Let's learn, innovate, and make a difference!

Student Presidents' Message

Hey everyone!

I'm Charan, the proud President of the Bioengineering & Biotechnology Club at CBIT. If you're passionate about biotechnology, research, and innovation—or even if you're simply curious about exciting areas like Tissue Engineering, Nano-biotechnology, Drug Design, and Molecular Diagnostics—then you're in the right place to explore new ideas, build skills, and grow with a supportive community.

Our club is all about learning through experience. We believe science becomes meaningful when you get to work with it directly, so we organize hands-on workshops, industry interactions, technical sessions, and project-based activities that help you connect classroom concepts with real-world applications. Whether you want to try advanced lab techniques, dive into emerging research, or understand how biotech shapes industries, you'll find plenty of opportunities here.

What makes our club special is that we focus not just on technical knowledge but also on overall development. Biotechnology is moving fast, and today's challenges need people who can lead, think critically, and bring fresh ideas to the table. That's why we encourage teamwork, problem-solving, creativity, and leadership among all our members. If you aim to make a difference in healthcare, sustainability, or innovation, this is a great place to start.

Behind the scenes, we have a dedicated team that works hard to create meaningful events, research collaborations, and interactive learning spaces. Together, we aim to build a club that is vibrant, inspiring, and open to anyone eager to learn or contribute.

So whether you want to explore new concepts, experiment with innovative ideas, be part of research-driven projects, or simply connect with people who share your enthusiasm for science, we invite you to join us on this exciting journey. Let's learn, create, and achieve something memorable—together.

Welcome to the future of bioengineering at CBIT!

M.C.K. Charan
4th Year, Department of Biotechnology, CBIT

Awareness Talk on Cancer and Early Diagnosis

01 *Awareness Talk on Cancer and Early Diagnosis by Dr. AVS Suresh*

BBCC Hosts Awareness Talk on Cancer and Early Diagnosis by Dr. AVS Suresh: The Bioengineering and Biotechnology Club (BBCC), CBIT, organized an insightful awareness talk on "Cancer and Early Diagnosis" by Dr. AVS Suresh, MD, DM, ECMO, Senior Consultant Medical Oncologist and Chief of Stem Cell Transport at Continental Hospital, Hyderabad, on November 10, 2023. The session, held at the Assembly Hall from 2:00 PM to 3:30 PM, was attended by 124 B.Tech Biotechnology students across all years. The talk covered crucial aspects of cancer, including its prevalence, causes, risk factors, types, and symptoms. Dr. Suresh elaborated on how socioeconomic factors influence cancer incidence and highlighted the importance of early detection. Students were introduced to conventional and advanced screening methods, emphasizing that screening is a preventive tool rather than a diagnostic test. The session also addressed questions on genes, cancer development, and hereditary cancers, showcasing real-life examples and case studies to contextualize the discussion. Dr. Suresh further explained cancer treatment options, including staging, cost-effective therapies, next-generation sequencing, personalized therapy, immunotherapy, and hyperthermic intraperitoneal chemotherapy. He also emphasized lifestyle factors, such as avoiding smoking and alcohol, and recommended dietary practices to reduce cancer risk.

The talk concluded with practical advice on cancer prevention and the significance of early detection, leaving students with a holistic understanding of oncology. The interactive session not only enriched academic knowledge but also encouraged students to adopt healthy habits and spread awareness, reflecting BBCC's commitment to fostering informed and socially responsible future biotechnologists.

“Ignite” Workshop at St. Andrews School

02 *Workshop at St. Andrews School (11^{th} and 12^{th}-grade students)*

BBCC Conducts “Ignite” Workshop at St. Andrews School: The Bioengineering and Biotechnology Club (BBCC), CBIT, organized an educational outreach event, “Ignite”, at St. Andrews School on August 4, 2023, aimed at introducing 11^{th} and 12^{th}-grade students to the exciting world of biotechnology. The session, led by six dedicated club members along with a supportive faculty coordinator, combined theory, practical demonstrations, and interactive activities to spark curiosity and engagement. The workshop began with an engaging introduction to the scope and significance of biotechnology. Students learned about the relevance of blood type testing through informative discussions and interactive demonstrations, and actively participated in testing their own blood types. This hands-on activity reinforced theoretical knowledge while providing students with a tangible connection to scientific concepts. The event then transitioned into a practical laboratory session focused on agarose gel electrophoresis, a fundamental technique in biotechnology. Students performed experiments under guidance, gaining confidence and understanding of both the procedure and the underlying principles. This practical exposure helped demystify laboratory processes and encouraged interest in pursuing further studies in biotechnology.

An ice-breaker session facilitated meaningful interaction between students, club members, and faculty, fostering collaboration and curiosity beyond the classroom. The session concluded with a discussion reflecting on the outcomes of the workshop, with feedback collected from participants to enhance future outreach initiatives.

The “Ignite” workshop successfully combined education, engagement, and hands-on experience, leaving a lasting impression on all 56 participants. BBCC’s initiative highlighted the importance of early exposure to biotechnology, inspiring young students to explore its vast possibilities while cultivating scientific curiosity and enthusiasm.

Guest Lecture on Carrier Testing for Hypertrophic Cardiomyopathy

03 *"Carrier Testing for Hypertrophic Cardiomyopathy (HCM)" by Dr. Benet Bosco Dhas, CEO of 30M Genomics*

BBCC Hosts Guest Lecture on Carrier Testing for Hypertrophic Cardiomyopathy:

The Bioengineering and Biotechnology Club (BBCC), CBIT, organized an insightful guest lecture on "Carrier Testing for Hypertrophic Cardiomyopathy (HCM)" by Dr. Benet Bosco Dhas, CEO of 30M Genomics, on March 19, 2024, at the D Block Seminar Hall, CBIT. The lecture focused on the significance of early diagnosis in genetic disorders, with an emphasis on HCM and its link to sudden cardiac death.

Dr. Dhas highlighted the critical distinction between myocardial infarctions and sudden cardiac deaths, underscoring the importance of early detection and preventive care. Using real-life examples, including cases involving public figures, he illustrated the severity and sudden onset of HCM. The session included informative demonstrations and videos to help students understand the disease's impact, making the discussion both engaging and impactful.

Key takeaways from the lecture included the genetic basis of HCM, the prevalence of specific mutations such as the 25-base pair deletion in the MYBPC3 gene among South Asians, and the fact that over 80 % of HCM cases are detectable through screening. Dr. Dhas stressed the importance of proactive genetic testing, especially for individuals with family histories of HCM, athletes, and fitness enthusiasts, advocating that "prevention is better than cure."

Additionally, Dr. Dhas introduced initiatives by 30M Genomics, including affordable NA test kits and concessions for individuals under 25, aimed at facilitating early detection and preventive care.

The lecture provided students with a comprehensive understanding of HCM, preventive strategies, and the role of genetics in disease management. It reinforced the importance of vigilance, early diagnosis, and proactive engagement in genetic health, leaving a lasting impression on all attendees.

