Biotaction

Reaching new Horizons...

Animal & Plant Biotechnology

MIET BIOTECHNOLOGY SOCIETY, MEERUT

2020-21

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 interdisciplinary 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 a 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 brining out **BIOTACTION**.

Message from Desk of Director

There is no limit to the goals you can attain or success you can achieve, your possibilities are as endless, as your dreams

MIET stands for a healthy, intellectual and creative environment so that the young minds are transformed into responsible and progressive citizens of the nation. It is a great feeling ahead to the numerous positions. It is a matter of immense pleasure and pride that the MIET Biotechnology Society is coming up with its new edition of the Biotech magazine **BIOTACTION.** I sincerely appreciate the initiative of the students of Biotechnology in bringing up this magazine. I wish this opens up new vistas of knowledge and the good work continues in time to come.

Dr. Mayank Garg
BE (Mechanical), ME, Ph. D.

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.

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Exploring the World of Animal Cell Culture: A Crucial Tool in Biomedical Research

Animal cell culture is a sophisticated and invaluable technique that has revolutionized the field of biomedical research. This method involves the cultivation of animal cells in a controlled environment, outside their natural habitat, to study cell behavior, genetic processes, disease mechanisms, and to develop therapeutic strategies. This article delves into the key aspects of animal cell culture, its applications, and its pivotal role in advancing scientific and medical knowledge.

Cell Sourcing and Isolation

The journey of animal cell culture begins with the sourcing of cells from tissues or organs of animals. Cells can be primary, directly derived from the organism, or established cell lines, which are immortalized and capable of continuous division. Once obtained, tissues are subjected to isolation processes where cells are released from the extracellular matrix. This can involve mechanical methods or the use of enzymes to dissociate tissues and obtain individual cells.

Cell Culture Media

A carefully crafted environment is crucial for the successful growth of animal cells. Culture media play a pivotal role in providing the necessary nutrients, salts, amino acids, vitamins, and growth factors essential for cell proliferation. These media formulations are tailored to mimic the physiological conditions required for specific cell types, ensuring optimal growth and function.

Cell Seeding and Cultivation

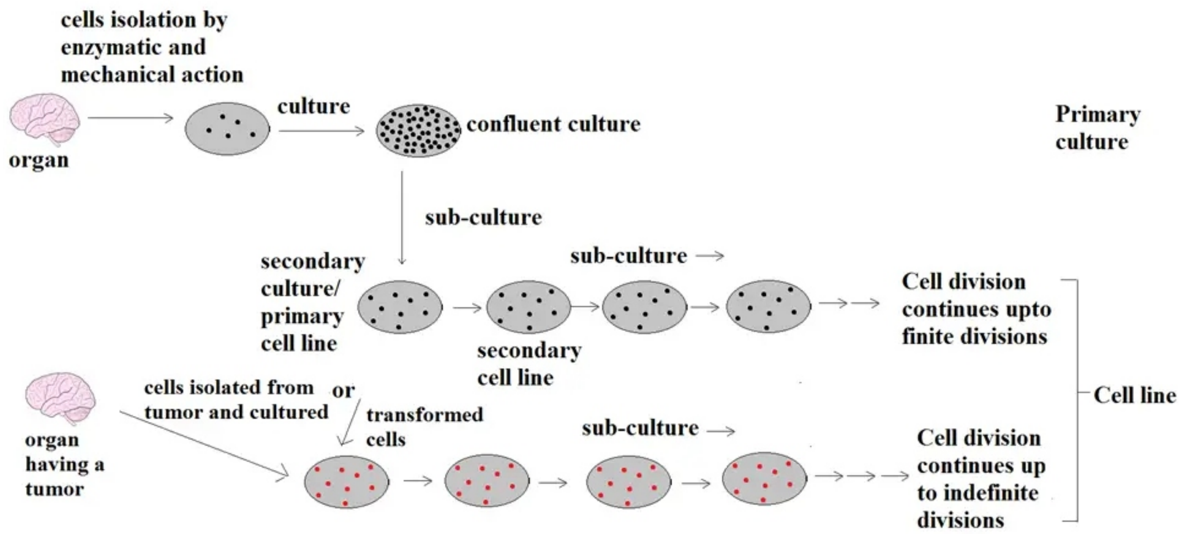
Seeding cells onto a suitable culture vessel marks the initiation of the cultivation process. Cells adhere to the surface and begin to proliferate under controlled conditions, typically at a temperature of 37°C and in a humidified atmosphere with 5% CO_2. Regular changing of the culture medium ensures a continuous supply of nutrients and removes waste products, fostering a healthy cell population.

