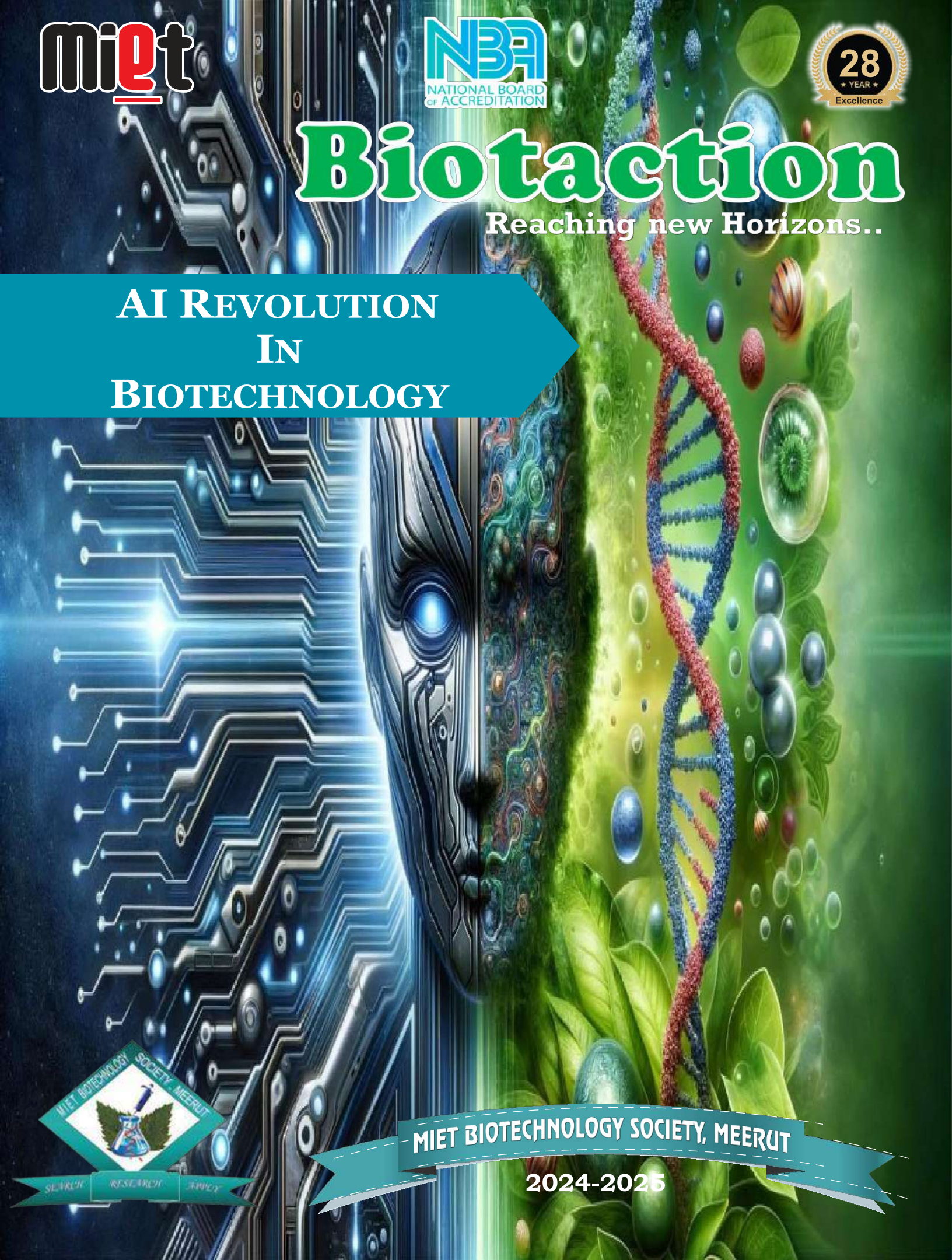

miet
NBA
NATIONAL BOARD OF ACCREDITATION
28
YEAR
Excellence
Biotaction
Reaching new Horizons..
AI REVOLUTION
IN
BIOTECHNOLOGY
MIET BIOTECHNOLOGY SOCIETY, MEERUT
SEARCH
RESEARCH
APPLY
MIET BIOTECHNOLOGY SOCIETY, MEERUT
2024-2025

Biotaction

Departmental Vision

To be a leading department in the country imparting biotechnological education and problem solving skills to the budding biotechnocrats capable of meeting emerging challenges in the area of inter-disciplinary education and industries.

Departmental Mission

1. Educating young aspirants in the field of biotechnology and allied fields to fulfill national and global requirements of human resource.
2. Generating trained man-power with advanced techniques in order to meet the professional responsibilities.
3. Imparting social and ethical values in graduates for Progressive attainment at social level.

Program Educational Objectives (PEOs)

The Biotechnology Department of Meerut Institute of Engineering & Technology, Meerut produces graduates with a strong foundation of scientific and technical knowledge and who are equipped with problem solving, teamwork, and communication skills that will serve them throughout their career. The specific program educational objectives are:

PEO1: Pursue career as biotechnocrats in core and allied biotechnological fields all over the world.

PEO2: Undertake advanced domain research and development in the field of translational research, in a sustainable, environment- friendly and inventive manner.

PEO3: Become an entrepreneur to meet the expectations and demand of modern industrial technologies and health care system.

PEO4: Carry out professional leadership roles in industries as well as academics with a commitment to continuous learning.

PEO5: Serve the society as a bonafide global citizen with strong sense of professional responsibility and ethics.

Program Specific Outcomes (PSOs)

1. An ability to apply biotechnology skills (including molecular & micro biology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields.
2. An ability to integrate technologies and develop solutions Based on inter disciplinary skills.

Message from Chairman

Shri Vishnu Saran
B.E. (Mechanical)

To burn always with this hard gem like flame, to maintain this ecstasy, is success in life.

It's a feeling of pride for me that the MIET Biotechnology Society is coming up with the new edition of magazine **BIOTACTION** , which is going to explore the technical and creative talent of our students. We in MIET have always supported intellectual and technical growth in all the distinct spheres of life. The publication of this magazine is an example of the same, and for sure it showcases talent, innovation and dedication of our students who deserve to excel and achieve the zenith. I wish my students good luck in their current academic endeavors and their future and professional careers. I congratulate the entire Biotechnology Society for the excellent effort of bringing out **BIOTACTION** .

Message from Vice-Chairman

Shri Puneet Agarwal
B.Tech. (IIT BHU), PGDM (IIM A)

It is a moment of great satisfaction to witness the Department of Biotechnology presenting yet another edition of its magazine **BIOTACTION**. The magazine reflects the intellectual curiosity, creativity, and scientific vision of our students, which we at MIET always strive to encourage. Every edition stands as a symbol of their perseverance and commitment to excellence. I appreciate the efforts of the faculty and students for nurturing such a culture of innovation and teamwork. My best wishes to all for the continued success of **BIOTACTION** and future academic endeavors.

Message from Director

Prof. (Dr.) Sanjay Kr. Singh
B. Tech. (E&T), M. Tech. (E&C),
Ph.D. (VLSI Design)

"Dreams set the course, and determination paves the way."

There are no limits to what you can achieve; the possibilities are as vast as your vision. MIET fosters a healthy, creative, and intellectually vibrant environment, empowering young minds to grow into responsible and progressive citizens of our nation. It is with great pride that I welcome the new edition of **BIOTACTION**, the Biotech magazine of the MIET Biotechnology Society. I sincerely applaud the initiative and hard work of our Biotechnology students in bringing this magazine to life. May this platform continue to inspire curiosity, share knowledge, and open new horizons for learning and innovation in the times ahead.

Message from Director-Placement

Ms. Akanksha Agarwal
PGDBM

I am pleased to see the Department of Biotechnology bringing out the new issue of **BIOTACTION**, which captures the spirit of innovation and learning among students. Initiatives like this magazine provide a platform for students to express their ideas, enhance their technical understanding, and connect academics with real-world perspectives. It also reflects their readiness to take on professional challenges with confidence and creativity. I congratulate the Biotechnology Society for this commendable effort and wish them great success in their academic and career journeys ahead.

Message from Dean Academics

Dr. Sanjeev Singh
M.Tech., Ph.D. (IIT BHU)

The magazine **BIOTACTION** stands as a vibrant reflection of the Department of Biotechnology's dedication to academic innovation, creativity, and research excellence. It is heartening to see our students and faculty come together to showcase ideas that bridge science and imagination.

Such initiatives not only highlight the intellectual strength of the department but also encourage a spirit of inquiry, teamwork, and continuous learning among students. I extend my best wishes to the entire editorial team for this commendable effort and look forward to many more inspiring editions ahead.

Message from HoD

Dr. Avinash Singh
M.Tech., Ph.D.

Dear Students,

I am elated to present the new issue of the MIET Biotechnology Society's official magazine: **BIOTACTION.** In today's world, it is extremely important, especially for students, teachers as well as entrepreneurs in the field of biotechnology to be fully aware of the recent developments in the biotechnological arena. Biotechnology offers the widest range opportunities in the present global scenario. Therefore, **BIOTACTION** is an effort from the MIET Biotechnology Society towards increasing the knowledge-base of its readers.

I hope the exposure that **BIOTACTION** provides is helpful in generating interest, increasing awareness and spreading the message to the Society.

My sincere best wishes to all.

Table of Contents

About the Department

Premier & Oldest Department

- One of the Premier Department in Education & Research in Uttar Pradesh.
- Established in 2001 and is one of the oldest Departments in state offering graduate and post graduate Engineering degrees in Biotechnology.

Research Centre

- Approved Research Center for conducting Ph.D. Program in Biotechnology by Dr. A.P.J. Abdul Kalam Technical University, Lucknow.

State of the Art Laboratories

- State-of-the-Art Laboratories provide advanced facilities for cutting-edge research and practical learning.

Experienced and Qualified Faculty

- Doctorate from (IITs/NITs/CSIRs)

Why Biotechnology at MIET?

01 Well-Established Institution

02 Approved Research Center by AKTU

03 Dedicated Placement cell

04 Experienced and Qualified Faculty (IITs/NITs/CSIRs)

05 Alumni Success

06 Extra-Curricular Development

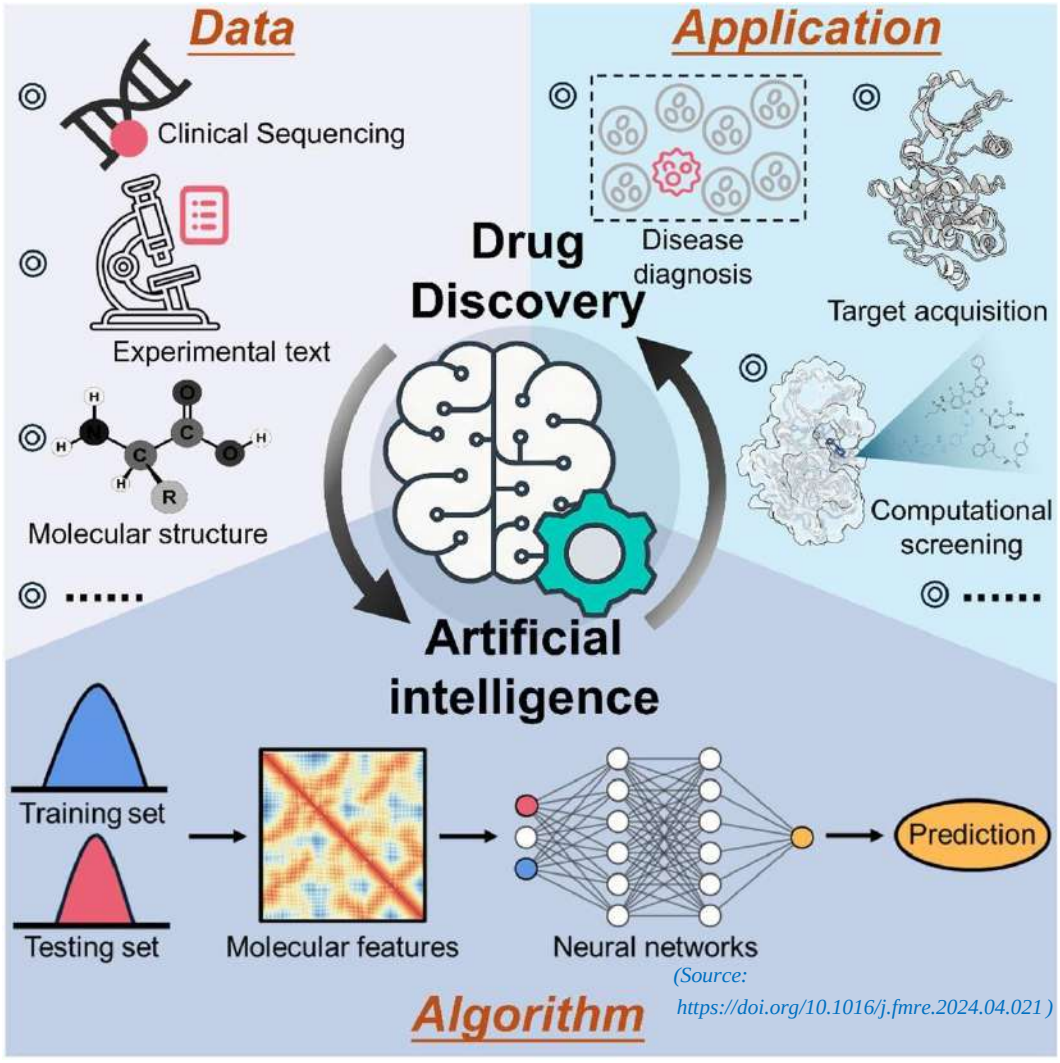
Artificial Intelligence in Drug Discovery and Development

The integration of Artificial Intelligence (AI) into the field of biotechnology has revolutionized the conventional process of drug discovery and development. Traditionally, the journey from target identification to clinical trials required years of experimentation and extensive financial investment. However, AI-driven systems now enable researchers to analyze complex biological data, predict molecular interactions, and identify potential drug candidates with unprecedented speed and accuracy. This paradigm shift marks the beginning of a new era in pharmaceutical biotechnology, where computational intelligence complements human expertise to accelerate innovation.