STUDENT ACHIEVEMENTS

Mr. Tanmay Dacha won first place at the university level Discuss throw event on December 9, 2023. Mr. Tanmay Dacha's strong performance at the state-level athletics competition reflects his growing skill and commitment to discus throw. Competing against tough opponents, he delivered a powerful and well-executed throw that highlighted his strength, technique, and focus. His achievement is the result of consistent training, where he keeps working on refining his form and building his endurance.

Tanmay's dedication has helped him progress steadily in the sport, making him one of the promising young athletes in his category. His hard work and determination continue to inspire others, and this accomplishment marks another important step in his athletic journey.

Tanmay Dacha


ARUNAI
Engineering College
TIRUVANNAMALAI

National Conference on
RECENT TRENDS IN BIOTECHNOLOGY RESEARCH
22 March 2024

HAPTEN

In association with
Biotech Research Society of India

CERTIFICATE OF EXCELLENCE

This is to certify that the paper/project/poster entitled COMPUTATIONAL UNVEILING OF PAD ENZYMES & EPIGENETIC REMODELLING IN TAPESTRY OF RA PATHOGENESIS presented by Dr./Mr./Mrs./Ms VALLURU SAILEELA SIRISHA of CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY, HYD has awarded as best paper/project/poster in the National Conference on Recent Trends in Biotechnology Research held on 22 March 2024 at Arunai Engineering College, Tiruvannamalai,Tamilnadu,India.

Er.E.V.Kumaran, Vice Chairman | Dr.R. Sathiyaseelan, Registrar | Dr.R. Ravichandaran, Principal | Prof. R. Praveen Kumar, Head - BT & Chemical

Valluru Saileela Sirisha

We extend our congratulations to Ms. Valluru Saileela Sirisha from the Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, for her outstanding achievement. Ms. Sirisha was awarded the best paper/project/poster prize at the National Conference on Recent Trends in Biotechnology Research. Her winning entry was titled, "COMPUTATIONAL UNVEILING OF PAD ENZYMES & EPIGENETIC REMODELLING IN TAPESTRY OF RA PATHOGENESIS."

The conference, held on March 22, 2024, at Arunai Engineering College, Tiruvannamalai, recognized her significant contribution to understanding complex biological processes using computational methods. This achievement highlights the caliber of research being conducted by our students in advanced biotechnology.

STUDENT ACHIEVEMENTS

Aditi Reddy Kamana

Ms. Adithi Reddy K. from CBIT has demonstrated remarkable prowess and consistent commitment to competitive basketball, securing multiple accolades at the state and university level. Her achievements collectively showcase a dedicated student-athlete deeply engaged in the sport. Adithi Reddi Kamana, has demonstrated commendable sporting excellence in basketball during the academic year 2023–24 at the state level. She secured Third place at Airo'24, hosted by Mahindra University, Hyderabad, February 15-17, 2024. Further showcasing her skill and competitive spirit, she emerged as the Winner at AARAMBH'24 State Level Sports Fest, organized by the Department of Physical Education, J.B. Institute of Engineering & Technology (JBIET), Hyderabad, March 12–14, 2024. She also represented her institution at the State Level Engineering Premier League held at CVR College of Engineering, Hyderabad, February 26-29, 2024. This series of accomplishments highlights her outstanding performance, dedication, resilience, and ability to successfully compete against peers, inspiring others to balance academics with extracurricular excellence.

B. Nitin Ratnam & B. Shreya

We celebrate the excellent research presented by Dr. Y. Rajasri, Mr. Nitin Ratnam Badhe, Ms. Shreya Banalla, and Dr. K. Dharmalingam at the 9th International Food Convention (IFCoN 2023).

Held at the CSIR-CFTRI Campus in Mysuru in December 2023, the team's work earned the Certificate for BEST POSTER, sponsored by the AFST(I), Lucknow Chapter.

Their winning research was titled: "Enhancing alginate and carrageenan-based bioplastics for eco-friendly food packaging solutions." This achievement highlights their innovative contribution to green food processing and sustainable packaging, reinforcing the commitment to environmental solutions within food technology research.

STUDENT SPOTLIGHT

Liquid Biopsies: The Future of Early Cancer Detection

Cancer is a disease in which certain cells grow uncontrollably and may spread to other parts of the body. Normally, cells divide to replace old or damaged ones, but when this process breaks down, abnormal cells multiply when they should not, sometimes forming tumours. These tumours can be benign or malignant. Cancer develops due to genetic changes caused by random errors during cell division, environmental factors such as tobacco smoke or ultraviolet radiation, or inherited mutations. Although the body can repair or remove damaged cells, this ability decreases with age, increasing cancer risk.

Traditional tissue biopsies are essential for diagnosis, but they come with disadvantages, including bleeding, bruising, pain, swelling, and a small risk of infection. Rarely, nearby tissues may be affected, or allergic reactions to anesthesia may occur. Waiting for biopsy results can also cause emotional stress.

Liquid biopsies provide a promising, minimally invasive alternative. Through a simple blood draw or another body fluid sample, doctors can analyse tumour DNA, RNA, or circulating tumour cells to detect cancer early, even before symptoms appear. Liquid biopsies can be repeated over time, offering real-time insight into how a tumour changes, responds to treatment, or develops resistance. They may also reveal mutations that a single tissue biopsy could miss.

When traditional biopsies are risky or not possible, liquid biopsies offer a safer and more accessible option. Due to their convenience, accuracy, and ability to guide personalized treatment, liquid biopsies are emerging as a powerful tool for the future of early cancer detection.

Company	Test	Cancer Type	(%)	Sensitivity (%)	Turnaround Time
Guardant Health (USA)	Shield™	Colorectal	92	91	~2 weeks
Dxcover (UK)	Dxcover (AI-based)	Brain	45–90	47–96	1 day
Abcodia (UK)	ROCA	Ovarian	87.6	87.1	Varies
MDxHealth (Belgium)	SelectMDx	Prostate	53	89	5 days
OPKO (USA)	4Kscore	Prostate	27	97	2–3 days

Table 1: Key Liquid Biopsy Tests for Early Cancer Detection

~Adithi Reddi Kamana, IVth Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

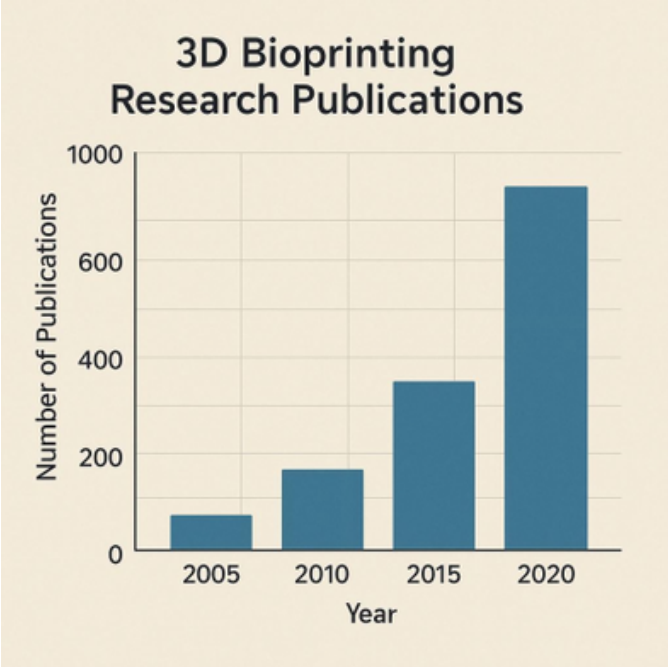
3D Bioprinting: Printing Organs, Printing Hope

3D bioprinting has grown from an ambitious idea to one of the most promising frontiers in modern biotechnology. At its core, the technique combines living cells with biomaterials to create tissue-like structures layer by layer. What once felt like distant science fiction now stands at the edge of real clinical use, offering new possibilities for patients who wait months or even years for organ transplants.