Subculturing or Passaging

As cells approach confluence, they need to be subcultured or passaged to new vessels. This step is crucial to prevent over confluence, maintain cell viability, and allow for continued growth. Subculturing involves detaching cells from the culture vessel, typically using enzymatic or mechanical methods, and transferring them to fresh culture vessels.

Cell Authentication and Quality Control

Maintaining the integrity of the cell line is paramount. Researchers routinely authenticate cell lines to ensure they are studying the intended cell type. Quality control measures, such as regular testing for mycoplasma contamination, are implemented to guarantee the reliability and reproducibility of experimental results.



Freezing and Thawing

Cryopreservation is employed to store cells for extended periods. Cells are frozen with a cryoprotective agent and can be thawed when needed for experiments. This allows for long-term storage of cell lines, ensuring a stable and consistent supply for ongoing research.

Scale-Up and Bioreactors

For large-scale production, cells can be transferred to bioreactors. These sophisticated systems provide a controlled environment for cell growth, nutrient supply, and waste removal. Bioreactors are instrumental in the development and production of vaccines, biopharmaceuticals, and other medical treatments.

Conclusion

Animal cell culture is an indispensable tool in modern biomedical research, contributing significantly to our understanding of cell biology, genetics, and disease mechanisms. Its applications range from fundamental research to the development of life-saving therapies, making it a cornerstone in the pursuit of scientific knowledge and medical advancements. As technology continues to advance, the role of animal cell culture is likely to expand, further propelling breakthroughs in various fields of science and medicine.

Akshita Panwar

Batch: 2019-2023

Vital Role of Animal Models in Advancing Vaccine Development

Vaccine development has been a cornerstone of modern medicine, providing humanity with powerful tools to combat infectious diseases and safeguard public health. Behind each successful vaccine lies a complex journey of research, discovery, and validation, wherein animal models play an indispensable role. From mice to non-human primates, animal models serve as invaluable surrogates for studying pathogen-host interactions, evaluating vaccine safety and efficacy, and elucidating immunological mechanisms. This article explores the importance of animal models in vaccine development, delving into scientific principles, ethical considerations, and future directions.

Understanding Pathogenesis and Immune Responses

The first step in vaccine development involves understanding the intricate mechanisms of pathogenesis– "The process by which pathogens invade and cause disease within the host organism". Animal models provide researchers with a platform to simulate and investigate the dynamics of infection. By infecting animals with pathogens, scientists can observe the progression of disease, identify key immune responses, and unravel the molecular mechanisms underlying host-pathogen interactions.

For instance, in the study of viral infections such as influenza and COVID-19, animal models have been instrumental in elucidating the mechanisms of viral entry, replication, and spread within the host. Mice, ferrets, and non-human primates infected with influenza viruses have helped researchers understand viral tropism, immune evasion strategies, and the role of cytokine storms in disease severity. Similarly, animal models of COVID-19, including transgenic mice and non-human primates, have provided critical insights into viral transmission, immune responses, and vaccine efficacy.

Assessing Vaccine Safety and Efficacy

Animal models play a pivotal role in assessing the safety and efficacy of candidate vaccines before they advance to human clinical trials. Preclinical studies involving animals allow researchers to evaluate various aspects of vaccine development, including immunogenicity, dose optimization, and formulation stability.

In vaccine safety assessment, animal models help identify potential adverse effects and determine the optimal dosage regimen. For example, studies in mice and non-human primates have been used to assess the reactogenicity and immunogenicity of COVID-19 vaccines, providing valuable data on vaccine-induced immune responses and potential side effects.