Drug discovery is an inherently data-intensive process involving multiple stages such as target identification, compound screening, lead optimization, and toxicity testing. AI, particularly through machine learning (ML) and deep learning (DL) models, can process vast datasets derived from genomics, proteomics, and cheminformatics. These models are capable of identifying hidden patterns, predicting biological responses, and evaluating compound–target interactions. For instance, AI algorithms can predict the binding affinity of a molecule to its target protein, significantly reducing the number of experimental trials required. This ability helps in prioritizing the most promising compounds for further testing. One of the most transformative contributions of AI to drug discovery is structure-based drug design. The development of DeepMind's *AlphaFold* has enabled scientists to predict protein structures with near-experimental accuracy. This advancement allows researchers to understand the three-dimensional conformation of target proteins, which is essential for designing specific inhibitors or activators. AI also facilitates ligand -based screening, where neural networks predict the biological activity of chemical compounds based on known drug–target interactions. Consequently, the time required to identify hit compounds has been drastically reduced from years to a matter of weeks.

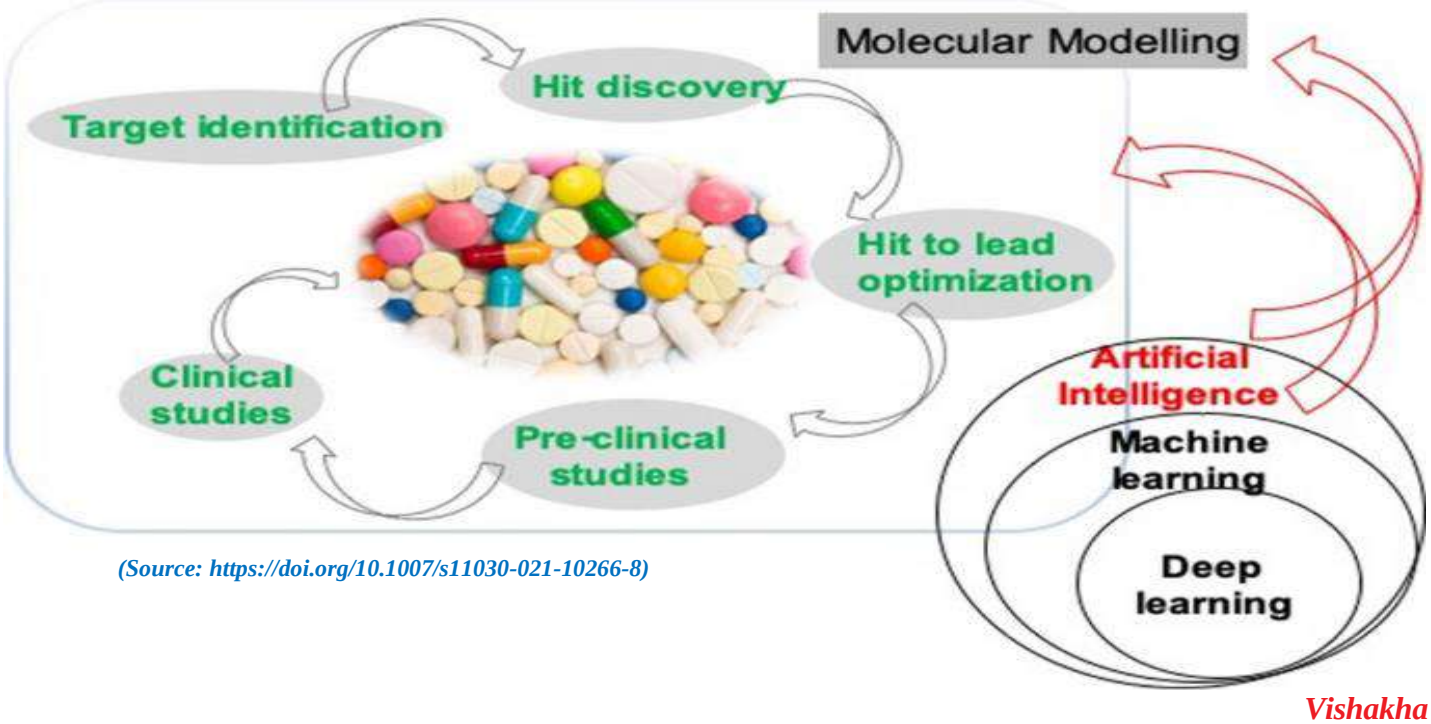
AI also plays a pivotal role in drug repurposing, an approach that seeks to identify new therapeutic uses for existing drugs. By mining clinical and molecular data, AI algorithms can uncover hidden relationships between diseases and known drug molecules. For example, during the COVID-19 pandemic, AI-assisted platforms helped identify potential antiviral candidates by screening databases of approved pharmaceuticals, significantly accelerating the response to the global health crisis. Furthermore, AI enhances preclinical and clinical trial design. Predictive models can estimate the pharmacokinetics, toxicity, and efficacy of drug candidates before animal or human testing begins. Natural language processing (NLP) algorithms assist researchers in reviewing scientific literature and extracting relevant data automatically, thereby facilitating evidence-based decision-making. In clinical trials, AI aids in patient recruitment by matching genetic, physiological, and demographic data to trial requirements, improving both efficiency and diversity in participant selection.

Despite its remarkable progress, AI-driven drug discovery faces several challenges. The accuracy of predictions depends heavily on the quality and quantity of available data. Incomplete or biased datasets can lead to misleading results. Additionally, the interpretability of AI models remains a concern, as many deep learning systems function as "black boxes," providing limited insight into their decision-making process. Addressing these challenges requires interdisciplinary collaboration between biologists, chemists, data scientists, and ethicists to ensure transparent and reproducible outcomes.



(Source: https://doi.org/10.1016/j.fmre.2024.04.021)

In conclusion, AI has transformed drug discovery and development into a data-driven, efficient, and predictive science. By integrating machine learning, big data analytics, and computational modeling, biotechnology now has the tools to explore biological complexity with greater precision. The continued evolution of AI promises to reduce development costs, shorten timelines, and increase the success rate of new therapeutics. Ultimately, this synergy between artificial intelligence and biotechnology heralds a future where life-saving drugs can reach patients faster, safer, and more effectively than ever before.



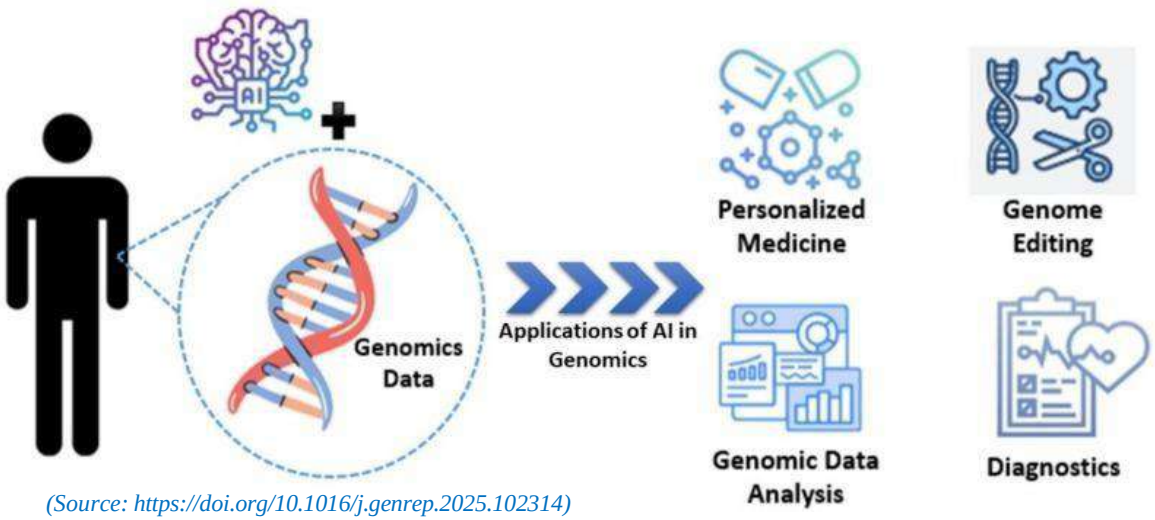
(Source: https://doi.org/10.1007/s11030-021-10266-8)

Vishakha
Batch: 2021-2025

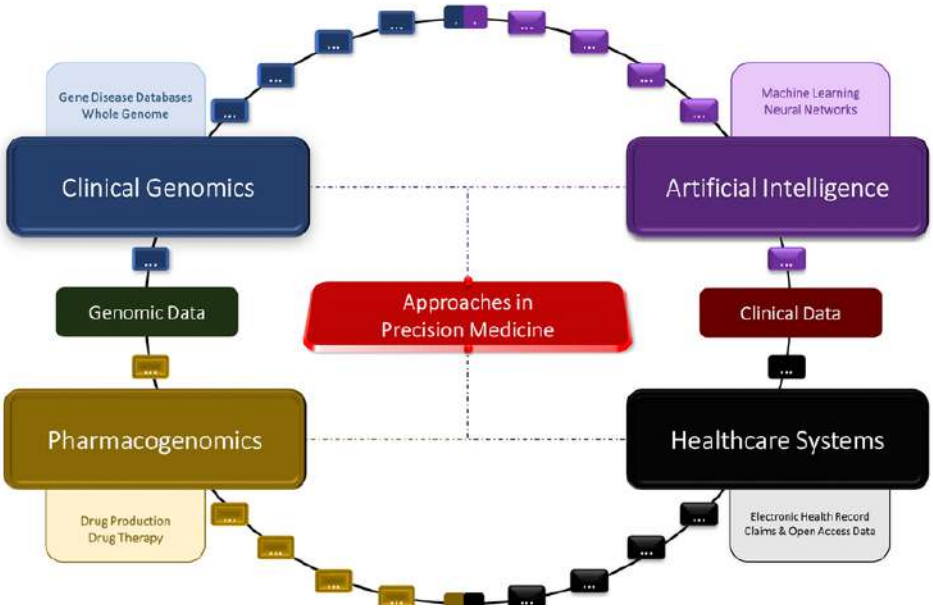
Role of Artificial Intelligence in Genomics and Precision Medicine

Artificial Intelligence (AI) has become a cornerstone technology in genomics and precision medicine, where it bridges the gap between raw genetic information and personalized healthcare solutions. The massive influx of genomic data from sequencing platforms demands analytical systems capable of identifying meaningful biological patterns—an area where AI excels.