The process begins with a digital model of the desired tissue. Bioprinters then deposit cell-laden bioinks with careful precision, forming patterns that guide the development of functional tissue. Researchers have already produced simplified versions of skin, cartilage, and vascular structures. Although these printed tissues are not yet ready to replace fully developed organs, each step forward brings the field closer to that reality.

The true hope in bioprinting lies in its potential to address the global shortage of donor organs. Instead of depending on availability or compatibility, future treatments may rely on personalized constructs grown from a patient's own cells. This would reduce rejection risks and transform the way we think about regenerative medicine.

As students in biotechnology, we witness a field that is still evolving but full of promise. 3D bioprinting reminds us that innovation begins with curiosity and that today's experiments can become tomorrow's lifelines.



~Jyothika Meenakshi Kambhampati, IVth Year,
B.Tech. Biotechnology

CELL CRAFT

Cells are the fundamental units of life, yet they hold mysteries far beyond what we see under the microscope. "Cell Craft" is the art and science of understanding how these microscopic structures come together to create living organisms. Each cell is like a miniature world, complete with its own machinery, energy systems, and communication networks that keep life running smoothly.

From the single-celled bacteria thriving in extreme conditions to the complex multicellular organisms that form humans, the versatility of cells reflects nature's creativity. They divide, differentiate, and adapt with precision, reminding us how even the smallest unit can hold immense power. In biotechnology, this understanding of cellular function becomes the foundation for innovation.

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Scientists use cell culture, genetic engineering, and synthetic biology to design new possibilities like growing artificial tissues, developing vaccines, or producing biofuels.

But beyond the laboratory, studying cells teaches us patience, observation, and curiosity. It shows that progress often begins with looking closer, asking questions, and crafting solutions from the microscopic level.

"Cell Craft" is not just about manipulating biology; it's about mastering the delicate balance between science and imagination, where discovery begins one cell at a time.

~Divyamshu Surabhi, IVth Year,
B.Tech. Biotechnology.

Agro Spectrum

Agriculture has always been the backbone of human civilization, but in today's era of biotechnology, it is undergoing a transformation that is both fascinating and necessary. "Agro Spectrum" represents the wide range of scientific approaches that aim to make farming more sustainable, efficient, and environmentally friendly. It brings together biology, technology, and innovation to reshape how we grow our food and manage our natural resources.

From genetically modified crops that resist pests and diseases to biofertilizers that enrich the soil naturally, biotechnology is redefining agriculture at every level. Microbial research is helping farmers enhance crop yields while minimizing chemical usage, and plant tissue culture techniques are enabling the rapid multiplication of disease-free plants.

Even waste from farms is finding new life as biofuels and bioplastics, showcasing how nothing in nature truly goes to waste.

The "Agro Spectrum" also highlights a shift in mindset from exploiting resources to managing them responsibly. It reminds us that progress in agriculture must go hand in hand with ecological balance. For young biotechnologists, this field opens doors to innovate with purpose, ensuring food security for future generations.

Biotechnology doesn't just add science to farming; it adds sustainability, creativity, and hope for a greener tomorrow.

~Y Sai Shriya, IVth Year,
B.Tech. Biotechnology.

Future Biotech's - "Shaping Tomorrow Through Innovation"

Future Biotech represents the next leap in scientific evolution, the convergence of biology with cutting-edge technologies like artificial intelligence, nanotechnology, and robotics. Together, they are reshaping medicine, agriculture, and environmental sustainability, bringing humanity closer to a world powered by bioinnovation.

In healthcare, the rise of regenerative therapies, gene editing, and organ bioengineering promises a future where chronic diseases and organ failures can be fully reversed. In agriculture, genetic modification and precision farming are ensuring crop resilience against pests, drought, and changing climates, securing food for billions. Industrial biotechnology is advancing bio-based

STUDENT SPOTLIGHT

fuels, biodegradable materials, and carbon-neutral production methods, all aimed at achieving sustainability.

Another revolutionary field, synthetic biology, allows scientists to design living systems to perform specific functions, from creating new drugs to degrading pollutants. Another revolutionary field, synthetic biology, allows scientists to design living systems to perform specific functions, from creating new drugs to degrading pollutants.

Future Biotech embodies hope and responsibility, a call for scientists and innovators to shape a world where technology not only advances life but also protects it.

~Kirthikha Shanmuga Sunder , III[rd] Year,
B.Tech. Biotechnology

mRNA: The Molecule that Changed Medicine Forever

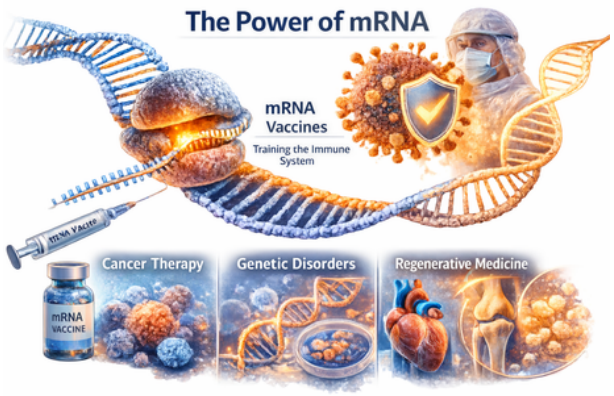
Messenger RNA has quietly shaped life for billions of years, yet its impact on modern medicine became truly visible only in recent times. At its core, mRNA is a simple carrier of genetic instructions, guiding cells to build specific proteins. This basic role transformed into a powerful therapeutic tool once scientists learned to design and stabilize synthetic mRNA.

The rise of mRNA vaccines marked a turning point. By delivering a harmless set of genetic instructions, these vaccines taught the immune system to recognize threats without exposing the body to actual pathogens. The speed and precision of this approach demonstrated how adaptable mRNA technology can be, especially during global health emergencies. What once seemed experimental became a practical solution trusted worldwide.

Beyond vaccines, mRNA now stands at the front line of innovation. Researchers are exploring its potential in cancer immunotherapy, rare genetic disorders, and regenerative medicine.

The idea of programming cells to heal, defend, and rebuild feels bold, yet it grows more realistic with each discovery. mRNA offers a flexible platform with room to evolve as science advances.

As students, this moment feels inspiring. We are witnessing a shift in how diseases are understood and treated. mRNA did more than introduce a new class of medicine. It opened doors to possibilities that were once purely hopeful ideas. Its story is still being written, but its influence is already undeniable.