Machine learning algorithms can process terabytes of genomic sequences to pinpoint genetic variants linked with diseases. Deep learning models such as convolutional neural networks analyze complex relationships between genes, mutations, and disease phenotypes. These insights enable early diagnosis, prediction of disease susceptibility, and individualized treatment strategies. In the realm of precision medicine, AI integrates patient-specific genomic data with clinical records and environmental factors to design tailored therapies. For instance, AI can help classify cancer subtypes or predict how a patient will respond to a specific drug, reducing trial-and-error treatments. Pharmacogenomic applications also benefit from AI, which helps foresee potential adverse reactions and optimize dosage for maximum safety and efficacy. Beyond clinical applications, AI supports genome annotation and functional prediction. It can analyze non-coding DNA regions to predict transcriptional activity and gene regulation patterns. Such advancements provide deeper insight into molecular mechanisms underlying complex diseases.



(Source: https://doi.org/10.1016/j.genrep.2025.102314)



(Source: https://doi.org/10.3389/fgene.2022.929736)

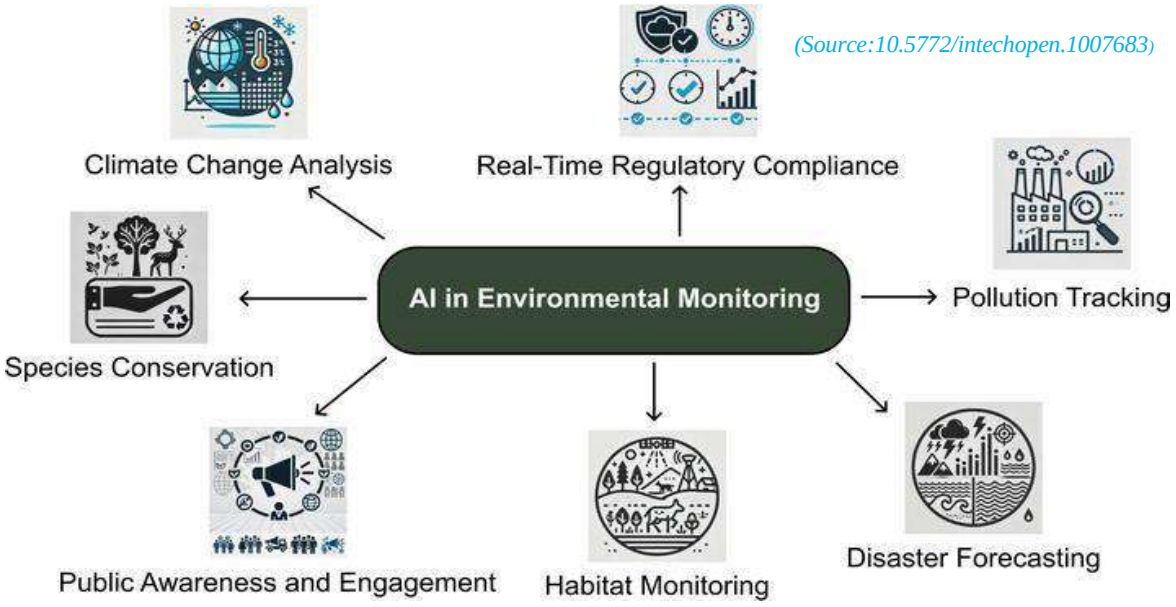
Despite its promise, AI implementation faces challenges related to data security, ethical governance, and algorithmic transparency. Protecting sensitive genomic data and ensuring fairness in AI predictions are crucial for patient trust and safety. Nevertheless, as computational tools continue to evolve, AI-driven genomics promises to revolutionize how medicine is practiced—turning reactive care into predictive, preventive, and personalized healthcare.

Almas Nausheen
Batch: 2022-2026

AI-Powered Microbial Genome Analysis for Environmental Biotechnology

Artificial Intelligence (AI) has become an indispensable analytical tool in environmental biotechnology, especially in microbial genome analysis. Microorganisms are central to biogeochemical cycles, bioremediation, and wastewater treatment processes. Understanding their genetic makeup and functional roles requires extensive genomic and metagenomic data interpretation — a task well-suited to AI due to its efficiency in handling complex, high-dimensional datasets.

In environmental microbiology, the characterization of microbial communities often relies on metagenomic sequencing, where thousands of species coexist within a single sample. Traditional bioinformatic tools face limitations in accurately classifying species and predicting gene functions in such complex environments. AI algorithms, particularly machine learning (ML) and deep learning (DL), have addressed these challenges by enabling automated genome assembly, annotation, and taxonomic classification. These models learn from known genetic patterns to predict the functions of unknown genes and metabolic pathways, thereby unveiling the ecological significance of microbial consortia. A remarkable application of AI is in predicting microbial interactions and community dynamics. Using predictive modeling, researchers can estimate how microbial populations respond to environmental changes such as nutrient fluctuations, temperature variations, or pollutant stress. This information aids in optimizing bioreactors for wastewater treatment or bioenergy production. For example, AI-driven modeling in aerobic granular sludge (AGS) and anaerobic membrane bioreactors (AnMBRs) helps forecast microbial performance and pollutant removal efficiency under varying operational conditions.



(Source:10.5772/intechopen.1007683)

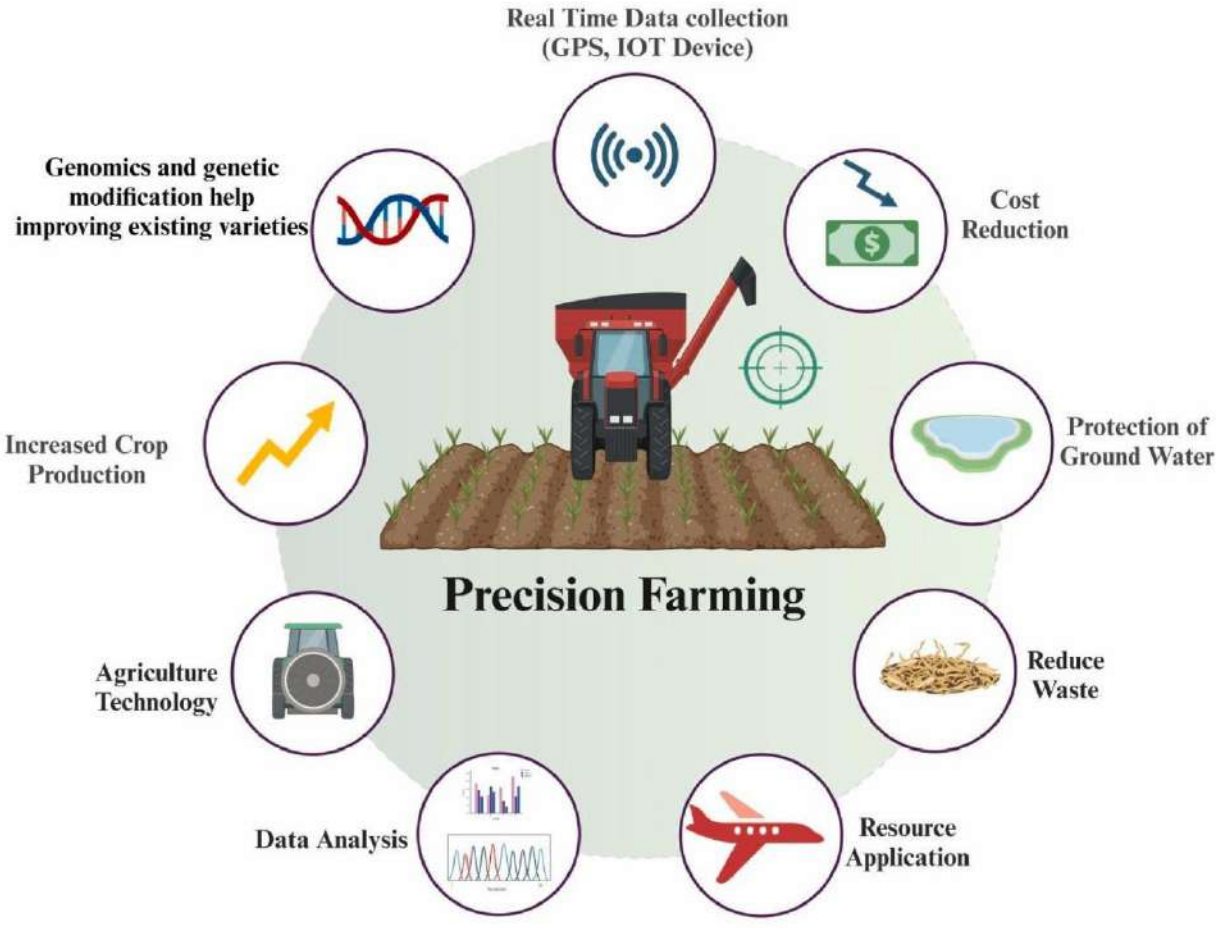
AI-powered microbial genome analysis bridges the gap between data generation and ecological interpretation. By uncovering hidden genetic information and functional relationships, AI enables a deeper understanding of microbial ecology and environmental biotechnology. This integration of computational intelligence with microbial genomics supports the design of efficient bioprocesses for pollution control, waste treatment, and ecosystem restoration — reinforcing the pivotal role of AI in building a cleaner and more sustainable future.

Anuj Kumar
Batch: 2022-2025

Application of AI in Agricultural Biotechnology

The integration of Artificial Intelligence (AI) into agricultural biotechnology is revolutionizing modern farming practices and crop research. Agriculture is a data-intensive sector, involving information on soil quality, crop genetics, climate variability, pest prevalence, and nutrient management. AI provides the computational capacity to analyze these multifactorial datasets, enabling precision agriculture, crop improvement, and sustainable resource utilization. By combining AI with biotechnology, researchers can optimize plant breeding, disease management, and yield prediction, driving innovations in food security and environmental sustainability.

One of the most transformative applications of AI in agricultural biotechnology is in precision breeding and genome editing. AI algorithms analyze genomic data to identify genes associated with desirable traits such as drought tolerance, disease resistance, and nutrient efficiency. These insights guide plant breeders in selecting optimal parent lines and accelerating the development of high-yield, resilient crop varieties. In conjunction with gene-editing technologies such as CRISPR-Cas9, AI models predict off-target effects and optimize guide RNA design, ensuring precise genetic modifications for enhanced crop performance.



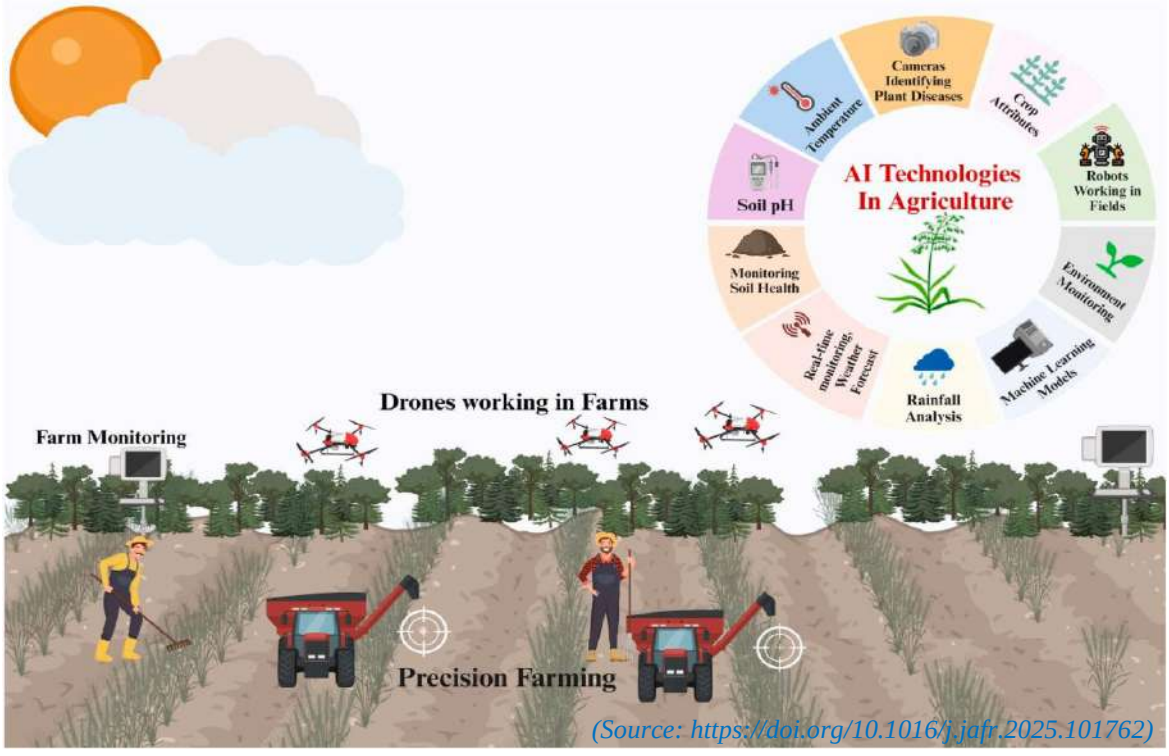
(Source: https://doi.org/10.1016/j.jafr.2025.101762)

AI also plays a pivotal role in disease detection and management. Machine learning models trained on image datasets can identify plant diseases from leaf images, canopy patterns, or spectral signatures with high accuracy. Drones, satellites, and field-based sensors collect real-time crop data, which AI analyzes to detect

early signs of stress, pest infestations, or nutrient deficiencies. Early detection allows timely intervention, reducing crop losses and minimizing the need for excessive pesticide application, thus promoting sustainable farming practices. Another key application is yield prediction and resource optimization. AI models integrate environmental parameters, historical crop performance data, and soil characteristics to forecast crop yields. These predictive analytics support farmers in decision-making related to irrigation, fertilization, and harvest scheduling. Furthermore, AI-powered robotic systems can automate tasks such as seeding, weeding, and harvesting, enhancing efficiency while reducing labor costs.

In addition, AI facilitates agro-biotechnological research through the analysis of omics data, including genomics, transcriptomics, and metabolomics. By identifying functional genes, regulatory pathways, and metabolic networks, AI accelerates the development of biofortified crops, stress-resilient varieties, and plants capable of producing high-value secondary metabolites. For instance, AI-driven metabolomic analysis can optimize the production of plant-derived pharmaceuticals and nutraceuticals. Despite these advances, challenges remain in the widespread adoption of AI in agriculture. High-quality, standardized datasets are essential for accurate predictions, yet such data is often scarce, particularly in developing regions. Additionally, integrating AI tools with field-level biotechnology requires interdisciplinary expertise and infrastructure support. Addressing these challenges will require collaboration between agronomists, biotechnologists, data scientists, and policymakers.

AI has become an indispensable tool in agricultural biotechnology, enabling data-driven, precise, and sustainable crop management. By enhancing genome analysis, disease monitoring, yield prediction, and resource optimization, AI contributes to improved productivity, environmental conservation, and global food security. The continued convergence of AI and biotechnology promises a future where agriculture is smarter, more efficient, and capable of meeting the challenges of a growing population and changing climate.

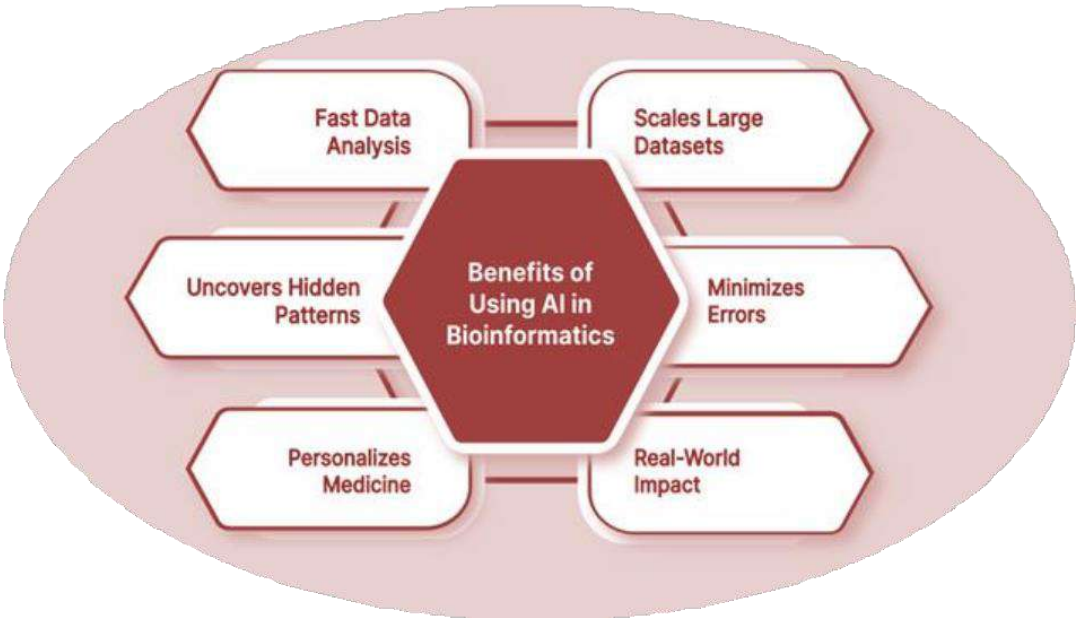


(Source: https://doi.org/10.1016/j.jafr.2025.101762)

Parnika Vashist
Batch: 2022-2026

AI and Bioinformatics: Revolutionizing Biological Data Analysis

The emergence of Artificial Intelligence (AI) has profoundly transformed bioinformatics, enabling the analysis of massive and complex biological datasets with unprecedented speed and precision. Bioinformatics integrates biology, computer science, and statistics to interpret data from genomics, transcriptomics, proteomics, and metabolomics. Traditionally, the sheer volume and complexity of biological information posed challenges in data interpretation, pattern recognition, and predictive modeling. AI, through machine learning (ML) and deep learning (DL) algorithms, has become a powerful tool for extracting meaningful insights from this wealth of information, thereby accelerating research and applications in biotechnology.



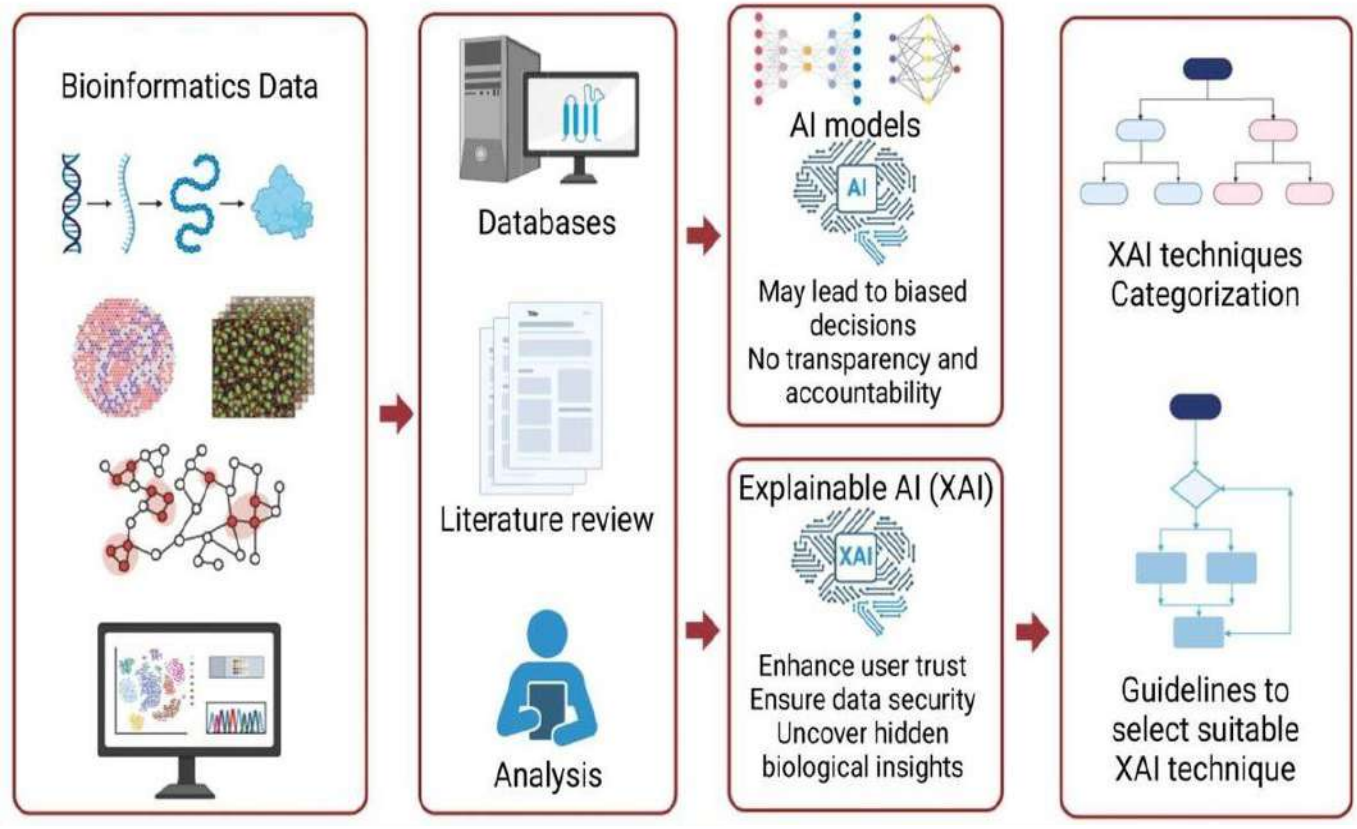
(Source: https://biostate.ai/blogs/ai-in-bioinformatics-methods-tools-applications/)

AI facilitates genomic and proteomic data analysis by identifying patterns that are difficult for humans to discern. For example, convolutional neural networks (CNNs) and recurrent neural networks (RNNs) are applied to predict protein gene structures, regulatory elements, and protein– protein interactions. Tools such as DeepMind's *AlphaFold* exemplify the potential of AI in predicting protein 3D structures with near-experimental accuracy, significantly advancing molecular biology and drug design. Similarly, AI-based models can identify disease-related genetic variants, supporting precision medicine and personalized treatment strategies. In metabolomics and transcriptomics, AI algorithms analyze high- dimensional data to uncover biomarkers, metabolic pathways, and gene expression patterns. Machine learning approaches such as support vector machines (SVMs), random forests, and gradient boosting facilitate classification and clustering of biological samples, enabling early disease detection, patient stratification, and biomarker discovery. For instance, AI has been successfully used to predict cancer subtypes based on gene expression profiles, providing insights for targeted therapies.

Another important application is in biological network analysis, where AI models map complex interactions between genes, proteins, and metabolites. By integrating multi-omics datasets, AI reveals regulatory networks, identifies key functional modules, and predicts how perturbations in one component affect the entire system. This systems biology approach enhances the understanding of cellular processes and disease mechanisms, guiding experimental design and hypothesis testing.

AI also supports data integration and literature mining in bioinformatics. Natural language processing (NLP) algorithms automatically extract relevant information from the rapidly expanding biomedical literature, databases, and clinical records. This capability reduces manual curation efforts and ensures that researchers have access to the latest discoveries, improving the speed and quality of scientific research. Despite these advancements, challenges remain in AI-driven bioinformatics. Data heterogeneity, quality variability, and computational resource demands can limit model performance. Moreover, ensuring model interpretability and avoiding biases in predictions are critical for reliable applications in biomedical research. Addressing these challenges requires interdisciplinary collaboration among biologists, bioinformaticians, and data scientists.

AI has revolutionized bioinformatics by enabling the efficient analysis of complex biological data, predicting molecular structures, uncovering functional relationships, and supporting personalized medicine. Its integration into biotechnology research enhances the understanding of life at the molecular and systems levels. As AI algorithms and computational tools continue to evolve, bioinformatics will play an increasingly central role in advancing biotechnology, healthcare, and environmental applications.