~Madikunta Divyasree, III[rd] Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

Women in Science: Breaking Barriers

Throughout history, women in science have faced challenges that have limited their opportunities, recognition, and participation. Yet, many women have broken these barriers, paving the way for future generations. Figures like Marie Curie, who discovered radium and polonium, and Rosalind Franklin, whose work was vital to understanding DNA structure, stand as symbols of perseverance and brilliance. Today, women are leading groundbreaking research in genetics, space exploration, medicine, and environmental science.

Despite the progress, gender gaps still exist in STEM fields. Encouraging young girls to explore science, providing equal opportunities, and recognizing women's achievements are vital steps toward building a balanced scientific community.

Organizations and initiatives worldwide are now supporting women scientists, ensuring that talent, not gender, defines success.

Women in science continue to prove that intellect knows no boundaries. Their journey is not only about discovery but also about breaking stereotypes and inspiring millions to dream without limits.

~Anshika Gupta, IIIrd Year,
B.Tech. Biotechnology

Neuron Networks

The human brain remains one of the most extraordinary creations of nature, a living network of billions of neurons that communicate through intricate electrical and chemical signals. "Neuron Networks" captures the fascinating intersection of neuroscience and biotechnology, where scientists seek to understand, map, and even replicate the mind's complex web of connections.

Every thought, emotion, and memory originates from the firing of neurons in a synchronized rhythm that shapes who we are. Understanding these networks allows us to explore how the brain learns, adapts, and heals. Modern biotechnology and computational tools have opened new possibilities in studying brain function, ranging from neural imaging and stem cell research to brain-computer interfaces and artificial neural networks inspired by biological ones.

The study of neuron networks is not limited to medicine; it also fuels advancements in artificial intelligence.

Machine learning algorithms mimic the structure of neurons to perform human-like decision-making. This parallel between biology and technology shows how understanding life at the cellular level can redefine how machines think and respond.

"Neuron Networks" symbolizes a bridge between the biological brain and synthetic intelligence, reminding us that every innovation starts with decoding nature's most brilliant design, the neuron. The more we learn about how these networks work, the closer we get to unlocking the full potential of both mind and machine.

~Alekhya Pasumarthy, IIIrd Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

The Human Microbiome – Your Body's Hidden Ecosystem

The human body is not just made up of human cells. It is home to trillions of tiny organisms such as bacteria, fungi, and viruses that together form the human microbiome. These microscopic partners live on our skin, in our mouth, and most importantly, in our gut. Though invisible, they play an essential role in keeping us healthy.

The gut microbiome is especially important because it helps in digestion, strengthens the immune system, and even influences our mood and mental health through the gut-brain connection. A balanced microbiome helps maintain body weight and protects us from diseases, while an imbalance can lead to digestive problems, allergies, and inflammation.

Taking care of the microbiome is simple but vital. Eating fiber-rich and fermented foods, avoiding unnecessary antibiotics, sleeping well, and managing stress all help keep this internal ecosystem healthy. Scientists are now studying the microbiome to develop new treatments for diseases, using probiotics and microbiome-based therapies.

The microbiome reminds us that health is a partnership between humans and microbes. Inside every person exists a living world that quietly protects and sustains us each day.

~Dhruv Tadikonda, III[rd] Year,
B.Tech. Biotechnology

Molecular Healing - "Restoring Life at its Smallest Scale"

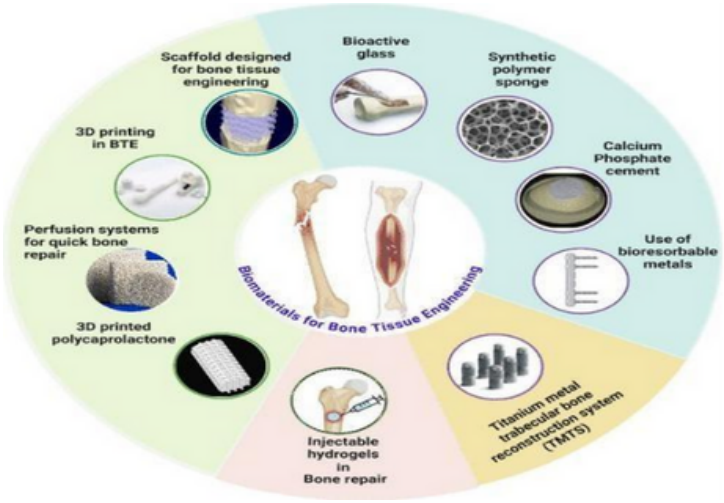
The field of Molecular Healing marks a new frontier in biotechnology, where science delves into the genetic and cellular foundations of disease to offer precise, long-lasting cures. By leveraging tools such as gene therapy, recombinant DNA technology, and molecular diagnostics, researchers are now capable of correcting defective genes and reprogramming cellular functions.

Unlike conventional treatments that only alleviate symptoms, molecular healing addresses disorders at their biological roots. Breakthroughs such as CRISPR-Cas9 gene editing have made it possible to alter defective genes with remarkable precision, offering hope for patients with hereditary diseases like muscular dystrophy, cystic fibrosis, and certain cancers. Likewise, RNA-based therapies and monoclonal antibodies have transformed modern medicine by providing targeted treatments with fewer side effects.

Another key milestone is personalized medicine, where therapies are tailored according to a patient's genetic profile.

This shift toward precision healthcare ensures effective, safe, and individualized treatment strategies.

Molecular healing reflects biotechnology's ultimate mission: to repair, regenerate, and restore life from its very building blocks. As science continues to evolve, it paves the way for a future where diseases are no longer managed but truly cured.



~Thode Neha, III[rd] Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

From Lab to Life: The Scientific and Biotechnological Impact of Casgevy's Approval

The approval of Casgevy, the world's first CRISPR-based therapy for sickle cell disease (SCD) and transfusion-dependent β-thalassemia, marks one of the most significant milestones in modern biotechnology. Writing in 2024, it is clear that Casgevy's approval represents not just a new treatment but the moment when CRISPR moved from laboratory experimentation to real-world medical practice, truly bringing gene editing "from lab to life."

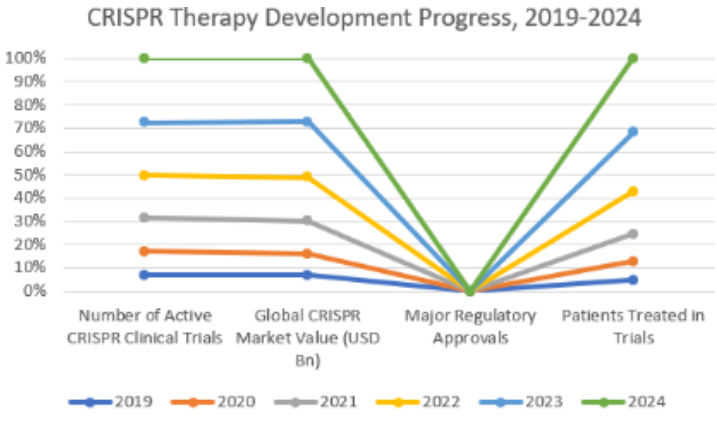
Casgevy's impact begins with its scientific achievement. CRISPR-Cas9 technology, once a theoretical gene-editing tool, is now validated as a safe and functional therapeutic strategy in humans. By precisely modifying the patient's hematopoietic stem cells to reactivate fetal hemoglobin production, Casgevy addresses the genetic root cause of SCD, something traditional therapies could never accomplish.