(Source: https://doi.org/10.1016/j.csbj.2024.12.027)

Ojasvi Tyagi
Batch: 2023-2027

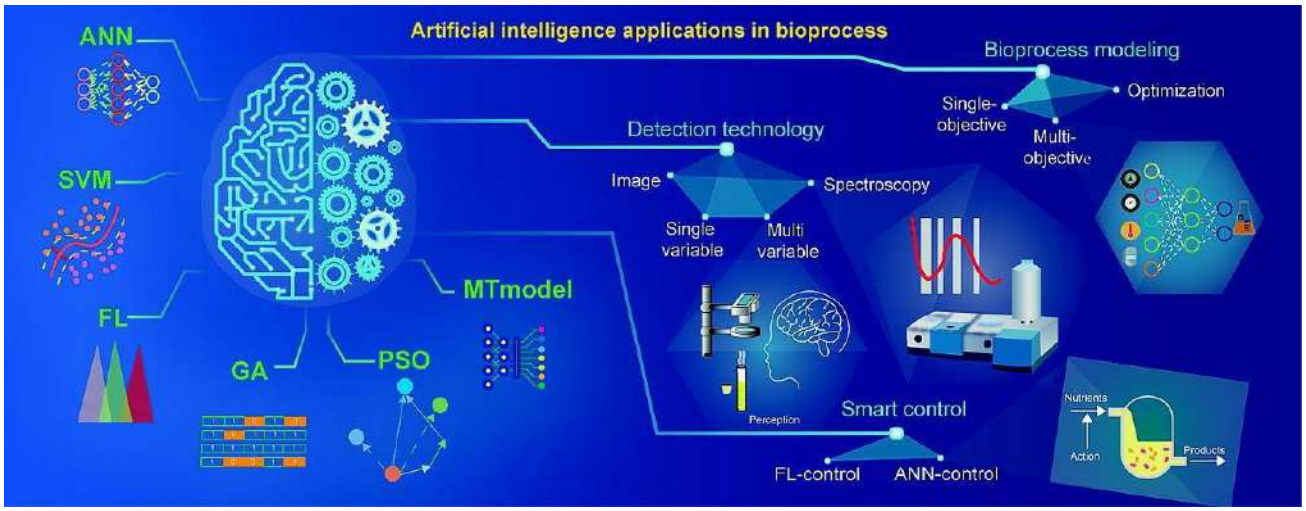
AI-Enabled Bioprocess Optimization and Fermentation Control

Artificial Intelligence (AI) has emerged as a transformative tool in industrial biotechnology, particularly for bioprocess optimization and fermentation control. Traditional approaches for optimizing microbial cultivation, enzyme production, and biofuel generation often rely on trial-and-error methods, which are time-consuming and resource-intensive. AI, through machine learning (ML) and predictive modeling, enables efficient monitoring, control, and optimization, leading to higher productivity and improved product quality.

In fermentation-based bioprocesses, operational parameters such as pH, temperature, dissolved oxygen, substrate concentration, and agitation play a crucial role in microbial growth and metabolite production. AI algorithms, including neural networks and support vector machines (SVMs), analyze historical process data to identify patterns and predict optimal conditions, reducing the number of experimental iterations and facilitating faster scale-up from laboratory to industrial levels.AI also supports real-time monitoring and automated control by integrating sensor networks with predictive models. This allows proactive adjustments in aeration, nutrient supply, and agitation to maintain optimal conditions, minimizing process variability and ensuring consistent product quality while lowering production costs.

Furthermore, AI techniques like reinforcement learning and genetic algorithms enable bioprocess modeling and simulation. They can predict microbial growth dynamics, substrate utilization, and product formation under various scenarios, supporting process design, risk assessment, and decision-making without extensive laboratory experiments. For example, AI models can evaluate the effects of new substrates or altered feeding strategies in fed-batch fermentations.Another key application of AI is in quality control and anomaly detection. Machine learning models analyze sensor data to identify unusual patterns indicating contamination, equipment malfunction, or metabolic stress, enabling timely corrective measures and regulatory compliance.

Despite its benefits, implementing AI in bioprocesses requires large, high-quality datasets and interdisciplinary expertise in biotechnology, process engineering, and data science. Nonetheless, AI has revolutionized industrial biotechnology by enabling predictive modeling, real-time monitoring, and automated decision-making, resulting in increased efficiency, better product quality, and sustainable production practices.



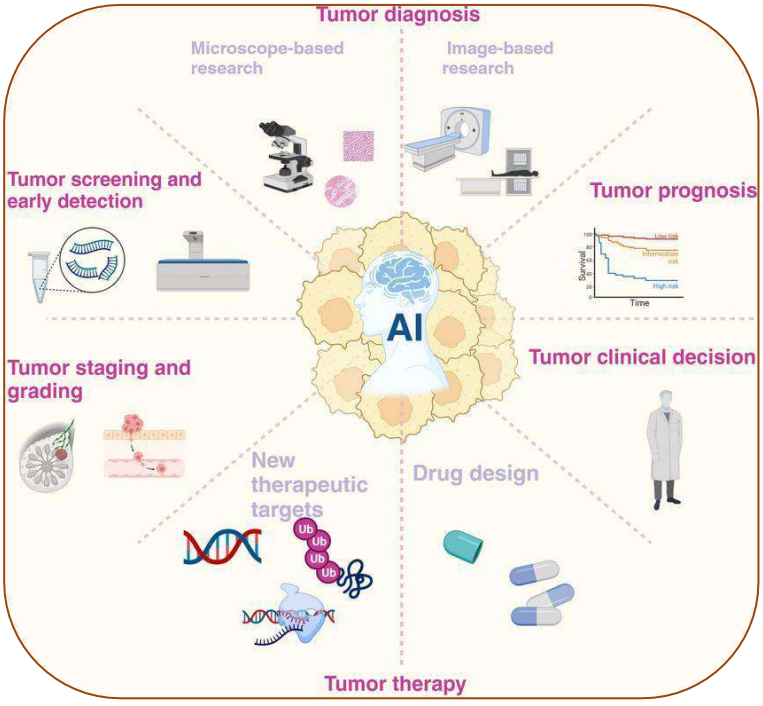
(Source: https://doi.org/10.1016/j.biortech.2022.128451)

Shraddha
Batch: 2021-2025

Role of AI in Cancer Diagnosis and Therapeutics

Cancer is one of the most complex and challenging diseases, requiring accurate diagnosis, precise treatment planning, and timely intervention. Artificial Intelligence (AI) is transforming oncology by enabling the analysis of large clinical, genomic, and imaging datasets, supporting faster, more accurate and personalized patient care.

In cancer diagnosis, AI excels in advanced image analysis. Machine learning (ML) and deep learning (DL) models, especially convolutional neural networks (CNNs), can detect tumors at early stages by identifying subtle features often missed by human observers. For example, AI algorithms can recognize microcalcifications in mammograms, small nodules in lung CT scans, or atypical cells in histopathology slides, improving diagnostic accuracy and reducing false negatives.AI also plays a key role in genomic-based diagnostics. By analyzing patient-specific genetic and multi-omics data—including genomics, transcriptomics, and proteomics—AI identifies cancer-associated mutations, prognostic biomarkers, and therapeutic targets. This enables precision oncology, where treatment is tailored to the molecular profile of each patient's tumor rather than using a one-size-fits-all approach.



(Source: https://doi.org/10.1016/j.biortech.2022.128451)

In therapeutics, AI aids decision-making and drug development. Predictive models simulate tumor responses to chemotherapy, targeted therapies, or immunotherapy, helping oncologists select the most effective treatment while minimizing side effects. AI also accelerates drug discovery by identifying novel targets and predicting the efficacy of candidate compounds in cancer models.AI improves clinical workflows and patient monitoring as well. Natural language processing (NLP) extracts key information from medical records, pathology reports, and research literature to support evidence-based decisions. AI-enabled remote monitoring tracks patient responses, detects complications early, and helps optimize follow-up schedules.

Challenges remain, such as the need for high-quality datasets, ensuring data privacy, and addressing potential algorithmic bias. Overall, AI is reshaping cancer care by enabling early detection, precise molecular profiling, personalized therapy, and faster drug development, making oncology more efficient, accurate, and patient-centric.

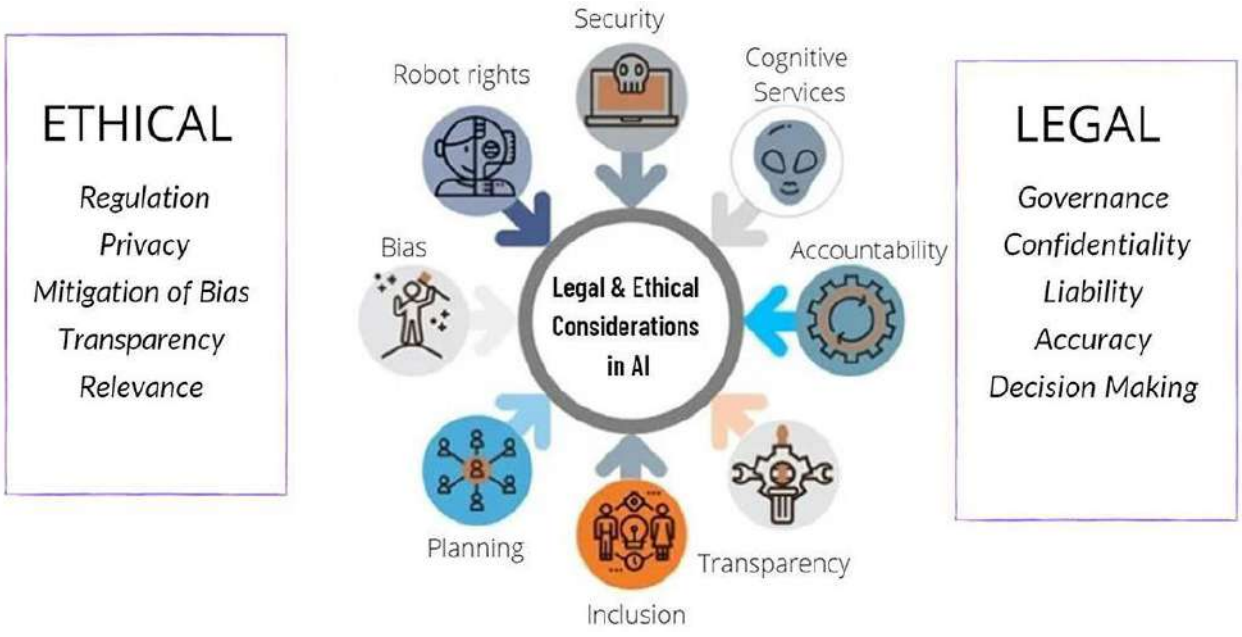
Ritika Gupta
Batch: 2021-2025

Ethical, Legal, and Social Implications of AI in Biotechnology

The integration of Artificial Intelligence (AI) into biotechnology has opened remarkable opportunities in research, healthcare, and industry. However, it also brings important ethical, legal, and social implications (ELSI) that must be addressed to ensure responsible, equitable, and safe use of AI technologies.

A key ethical concern is data privacy. AI systems depend on large datasets containing genomic, clinical, and personal health information. Unauthorized access or misuse of such data can threaten individual privacy and lead to discrimination. Therefore, secure storage, anonymization, and regulated data sharing are essential. Bias and fairness in AI models also remain major challenges. Algorithms trained on limited or unrepresentative datasets may yield skewed results, influencing clinical or agricultural outcomes. For example, a genomic AI tool trained mainly on one population may inaccurately predict disease risks in others. To prevent this, developers must minimize bias and validate models across diverse datasets.Legal and intellectual property issues are equally significant. AI-driven discoveries in gene editing, synthetic biology, or bioproduct design raise questions about ownership, patent rights, and liability. Clear regulatory frameworks are needed to balance innovation with safety and accountability. Socially, AI's impact on employment, accessibility, and public trust cannot be ignored. Automation may reduce certain roles, and unequal access to AI-based solutions could deepen disparities. Transparency, education, and public engagement are crucial to build confidence in AI applications.

Dual-use concerns also require careful oversight, as AI tools capable of designing microorganisms or genetic sequences could be misused. Strong ethical review, risk assessment, and governance mechanisms are vital to prevent harm.AI holds transformative potential for biotechnology, but its success depends on addressing these ethical, legal, and social dimensions. Responsible AI implementation demands interdisciplinary collaboration, transparent governance, and robust regulation to ensure innovation benefits society safely and sustainably.



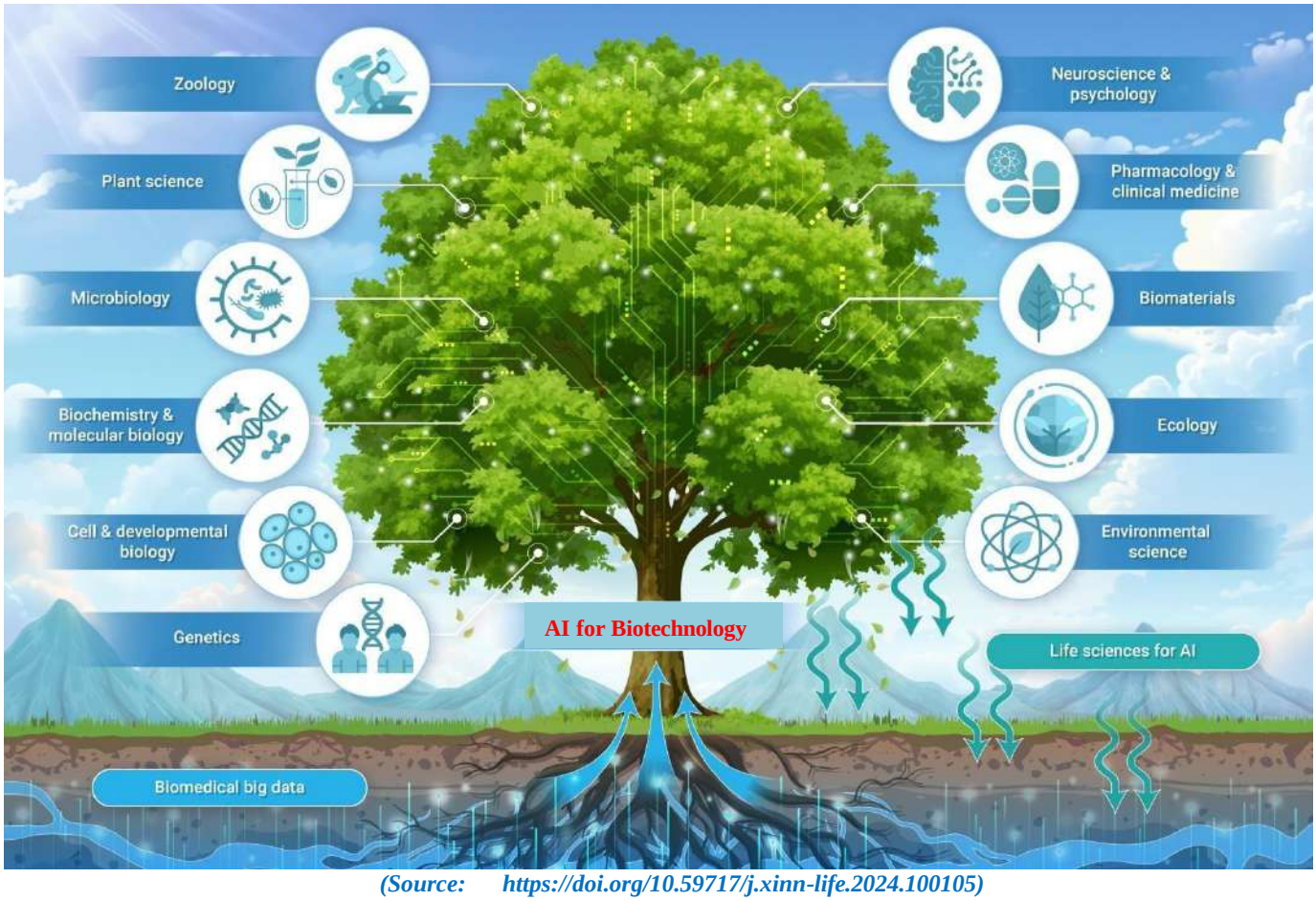
(Source: https://doi.org/10.3389/fsurg.2022.862322)

Ritik Kumar
Batch: 2022-2026

Future Prospects and Challenges of AI in Biotechnology

Artificial Intelligence (AI) is poised to transform biotechnology, offering unprecedented opportunities for research, healthcare, agriculture, and environmental management. By enabling predictive modeling, automation, and data-driven decision-making, AI accelerates discovery, enhances efficiency, and supports personalized solutions. The future of biotechnology is closely linked to the continued integration of AI across its diverse subfields.

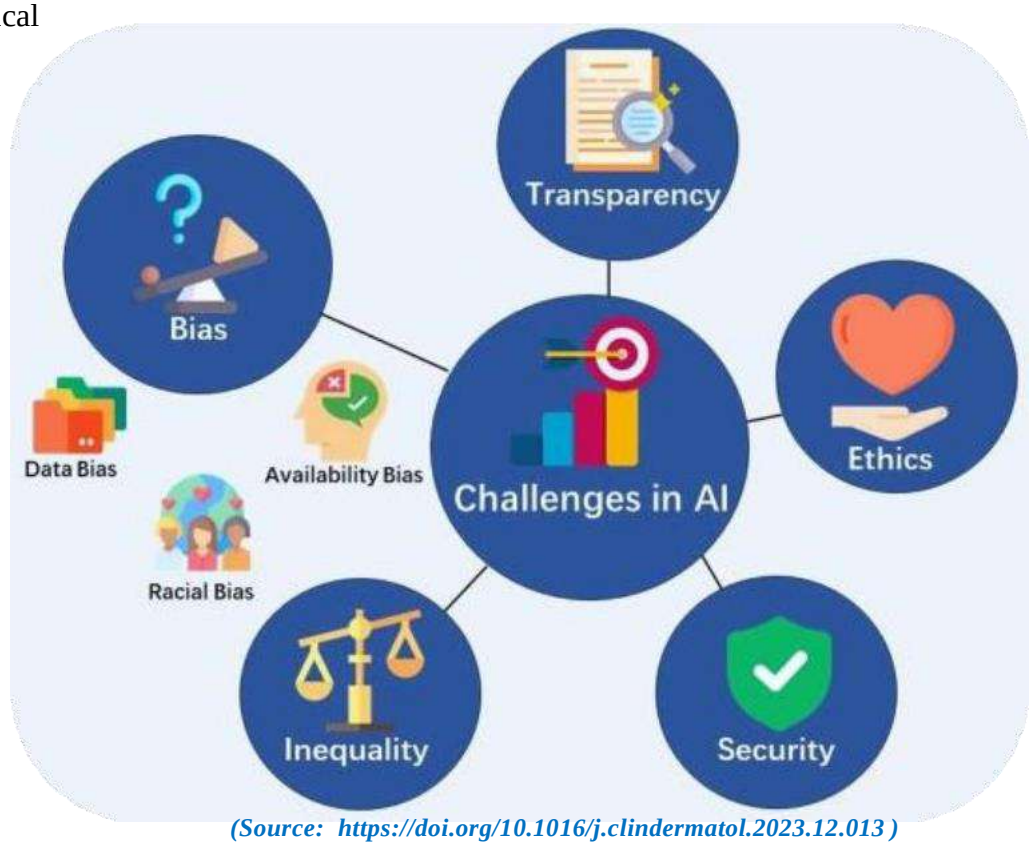
One major prospect is the advancement of precision medicine and therapeutics. AI can analyze multi-omics datasets, including genomics, proteomics, and metabolomics, to design personalized treatments, predict drug responses, and minimize adverse effects. Integration with CRISPR gene editing, synthetic biology, and nanobiotechnology further expands the potential for targeted interventions and novel therapeutics. In agriculture and environmental biotechnology, AI-driven tools can optimize crop breeding, disease management, resource use, and bioremediation. Predictive analytics, coupled with sensor technologies, drones, and remote monitoring, enables sustainable practices, improved yields, and early detection of environmental hazards. AI-based modeling of microbial communities and bioprocesses also enhances industrial biotechnology and waste treatment efficiency.



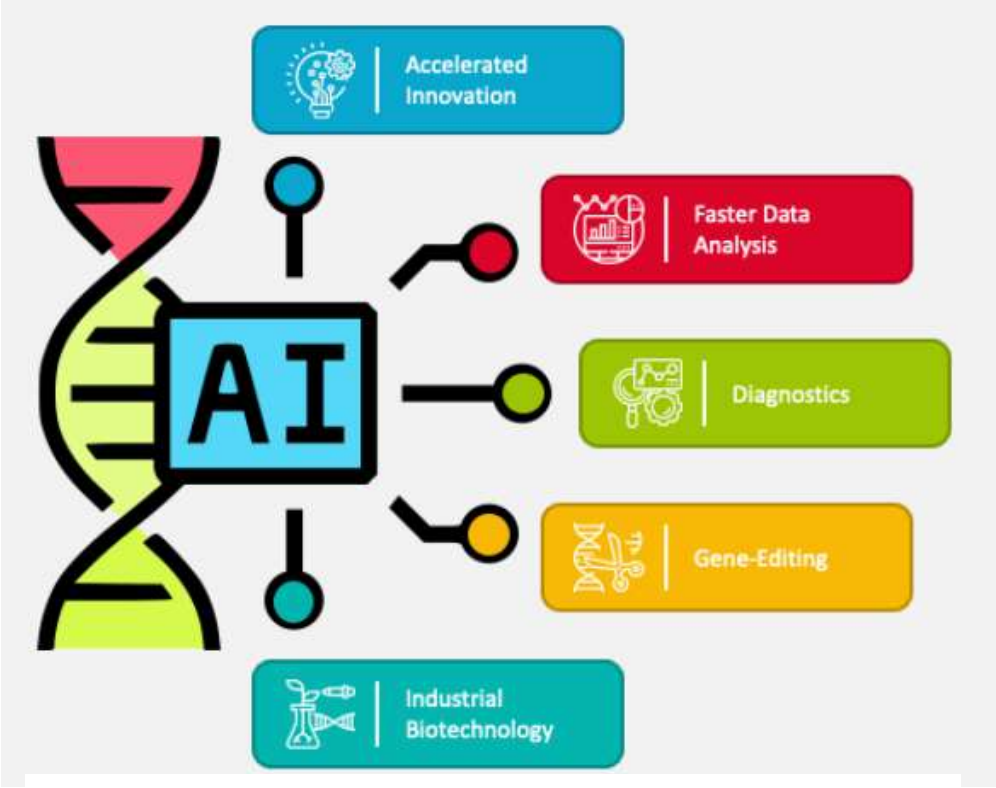
(Source: https://doi.org/10.59717/j.xinn-life.2024.100105)

AI is also expected to revolutionize biological data analysis**.** With the rapid growth of sequencing technologies and omics research, AI algorithms can efficiently process complex datasets, predict protein structures, and uncover hidden patterns in cellular networks. This accelerates discovery in drug design, synthetic biology, and functional genomics. High-quality, standardized datasets are essential for accurate AI

predictions, yet many biological datasets are heterogeneous or incomplete. Ethical and social concerns, including data privacy, bias, and equitable access to AI-driven technologies, must be addressed. Regulatory frameworks and biosafety measures are critical to ensure responsible and safe applications. Interdisciplinary collaboration among biologists, data scientists, engineers, and policymakers is necessary to translate AI innovations into practical solutions.



(Source: https://doi.org/10.1016/j.clindermatol.2023.12.013)



(Source: https://www.sketchbubble.com/en/presentation-ai-in-biotechnology.html)

AI holds immense promise in advancing biotechnology by enabling precision, efficiency, and innovation across medicine, agriculture, and environmental management. While technical, ethical, and regulatory challenges must be overcome, the continued convergence of AI with biotechnology is set to redefine research, industrial applications, and healthcare. By addressing these challenges responsibly, AI can unlock transformative solutions that improve human health, environmental sustainability, and global quality of life.