The approval also triggered a biotechnological ripple effect. Investments in gene-editing companies surged in 2023-2024, with multiple CRISPR therapies for cancers, rare disorders, and autoimmune diseases entering clinical pipelines. The success of Casgevy demonstrated that complex ex vivo gene-editing workflows, cell harvesting, editing, expansion, and reinfusion can be standardized for commercial-scale implementation.

From a regulatory standpoint, Casgevy pushed agencies like the Food and Drug Administration (FDA) and Medicines and Healthcare products Regulatory Agency (MHRA). MHRA to refine guidelines for genomic precision, off-target analysis, and long-term monitoring of gene-edited patients. These frameworks will accelerate future CRISPR therapeutics.

Economically and socially, Casgevy offers hope to millions affected by hemoglobinopathies, though challenges remain, particularly high therapy costs, infrastructure requirements, and the need for equitable global access.

As of 2024, Casgevy stands as a symbol of a new healthcare era, proving that gene-editing therapies can be safe, effective, and transformative at the beginning of genetic cures.



~Muthyala Srikanth, II[nd] Year,
B.Tech. Biotechnology

The Importance of IPR in Research

Intellectual property rights (IPR) and bioethics are essential for responsible and innovative biotechnology research. IPR protects novel discoveries like modified genes, vaccines, and biotechnological processes by granting creators ownership and promoting investment in further research. At the same time, bioethics guarantees that scientific activities comply with human rights, animal welfare, and environmental safety.

It establishes principles for genetic engineering, clinical testing, data protection, and the ethical use of biological materials. Together, IPR and bioethics form a balanced framework that encourages innovation while limiting technological misuse. By safeguarding both scientific originality and societal values, they contribute to public trust and long-term success in the biotechnology industry.

STUDENT SPOTLIGHT

One clear example is the creation of COVID-19 mRNA vaccines. The firms patented their mRNA platform technology, preserving their intellectual property and stimulating additional investment in vaccine research. Simultaneously, strict bioethical principles were followed throughout clinical trials to ensure informed consent, volunteer safety, and transparent data reporting. This mix of intellectual property protection and bioethical responsibility enabled rapid innovation while preserving public trust and safety.

~Amogh Anil Bellurkar, II[nd] Year,
B.Tech. Biotechnology

Reimagining Life: The AI-Biotech Alliance for Tomorrow

Artificial Intelligence (AI) and Biotechnology are two such forces that, if combined, can transform various sectors like healthcare, agriculture, and the environment. The merging of these two technologies, which can be referred to as AI-powered biotechnology, is, in fact, breaking the barriers of time and is at a pace hitherto unknown.

By analyzing large datasets derived from genomics, proteomics, and clinical trials, AI substantially shortens the time required for biotechnological research. What used to take years, such as pinpointing the genes responsible for diseases or inventing new drugs, is now done in only a few weeks. Machine learning algorithms also help scientists figure out which molecules to use for targeted therapies, thus leading to higher success rates and minimal side effects. The integration of AI has, in fact, been instrumental in the rapid development of new drugs and vaccines, where AI models can test billions of compounds in very little time.

AI-powered biotechnology is leading to the rise of climate-resilient agriculture and precision farming techniques. The farmers can not only predict pest outbreaks but also enhance soil fertility with the help of bioinformatics data.

Likewise, in industrial biotechnology, the use of AI is streamlining bioprocessing operations, hence making the production of biofuels, enzymes, and biodegradable materials more efficient and less expensive.

India is on the path of establishing Bio-AI hubs and biofoundries by investing heavily under the BioE3 Policy, which is aimed at AI-integrated biomanufacturing and research. The startups that are being supported by BIRAC are already implementing AI in processes like genome sequencing, protein engineering, and personalized medicine.

The fusion of AI and biotechnology is next to impossible to separate, as we envision a future that is bio-enabled and knowledge-driven. This groundbreaking alliance not only facilitates innovation but is also in line with India's agenda of creating a future where science, technology, and humanity move together towards a healthier, smarter planet.

~Shruti Das Mohapatra, II[nd] Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

Alginate and Beyond: Gelatin-Based Nanoparticles Redefine Food Preservation

The invisible guardians of our food supply are shrinking to nanoscale. As foodborne pathogens continue to develop resistance to traditional preservation methods, and consumers demand cleaner labels free from synthetic additives, biotechnology researchers are turning to nature's own polymers-alginates, gelatin, and chitosan-to engineer a new generation of antimicrobial food packaging.

At the interface between materials science and microbiology, nanoparticles based on gelatin represent a paradigm shift in how we protect perishable goods. Typically, in the range of 50 to 500 nanometers in diameter, these biocompatible carriers can be engineered to encapsulate with very high efficiency a wide variety of active compounds, remaining completely invisible to the naked eye and imperceptible to the palate. Unlike their synthetic counterparts, these natural biopolymers offer the advantages of biodegradability, FDA-recognized safety status (GRAS), and the ability to form edible coatings that extend shelf life without compromising food quality. The leader of this revolution is alginate, which is made from brown seaweed. Its special capacity to form hydrogels by ionic cross-linking with calcium results in a protective matrix that can release antimicrobial agents in a sustained, controlled way. These nanoparticles acquire mechanical strength and flexibility that pure alginate systems cannot match on their own when combined with gelatin, a collagen- derived protein with film-forming capabilities.

The result is active packaging that releases protective compounds exactly when and where they are needed, reacting dynamically to environmental cues like pH shifts or the presence of bacteria.

The effects go well beyond what scientists are interested in. Gelatin-based nanoparticle coatings are already being used in commercial settings, such as on fresh-cut fruits and vegetables that stay crisp for weeks and ready-to-eat meals that last longer in the fridge. They're working on real problems, like cutting down on the 1.3 billion tonnes of food that is thrown away each year, making it less necessary to use refrigeration in developing areas, and giving people protection against pathogens like E. coli that is as good as what you would find in a pharmacy. coli, Salmonella, and Listeria without using harsh chemicals to keep them from going bad. However, like with any new technology, there are still questions about how scalable, cost effective, and regulatory pathways for new nanomaterials in food systems will be. This article looks at how nanoparticles made of alginate and gelatin are changing the way food is stored, the science behind their ability to kill bacteria, and whether these tiny changes can live up to their big promises.

~D Bhoomika, IInd Year,
B. Tech. Biotechnology

STUDENT SPOTLIGHT

Rise of the Global Bioeconomy

The global bioeconomy is one of the most promising shifts of our time. Powered by biology instead of fossil fuels, countries are turning to the use of plants, microbes, and renewable biomass to produce energy, medicines, materials, and everyday consumer products. This rise isn't just technological in nature; it's also driven by urgent needs for things like climate action, cleaner production, and long-term economic resilience.

A reason for this momentum is the rapid development of biological technologies. Synthetic biology, precision fermentation, and genome engineering now let us design microbes that can make insulin, biofuels, biodegradable plastics, and specialty chemicals. Industries around the world are investing in biomanufacturing hubs, skill development, and green innovation.

From India's perspective, the bioeconomy is not merely an opportunity but a strategic imperative. On the back of a broad agricultural base, excellent biotech human talent, and an improving ecosystem for startups, India is poised to take up a mantle as one of the world's main bio-based manufacturing hubs. Agricultural residues can be converted into bioenergy, bamboo and plant fibers into sustainable materials, and microbial fermentation into high-value pharmaceuticals. India's Bioeconomy Report already highlighted that the sector is growing rapidly, driven by healthcare biotech, industrial enzymes, vaccines, and bioenergy.

What makes this transition so powerful is its circular mindset: waste becomes a resource. Crop residues, food waste, and even wastewater can be transformed into fuels, fertilizers, and valuable bioproducts. For a country like India, which needs to pursue sustainability and economic growth together, the bioeconomy presents an innovative path—a path that is inclusive, a future-ready path.

~Samhitha Reddy Chinthalapudi, IInd Year,
B.Tech. Biotechnology

STUDENT SPOTLIGHT

From Vaccines to Precision Medicine: The Next Era of mRNA Therapeutics

Messenger RNA (mRNA) is a single-stranded nucleic acid molecule that is involved in carrying genetic information from DNA to the ribosomes, where proteins with a specific function are synthesized. Therapeutically, synthetic mRNA is designed to instruct cells to produce proteins with preventive or therapeutic benefit, eliminating the need for weakened pathogens or externally manufactured biologics. This framework allows for platforms that are adaptable, scalable, and capable of rapid development.

The COVID-19 pandemic has shown the clinical efficacy of mRNA vaccines, notably via Moderna in the United States and BioNTech-Pfizer from Germany and the United States, which created global confidence in the technology. Research has since expanded to major biotechnology hubs around the world, including the United States, Germany, the United Kingdom, Canada, and Singapore, where academic institutes and pharmaceutical companies are extending applications well beyond infectious disease.

One of the most promising directions is personalized oncology. BioNTech, in cooperation with Genentech Roche, is developing individualized cancer vaccines such as BNT122, which is tailored to a patient's neoantigen profile to stimulate focused immune responses. In parallel, Moderna is assessing mRNA candidates like mRNA-3705 for methylmalonic acidemia, part of a growing field of protein replacement therapies targeting rare metabolic disorders.

Cardiovascular applications are now emerging; Moderna and AstraZeneca have investigated AZD8601, encoding vascular endothelial growth factor-A, for possible benefit in ischemic heart disease. Other companies, such as Sanofi of France/United States, are targeting pulmonary and autoimmune indications.

mRNA has generally been encapsulated in LNPs, a delivery technology honed through collaborations that involved institutions such as the University of British Columbia, to ensure stability and targeted cellular uptake. Next-generation approaches include studies at Imperial College London and by companies like Arcturus Therapeutics on self-amplifying mRNA. SaRNA seeks to extend protein expression while reducing the required dosage. Despite major advances, challenges persist in cold-chain logistics, innate immune activation, and equitable global access. The World Health Organization's mRNA Technology Transfer Hub in South Africa represents a significant initiative toward distributed manufacturing capacity.

Together, these activities place mRNA therapeutics at the heart of a vision for speedier, more flexible, and patient-tailored medical treatments that represent a paradigm shift in modern biomedical innovation.

~Venkata Sai Nikitha Teku, IInd Year,
B. Tech. Biotechnology

STUDENT SPOTLIGHT

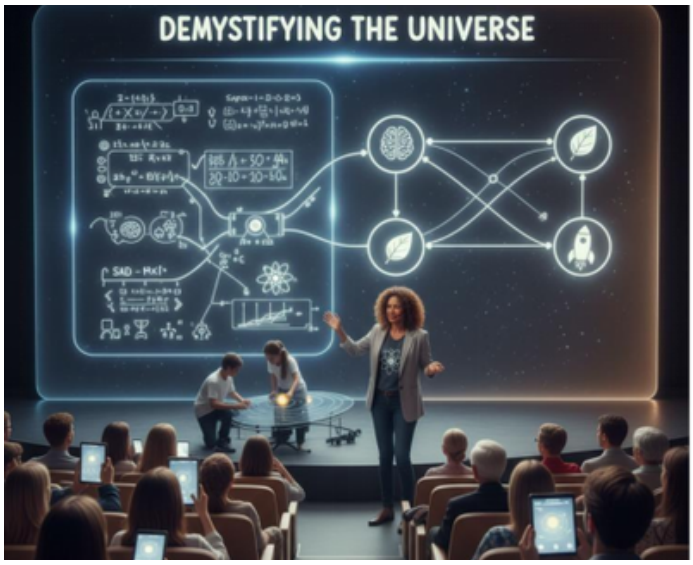
Science Communication- A Bridge Between Research and the Public

Science communication has emerged as one of the most essential pillars in today's knowledge-driven world. While groundbreaking discoveries are being made every day, whether in biotechnology, climate science, or artificial intelligence, these innovations hold value only when people beyond the laboratory can understand, trust, and apply them. This is where science communication becomes a transformative bridge, connecting complex research with the society it aims to benefit.

At its core, science communication translates intricate scientific concepts into meaningful, accessible narratives. It helps break down jargon-heavy language into clear explanations that students, policymakers, farmers, healthcare workers, and everyday citizens can relate to. This accessibility strengthens informed decision-making, whether it's choosing safe medical treatments, adopting sustainable technologies, or supporting evidence-based policies. Moreover, effective science communication builds trust. In an era marked by misinformation and rapidly spreading myths, clear and empathetic communication from scientists, educators, and communicators helps counter confusion and fear. It reassures the public that science is not distant or intimidating but a collaborative journey that relies on transparency and dialogue. For researchers, communicating their work also encourages interdisciplinary collaboration and enhances the societal impact of their findings.

It transforms scientific work from isolated knowledge into a shared resource that inspires innovation, education, and problem-solving.

Ultimately, science communication is more than just simplifying information; it is about creating connections, promoting understanding, and ensuring that scientific progress truly reaches the people it is meant to serve. Through this bridge, science becomes not just knowledge but empowerment.



~Malyala Rishika, Ist Year,
B. Tech. Biotechnology

STUDENT SPOTLIGHT

Biotech Meets Climate Tech: Innovations to Heal the Planet

The convergence of biotechnology and climate technology represents a transformative approach to addressing global environmental challenges. As a first-year biotechnology student, it is fascinating to observe how biological systems are being engineered to mitigate climate change, restore ecosystems, and create sustainable industrial practices. Emerging research demonstrates that biotechnology offers scalable, efficient, and eco-friendly solutions that complement traditional climate technologies.