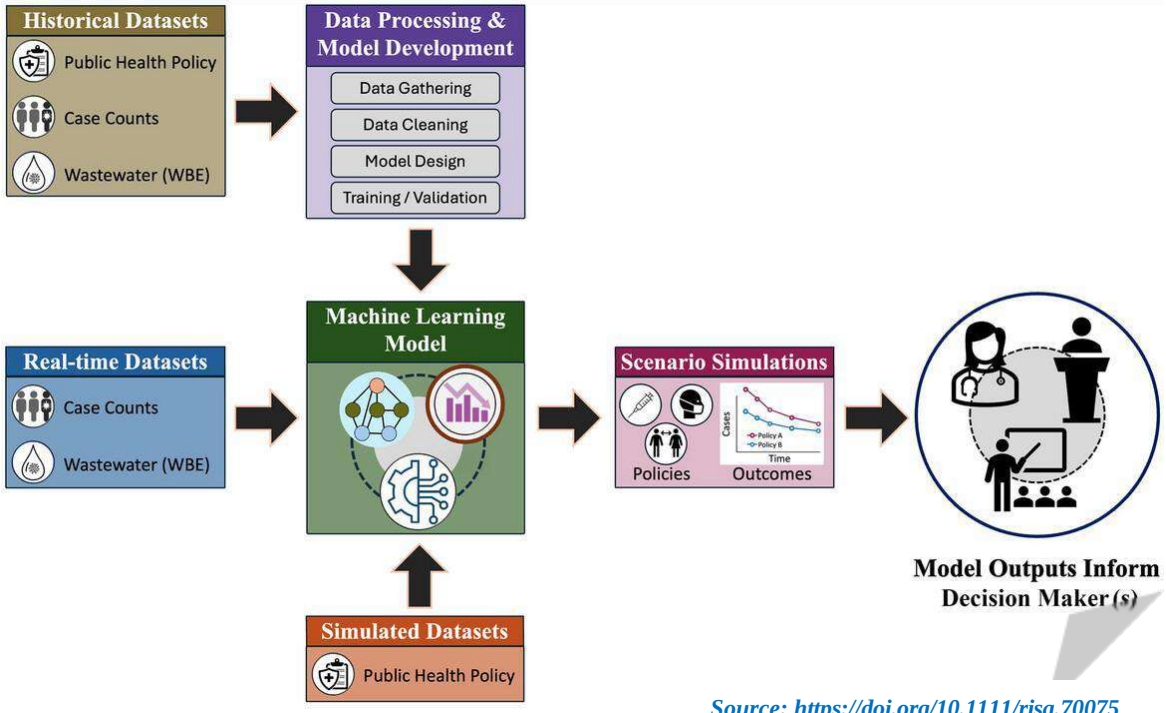
Prashasti
Batch: 2021-2025

AI in Wastewater-Based Epidemiology and Public Health Monitoring

Wastewater-based epidemiology (WBE) has emerged as a powerful tool for monitoring community health by detecting pathogens, pharmaceuticals, and chemical biomarkers in sewage. The integration of Artificial Intelligence (AI) with WBE enhances data analysis, predictive modeling, and early-warning capabilities, enabling proactive public health interventions. AI-driven approaches facilitate real-time surveillance of infectious diseases, environmental pollutants, and population-level health trends.

AI efficiently processes large and complex datasets from wastewater samples, using machine learning algorithms to identify correlations between biomarker concentrations and population health indicators. For example, AI can analyze viral RNA levels (such as SARS-CoV-2) to predict disease prevalence and outbreak trends, supporting timely interventions and efficient resource allocation. Through predictive modeling, AI integrates wastewater data with environmental, demographic, and mobility information to forecast disease outbreaks or exposure risks. Neural networks simulate changes in pathogen loads across time and space, assisting public health agencies and policymakers in decision-making.

AI also strengthens environmental risk assessment by tracking pollutants like pharmaceuticals and heavy metals in wastewater. By analyzing historical and real-time data, AI helps predict ecological impacts, exposure risks, and contamination hotspots, promoting sustainable water management.



Source: https://doi.org/10.1111/risa.70075

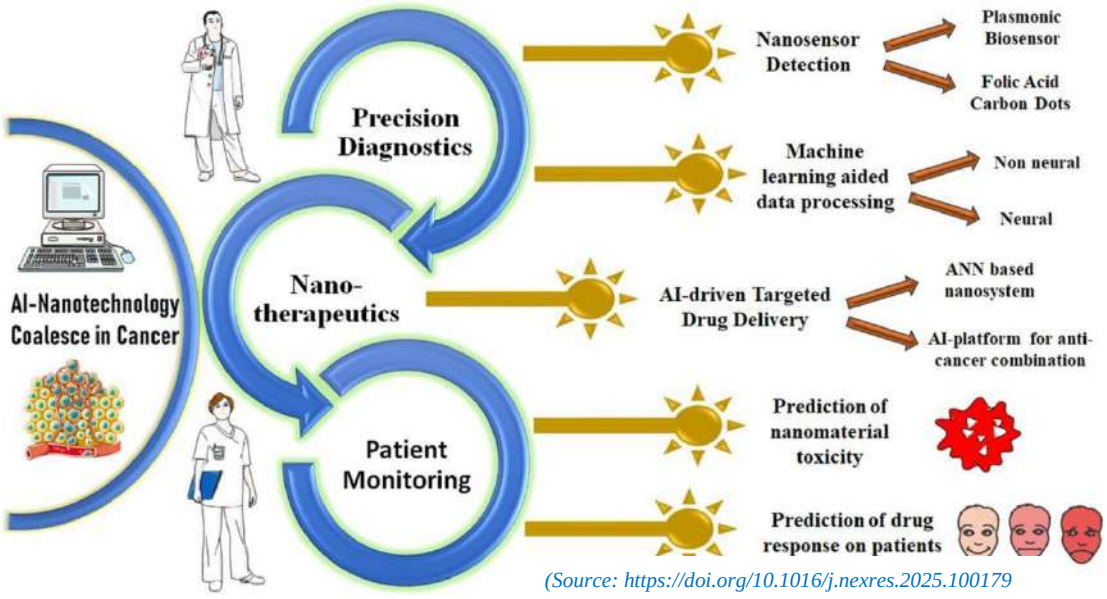
Additionally, AI enhances automation and real-time monitoring when Combined with sensors and high-throughput detection platforms. Integration with GIS enables spatial mapping of disease and pollution trends, reducing manual efforts and improving response speed. However, challenges such as data quality, standardized sampling, and ethical concerns—especially privacy issues when linking data to populations—must be addressed.In summary, AI has revolutionized WBE by enabling real-time surveillance, predictive analytics, and automated monitoring. Its integration supports smarter, data-driven public health management, enhancing resilience against infectious diseases and environmental hazards

Harshita
Batch: 2022-2026

Integration of AI and Nanobiotechnology for Smart Drug Delivery

The combination of Artificial Intelligence (AI) and nanobiotechnology has transformed drug delivery systems, enabling precise, targeted, and efficient therapeutic interventions. Traditional drug delivery methods often face challenges such as low bioavailability, non-specific distribution, and adverse side effects. Integrating AI with nanotechnology allows researchers to design intelligent nanocarriers that optimize drug release, targeting, and efficacy while minimizing toxicity.

AI contributes to nanocarrier design by predicting optimal particle size, shape, surface chemistry, and functionalization strategies. Machine learning algorithms analyze experimental datasets to identify the factors that influence cellular uptake, tissue penetration, and drug release kinetics. This predictive capability reduces trial-and- error experimentation and accelerates the development of efficient drug delivery systems. In targeted therapy, AI enables the design of nanoparticles that recognize specific cellular or molecular markers. For example, AI models can identify ligand-receptor interactions to direct nanocarriers to tumor cells, inflamed tissues, or specific organs. This targeted approach enhances therapeutic efficacy while reducing off -target effects, a critical consideration in oncology, immunotherapy, and precision medicine.



(Source: https://doi.org/10.1016/j.nexres.2025.100179

AI facilitates controlled and stimuli-responsive drug release by designing nanocarriers that respond to environmental triggers like pH, temperature, or enzymes. AI models predict interactions between these triggers and nanomaterials, ensuring precise timing and dosage for improved treatment outcomes and patient compliance. It also predicts biocompatibility and safety by analyzing physicochemical and toxicity data, helping select safer nanomaterials and reducing experimental effort. Moreover, AI enables personalized nanomedicine by tailoring drug delivery systems to individual genetic and physiological profiles, maximizing therapeutic efficiency and minimizing side effects in line with precision medicine goals.

The synergy of AI and nanobiotechnology is revolutionizing drug delivery by enabling intelligent, targeted, and controlled therapeutic interventions. This integration promises safer, more effective, and personalized treatments, marking a significant step forward in biotechnology, medicine, and patient care.

Bhawana Thakkar
Batch: 2021-2025

Summer Trainings & Industrial Visits

Summer Trainings (Batch 2021-25)

S. No.	Roll No.	Name of The Student	Organization
1	2100680540001	Aakansha Panwar	IIT Roorkee
2	2100680540002	Akshita Puri	University of Patanjali
3	2100680540003	Anishka Khari	Mankind Research Centre
4	2100680540004	Anuj Kumar	ICAR-Central Institute for Research on Cattle, Meerut
5	2100680540005	Anurag Kumar Yadav	Kalawati Hospital, Padrauna, Kushinagar
6	2100680540006	Arjun Sharma	Mother Dairy Fruit & Vegetable Pvt. Ltd., Hapur U.P.
7	2100680540007	Aryan Kaushik	Shree Jee laboratory Pvt. Ltd., Rajasthan
8	2100680540009	Asmita Rastogi	Cancer Hospital & Research Institute Gwalior, M.P.
9	2100680540010	Ayushi Sharma	Sir Ganga Ram Hospital, New Delhi
10	2100680540011	Azmi Rizvi	Department of Biotechnology, MIET
11	2100680540012	Bhawana Thakkar	ICSCCB, New Delhi
12	2100680540013	Harshit Pal	Dayal Fertilzers PVT. LTD. Partapur Meerut
13	2100680540014	Khushboo Gupta	Jubilant Generics Limited, Roorkee, Haridwar
14	2100680540015	Kirti Mittal	Ethereal Aromatics, Uttarakhand
15	2100680540016	Manish	IIMT Hospital, Ganga Nagar, Meerut
16	2100680540017	Mohd Arham	ICSCCB, New Delhi
17	2100680540018	Prashasti	IIT BHU
18	2100680540019	Priyanshi Bhardwaj	Northern Insectisides Private Limited, Muzzafarnagar
19	2100680540020	Rayna Salvia Joel	Zydus Wellness Products Limited
20	2100680540021	Ritika Gupta	Agilus Diagnostics Ltd., Gurugram, Haryana
21	2100680540022	Samriddhi Jha	IIT BHU
22	2100680540023	Shraddha	DRDO, New Delhi
23	2100680540024	Tooba Rizvi	Ethereal Aromatics, Uttarakhand
24	2100680540025	Vanshika Goel	Biotecnika Info Labs, Pvt. Ltd.
25	2100680540026	Vishakha	SVPUAT, Meerut
26	2100680540027	Vishu Verma	IIMT Hospital, Ganga Nagar, Meerut
27	2100680540028	Yashshwini Tyagi	ICAR-Central Institute for Research on Cattle, Meerut

Industrial Visit to Yakult Danone India Pvt. Ltd., Sonipat, Haryana

(29th November, 2024)

B. Tech. 2021-25, 2022-26 & 2023-27 & M. Tech.: 2023-25 & 2024-26

On 29th November 2024, B.Tech and M.Tech Biotechnology students had the opportunity to visit **Yakult Danone India Pvt. Ltd.**, located in **Sonipat, Haryana**. The purpose of this industrial visit was to gain practical insights into the production process of Yakult, a globally recognized probiotic drink.

As part of the session, students were also provided with samples of the Yakult drink. This added a practical dimension to the experience, allowing them to taste the product while understanding its benefits.

Dr. Sachin Kumar Tomar, Dr. Ashima Kathuria, Dr. Gourav Mishra, and Dr. Nitika Vats assisted the students for this visit.

National Conference On Regulatory Landscape of Herbal Medicines and Botanicals: Post Covid -19 Pandemic Impact

A two-day national conference **(06-07 December, 2024)** on "Regulatory Landscape of Herbal Medicines and Botanicals: Post Covid -19 Pandemic Impact" was organized by the Department of Pharmaceutical Technology & **Department of Biotechnology**, MIET Meerut, in collaboration with the National Medicinal Plants Board (NMPB), New Delhi. The event focused on the *impact of COVID-19 on business and development* and featured over 400 participants and 150 research papers on medicinal plant quality and conservation. B.Tech Biotechnology students also actively participated and presented posters during the conference. The proceedings were released at the event, where Dr. A. Jayaraj from the Ministry of AYUSH emphasized improving the quality and conservation of medicinal plants. Several eminent academicians and dignitaries graced the occasion.

IV दैनिक जागरण मेरठ, 7 दिसंबर, 2024

एमआइईटी में कार्यक्रम में पत्रिका का विमोचन करते अतिथि • सौ. संस्था

हर्बल औषधियों और वनस्पति विज्ञान पर हुई कार्यशाला

मेरठ : मेरठ इंस्टीट्यूट आफ टेक्नालाजी में फार्मा और बायोटेक्नोलाजी विभाग के संयुक्त तत्वावधान में हर्बल औषधियों और वनस्पति विज्ञान विषय पर दो दिवसीय राष्ट्रीय सम्मेलन का आयोजन किया गया। नेशनल मेडिसिन प्लांट बोर्ड के सहयोग से आयोजित सम्मेलन में 'कोविड 19 महामारी के बाद व्यापार और विकास पर प्रभाव' विषय पर कार्यशाला का आयोजन किय... इस दौरान सम्मेलन... के 400 प्रति...