One of the most promising areas is microbial carbon capture. Genetically engineered cyanobacteria and microalgae can fix atmospheric CO_2 at rates significantly higher than terrestrial plants. These organisms are now being optimized for biofuel production, biodegradable polymers, and high-value biomolecules, creating a circular carbon economy (Diner et al., 2020). Additionally, advances in synthetic biology have enabled the development of carbon-sequestering microbes that can convert greenhouse gases into useful products such as organic acids and bioplastics.

Bioremediation technologies also play a crucial role in environmental restoration. Engineered microbes capable of degrading pollutants such as petroleum hydrocarbons, plastics, and heavy metals are being deployed to clean contaminated soils and oceans. At the same time, climate-resilient crops developed through CRISPR-based genome editing help maintain food security by improving drought tolerance, nutrient efficiency, and stress resilience (Zaidi et al., 2019).

These biotechnology-driven innovations show that addressing climate change is no longer limited to mechanical or energy-based solutions. Instead, leveraging living systems provides adaptive, sustainable, and self-renewing tools to heal the planet. As the field advances, integrating biotech with climate tech will be key to building a resilient and environmentally conscious future.

~Manasvi Kurri, I[st] Year,
B. Tech. Biotechnology

STUDENT SPOTLIGHT

The Future of Tissue Engineering : Japan's Hydroxyapatite based Biocomposites

Tissue engineering aims to repair or replace damaged tissues using biomaterials, cells, and bioactive molecules. Hydroxyapatite (HA), a naturally occurring mineral form of calcium apatite, is extensively studied in Japan for its excellent biocompatibility, bioactivity, and similarity to human bone mineral. HA-based biocomposites have become a focal point in developing scaffolds and implants that promote osteogenesis while addressing the mechanical and biological challenges inherent in bone tissue engineering. Japanese researchers focus on enhancing HA composites by combining hydroxyapatite nanoparticles with polymers like gelatin, chitosan, and collagen to improve mechanical strength and bioactivity. Recent innovations include:

- Nanotechnology: Incorporation of nano-sized HA particles to closely mimic natural bone structure, increasing surface area and cellular interaction, which promotes faster bone regeneration.
- Three-dimensional (3D) Bioprinting: Use of 3D printing technologies to fabricate personalized, porous HA scaffolds tailored to patient-specific bone defects, improving integration and healing precision.
- Sustainable Sourcing: Japan leads in extracting HA from biomaterials such as fishbone and eggshell waste, advancing eco-friendly, sustainable production methods.
- Functionalization: Functional coatings and doping with ions such as silver or silicon to impart antibacterial properties and enhance osteoinductivity.

These developments synergistically address HA's traditional challenges of brittleness and slow degradation, enabling applications in dental implants, spinal fusion, bone defect repair, and craniofacial reconstruction.

The aging population in Japan drives demand for advanced biomaterials that provide long-lasting, biocompatible orthopedic and dental solutions. HA composites integrated with stem cell therapies and growth factors improve the regenerative microenvironment, facilitating faster recovery and enhanced bone quality.

Furthermore, AI-driven research accelerates materials discovery, optimizing HA composition and scaffold architecture. Japan's investment in combining smart biomaterials with IoT-enabled implant monitoring promises a new era of "smart implants," capable of tracking tissue healing in real-time, reducing failure rates.

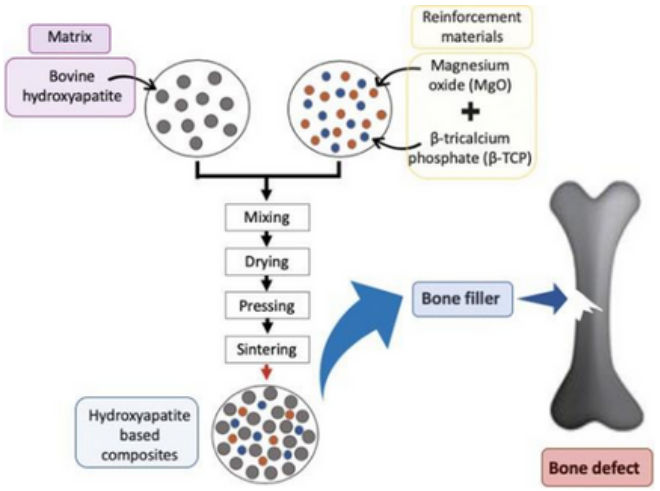
Commercially, the rising market for HA biocomposites aligns with advances in minimally invasive surgeries and personalized medicine, positioning Japan as a leader in next-generation tissue engineering biomaterials.

Key research directions in Japan's HA biocomposites include:

- Multifunctional Scaffolds: Developing hybrid scaffolds that address mechanical, biological, and antimicrobial needs simultaneously.
- Integration with Regenerative Medicine: Combining HA scaffolds with gene editing, stem cell therapies, and bioactive molecule delivery for complex tissue regeneration.
- Sustainability and Scalability: Refining waste-derived HA production for large-scale, cost-effective manufacturing without sacrificing material quality.
- Smart Technologies: Leveraging AI and machine learning to design and manufacture scaffolds with optimized architecture, biodegradation profiles, and biological response.

Such interdisciplinary approaches will markedly improve outcomes for patients with bone defects, trauma, and degenerative diseases.

STUDENT SPOTLIGHT



Japan's leadership in hydroxyapatite-based biocomposites exemplifies how cutting-edge material science, bioprinting, and regenerative medicine converge to transform tissue engineering. These innovations promise personalized, effective, and sustainable solutions for bone repair, signaling a bright future for regenerative healthcare technologies globally.

~Yamini Khasholka Iytha, I[st] Year,
B. Tech. Biotechnology

Wearable Genomics: How Smart Devices are Personalizing Health in Real Time

Wearable genomics represents the next major leap in personalized healthcare, combining genetic data with real-time physiological monitoring. Traditional wearables, such as smartwatches and fitness bands, track metrics like heart rate, sleep, and activity. When integrated with an individual's genomic information, these devices evolve into powerful tools capable of predicting health risks, tailoring lifestyle recommendations, and enabling early disease detection.

By analyzing gene variants associated with metabolism, cardiovascular health, stress response, or drug sensitivity, wearable genomic systems can offer highly customized guidance.

For example, a person with genetic markers for poor glucose regulation may receive instant alerts when their wearable detects patterns indicating rising blood sugar levels.

Similarly, individuals with a predisposition to cardiac issues could benefit from continuous electrocardiogram (ECG) monitoring paired with genomic risk profiling. The real-time synergy of biological signals and genetic insights allows for preventive healthcare rather than reactive treatment. These devices can support clinicians with richer datasets, helping them design personalized therapies and monitor responses more effectively.

As privacy and data security technologies improve, wearable genomics is poised to become a standard component of precision medicine, empowering individuals to understand their bodies better and make informed health choices every day.

~Dutta Yashmitha, I[st] Year,
B. Tech. Biotechnology

3D Bioprinting: Building Organs Layer by Layer

3D bioprinting is a revolutionary technology in tissue engineering that builds functional tissues and organs layer by layer using living cells, biomaterials, and biochemicals. Guided by computer-aided design (CAD) from medical imaging, this process enables precise placement of different cell types and materials to replicate the structure and function of real tissues.

The technology uses specialized bioinks—often made from stem cells or differentiated cell lines—which are deposited by print heads to form complex organ constructs, including vascular networks essential for tissue survival. Currently, 3D bioprinting has produced simpler tissues such as skin, cartilage, and blood vessels, which are already used in research, drug screening, and

STUDENT SPOTLIGHT

tissue repair. However, printing fully functional organs like the heart or liver remains a challenge due to their intricate architecture and diverse cell types. Despite these hurdles, 3D bioprinting holds tremendous promise for addressing organ donor shortages by enabling the creation of personalized organs with a lower risk of rejection. 3D bioprinting not only focuses on creating static organ structures but also incorporates dynamic tissue functions by integrating multiple cell types and signaling molecules within printed constructs.

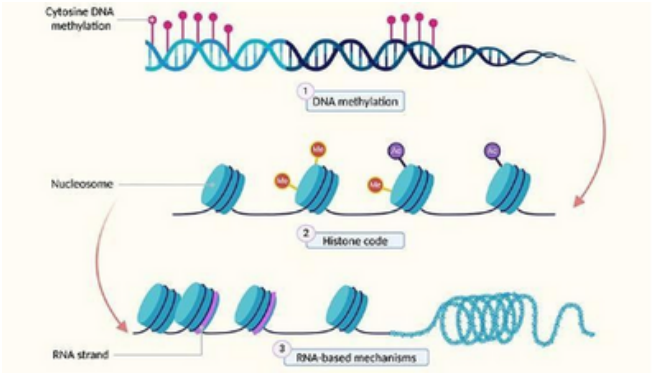
One key area of innovation is the development of multi-material bioprinting, which allows the precise placement of different biomaterials and cells to mimic the native cellular microenvironment more accurately. This improves tissue maturation and functional integration post-printing.

~Lingamdinne Trishika Reddy, Ist Year,
B. Tech. Biotechnology

Epigenetics: How Lifestyle Rewrites our Genes

What if your daily habits, the food you eat, the workouts you don't do, were the ones that are directly controlling your fate, not only your DNA? It has always been thought that our genome is unchangeable, but a revolution in molecular biology proves that gene expression is highly changeable. This is epigenetics: the study of the regulatory mechanisms that control gene expression by switching genes on or off, thus being the most dynamic part of your stable genetic blueprint and the ever-changing environment. Physical exercise is one of the most convincing examples. In fact, recent research indicates that short, intense exercise like cycling rapidly causes skeletal muscles to lose methyl groups; hence, hypomethylation at the promoter region of the master metabolic gene, PGC-1α, takes place. The epigenetic change in PGC-1α activates cellular programs for mitochondrial biogenesis. Thus, it fuels oxidative metabolism, and stamina is improved. Besides that, the exercise also influences the histone code by removing HDAC repressor proteins, providing a quick, non-methylation pathway to activate transcription. Nutrition, too, is the one that plays another direct role. Precision nutrition research tells us DNA methylation is the main factor that can predict metabolic health variability in humans.

Epigenome-Wide Association Studies (EWAS) have found many CpG sites, such as those near the HIF3A gene, associated with obesity. The research reveals that interventions, such as weight-loss diets, can reverse harmful methylations at metabolic loci, thus leading to better health outcomes. Methylation Risk Scores (MRS) are even capable of foreseeing the risk of Type 2 Diabetes that is independent of Body mass index (BMI). As epigenetic marks are reversible and very specific, it means that one's daily habits continuously adjust one's molecular machinery at a very fine level of regulation. Understanding these dynamic regulatory switches is the key to future biotechnological innovations in the diagnostics and personalized medicine fields.



~Hajra Saba, Ist Year,
B. Tech. Biotechnology

Placement Data - 2024

The Biotechnology Engineering batch of 2019–23 continues to stand out for its varied achievements in placements, higher studies, and competitive exam attempts. Many students stepped into roles across biotech, IT, analytics, and consulting, joining companies like Virchow Biotech, Mindtree, Cognizant, Accenture, LTIMindtree, Wipro, Labcorp (Labcorp Laboratories India Private Limited), and Brane Enterprises. Several explored non-traditional paths as well, moving into business operations, quality management, medical coding, and data-oriented roles, showing the versatility of their skill sets.

Higher education remained a major choice for a large portion of the batch. Students earned admissions into top global universities for programs in biotechnology, immunology, microbiology, engineering management, data science, analytics, and health policy. Universities such as the University of Buffalo, University of Texas at Dallas, Northeastern University, RMIT University, Johns Hopkins University, New York University, Indiana University, and the University of Galway were among the popular destinations. A few also chose MBA, public policy, and specialized biomedical programs to broaden their career scope.

Competitive exam participation was high, with many appearing for GATE, GRE, IELTS, and TOEFL. Some cleared these exams with strong scores, while others continued preparing for upcoming attempts. A few students also explored government career paths through state and national-level exams.

Several graduates are already working abroad as research assistants, scientists, and data analysts in reputed academic labs and biotech companies. Others joined R&D and QC laboratories within biologics, pharmaceutical manufacturing, and CDMO organizations. Internships and early-career roles helped many build foundational experience in wet lab work, regulatory documentation, and analytical techniques.

Overall, the 2019–23 batch reflects a promising mix of global opportunities, strong academic pursuits, industry placements, and diverse skill growth. Their journeys highlight the expanding reach of biotechnology and the increasing demand for interdisciplinary talent in science, technology, healthcare, and analytics.

MOU's & Industry Partners

Birla Institute of Technology and Sciences, Pilani (BITS Pilani) – November 2023

Chaitanya Bharathi Institute of Technology (CBIT), Hyderabad, has entered a Memorandum of Understanding (MoU) with Birla Institute of Technology & Science (BITS) Pilani on November 15, 2023. This strategic collaboration aims to enhance academic and research excellence through joint initiatives, student exchange programs, and direct admissions to Ph.D. programs at BITS Pilani. The agreement establishes a framework for academic cooperation, including joint research projects, exchange of scholarly materials, and organization of workshops and seminars in areas of mutual interest. Under this partnership, CBIT students will have the opportunity to participate in research and project work at BITS Pilani, gaining valuable hands-on experience.

Qualified B.Tech students from CBIT with a CGPA of 8.00 or above by their sixth semester will also be eligible for direct admission to BITS Pilani's Ph.D. program, subject to evaluation by a selection committee. The student exchange program allows CBIT students to spend a minimum of one semester and up to one year at BITS Pilani, where they will be mentored by faculty from both institutions. Tuition fees will be waived for participating students, and credits earned at BITS Pilani will be transferred to CBIT. Faculty from CBIT may also serve as co-supervisors for research work, fostering deeper academic collaboration. A coordination committee comprising representatives from both institutions will oversee the implementation and progress of the partnership. Intellectual property rights, funding, and specific research agreements will be determined on a case by-case basis. The MoU will remain in effect for five years, with the possibility of renewal upon mutual agreement. Both institutions are committed to upholding the highest standards of academic integrity, ensuring a seamless exchange of knowledge, and promoting research that contributes to technological and scientific advancements. This collaboration is expected to provide significant academic and professional benefits for students and faculty, further strengthening the bridge between research and industry.

Notes