150 शोध पत्रों का प्रदर्शन किया गया। शोध पत्रों में औषधीय पौधों की गुणवत्ता के शोध पत्र सम्मिलित रहे, जिनका कांफ्रेंस पत्रिका के माध्यम से विमोच... किया गया। मुख्य अतिथि आय... मंत्रालय में वैज्ञानिक डा... कहा कि समय की म... प्राथमिकता से औष... संरक्षण और उनक... होना चाहिए। डा. ... अनुराग, डीन डा. ... पुन कुमार गर्ग और...

Events Organized

Orientation Program

The Department of Biotechnology, MIET organized an Orientation Program on **17th September 2024** for the B.Tech Biotechnology students. The primary aim of the Orientation Program is to provide an introduction and information to the students about the department's academic environment, research potential and extracurricular activities, ensuring them about their all-round development. The program seeks to familiarize the students with the course structure, faculty members, and various resources available for their academic and professional development.

Counseling session on Mental Health

The Department of Biotechnology, MIET organized a Counseling session on 18th October 2024 for the B.Tech Biotechnology students. The aim of the event was to provide awareness and information to the students about mental health aspects, benefits, and remedies, through a counseling session by **Dr. Namami Sharma**, a counsellor at MIET, Meerut. The event sought to familiarize the students with a basic understanding of mental health, which was essential for their academic and professional development.

Children's Day Celebration

The Innovation and Entrepreneurship Cell–Biotechnology (IEC-BT) organized a quiz event on the occasion of Children's Day on **14th November 2024**. The event featured two engaging rounds — Rapid Fire on Entrepreneurship and Identify the Logo. The session was hosted by Ms. Prashasti and Ms. Aakansha Panwar (B.Tech Biotechnology, VII Semester), who also coordinated audience participation. The event, attended by faculty and students of the Department of Biotechnology, was successfully conducted under the guidance of Dr. Ashima Kathuria, Professor and Incharge, IEC-BT.

Times Pro Event

The Departments of Biotechnology and Pharmaceutical Technology, MIET, Meerut, jointly organized an insightful session in collaboration with *TimesPro*, the EdTech initiative of *The Times of India Group*, on **2nd December 2024**. The session aimed to bridge the gap between academic learning and industry expectations by providing students with exposure to emerging professional opportunities. Representatives from TimesPro highlighted various skill development programs and career pathways aligned with industry trends. The interactive session was highly informative and beneficial for students, enhancing their understanding of real-world professional requirements.

A Guest Lecture
on
Technology Transfer: From Lab to Commercialization

The Department of Biotechnology organized a *Guest Lecture* by **Dr. Alok Sharma** on **"Technology Transfer: From Lab to Commercialization"** on **14th February 2025**. The session provided valuable insights into the process of translating research innovations into commercially viable products. Dr. Sharma emphasized the importance of intellectual property rights, industry–academia collaboration, and entrepreneurship in biotechnology. The lecture was highly interactive and helped students understand the practical aspects of innovation and technology commercialization. Faculty members and students actively participated, making the session a highly enriching experience.

Project EXPO 2025

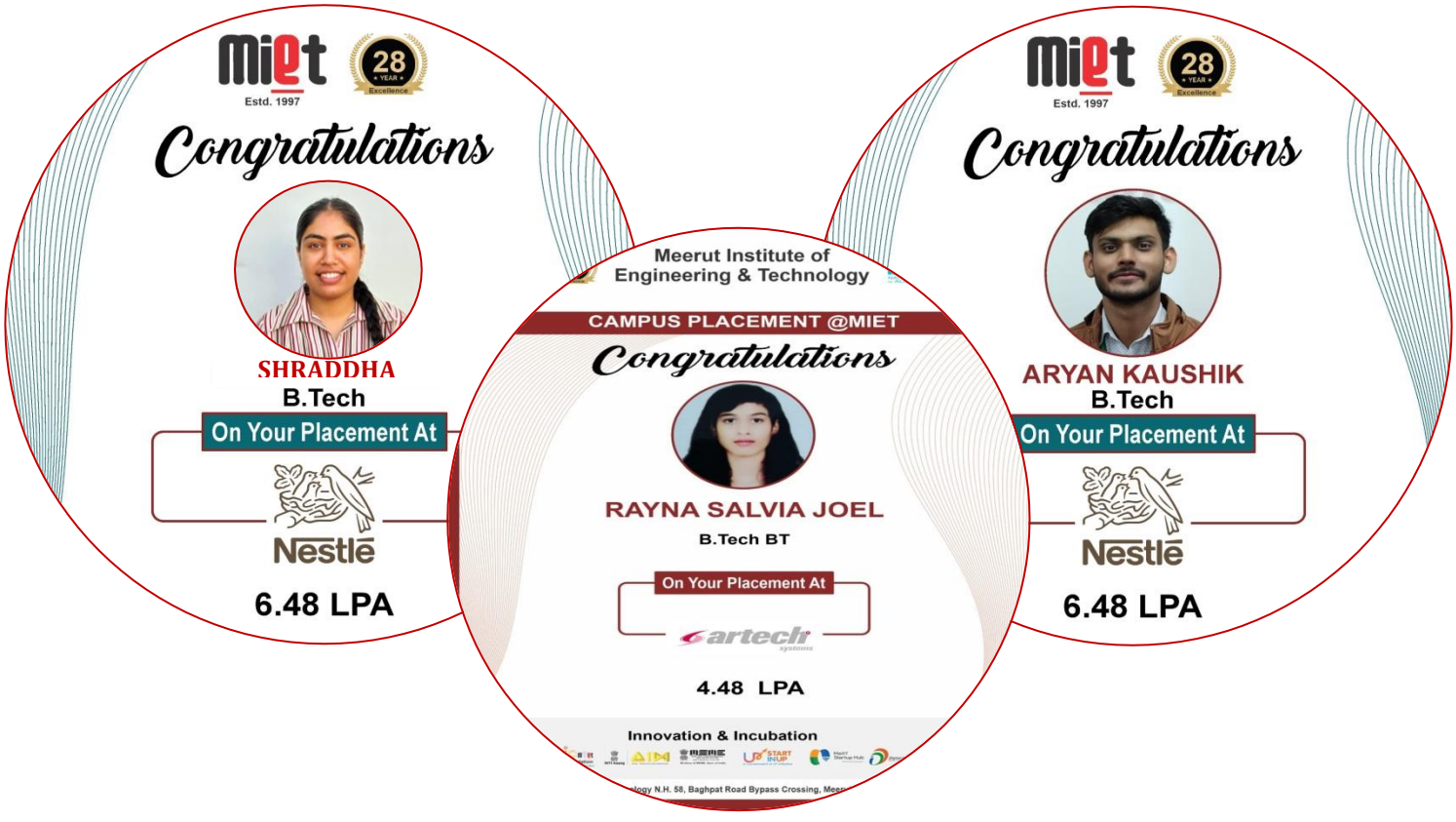
The Department of Biotechnology, MIET, organized *Project EXPO* on **4th April 2025**, showcasing the innovative B.Tech Biotechnology projects developed by final-year students. The event provided a platform for students to present their research ideas, experimental findings, and practical applications in various areas of biotechnology. Faculty members evaluated the projects based on innovation and technical content. Outstanding student projects were honored with awards presented by the Chairman Sit, Vice Chairman Sir, and Director Sir. The event highlighted the creativity and research potential of young biotechnologists.

Student Achievements

Area	Name	Roll No	Course	Event	Recognition
Academic	Prashsati	2100680540018	B.Tech	University Merit (Chemical Engineering Group)	7th rank
	Vishakha	2100680540026	B.Tech	University Merit (Chemical Engineering Group)	8th rank
	Prashsati	2100680540018	B.Tech	Poster Presentation (National Conference)	1st Position
	Arjun Sharma	2100680540006	B.Tech	Poster Presentation (National Conference)	2nd Position

Placement

Batch 2021-25 Placement Record			
S. No.	**Roll No**	**Name of the Student**	**Name of the Employer**
1.	2100680540002	Akshita Puri	Movidu Technology Pvt Ltd
2.	2100680540003	Anishka Khari	iEnergizer
3.	2100680540004	Anuj Kumar	Diagnostic Enterprises
4.	2100680540005	Anurag Kumar Yadav	Diagnostic Enterprises
5.	2100680540006	Arjun Sharma	Movidu Technology Pvt Ltd
6.	2100680540007	Aryan Kaushik	Nestle India
7.	2100680540009	Ashmita Rastogi	Hike education Pvt Ltd
8.	2100680540010	Ayushi Sharma	Hike education Pvt Ltd
9.	2100680540012	Bhawana Thakkar	Ennoble IP
10.	2100680540013	Harshit Pal	Family Business
11.	2100680540014	Khushboo Gupta	Infinity Education
12.	2100680540018	Prashasti	Hike education Pvt Ltd
13.	2100680540019	Priyanshi Bhardwaj	CPM India sales & Marketing Pvt. Ltd.
14.	2100680540020	Rayna Salvia Joel	Artech Infosystems Pvt LtdPvt Ltd & TeamLease Services Limited
15.	2100680540021	Ritika Gupta	TELUS Digital
16.	2100680540022	Samridhi Jha	Consortium E learning Network Pvt. Ltd
17.	2100680540023	Shraddha	Nestle India
18.	2100680540025	Vanshika Goel	CPM India sales & Marketing Pvt. Ltd.

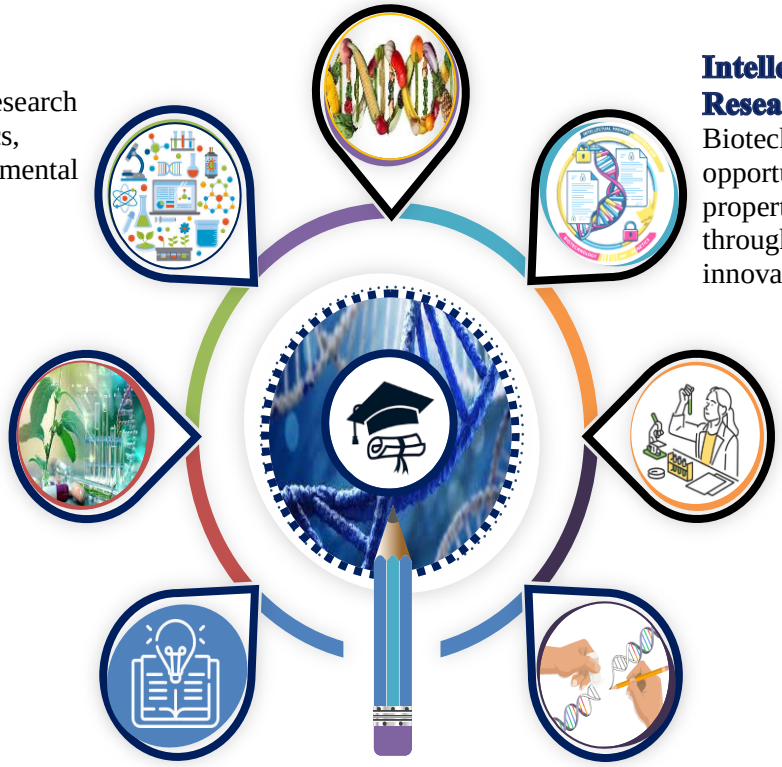


Opportunities after B. Tech in Biotechnology

Food Processing Industry
Biotechnology enhances food processing with innovations in fermentation and preservation.

Research Scientist
Biotechnology offers research opportunities in genetics, healthcare, and environmental innovation.

Intellectual Property & Research Patenting
Biotechnology offers opportunities in intellectual property and research patenting through novel inventions and innovations.



Pharmaceutical Sector
Biotechnology offers opportunities in pharmaceutical sector for drug discovery, development, and biopharmaceutical production.

Production Engineer and Quality Control Analyst
Biotechnology offers opportunities in production engineering and quality control through process optimization and product testing.

Masters & Doctorate in Biotechnology
Master's and Doctorate in Biotechnology advance expertise in biological innovation and research.

Technical Writing
Biotechnology offers technical writing opportunities in creating manuals, research papers, and regulatory documents.

Department of Biotechnology

Meerut Institute of Engineering & Technology

NH-58, Delhi Roorkee Bypass Road, Baghpat Crossing,
Meerut - 250005, Uttar Pradesh, India.

Website: www.miet.ac.in

Phone: 0121-2439019/2439057