Moreover, animal models serve as surrogates for evaluating vaccine efficacy by assessing the ability of candidate vaccines to confer protection against infection and disease. Challenge studies, where vaccinated animals are exposed to infectious agents, provide insights into the vaccine's ability to prevent or mitigate disease outcomes. Animal models have played a crucial role in demonstrating the efficacy of vaccines against a wide range of pathogens, including influenza, measles, poliovirus, and hepatitis B virus.

In vaccine safety assessment, animal models help identify potential adverse effects and determine the optimal dosage regimen. For example, studies in mice and non-human primates have been used to assess the reactogenicity

Table: Illustrative examples of animal models in vaccine development

Vaccine Development Aspect	Example	Animal Model Used
Understanding Pathogenesis	Study of influenza virus transmission	Ferrets
	Investigation of COVID-19 cytokine storms	Mice, non-human primates
Assessing Vaccine Safety	Evaluation of reactogenicity and immunogenicity of COVID-19 vaccines	Mice, non-human primates
	Determining optimal dosage regimens	Rats, rabbits
Modeling Human Diseases	HIV pathogenesis and vaccine efficacy	Non-human primates (e.g., rhesus macaques)
	Tuberculosis infection and vaccine development	Guinea pigs, rabbits
Exploring Immunogenicity	Assessment of vaccine-induced immune responses	Mice, rats, non-human primates
	Identification of adjuvants enhancing vaccine efficacy	Mice, ferrets, pigs
Translational Research	Preclinical testing of Ebola virus vaccines	Mice, guinea pigs, non-human primates
	Advancing COVID-19 vaccine candidates to human trials	Transgenic mice, non-human primates
Ethical Considerations	Implementation of humane treatment protocols	Mice, rats, rabbits
	Adherence to ethical review board guidelines	Non-human primates

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Modeling Human Diseases and Immunology

Animal models offer unique opportunities to model human diseases and study complex immunological processes. Genetically engineered mice, for example, enable researchers to mimic specific aspects of human physiology and immune function, facilitating the study of immune responses to infectious agents and vaccines.

Non-human primates, such as rhesus macaques, share genetic and physiological similarities with humans, making them valuable models for studying infectious diseases and testing vaccine candidates. Studies in non-human primates have provided key insights into HIV pathogenesis,

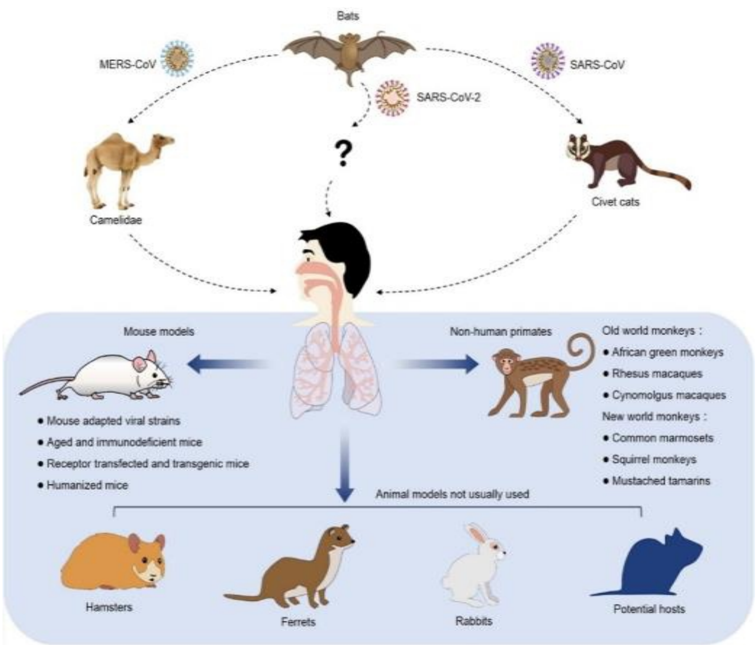


Fig.: Experimental animals of SARS-CoV, MERS-CoV and SARS-CoV-2.

vaccine-induced immunity, and the development of novel vaccine strategies.

In addition to modeling specific diseases, animal models contribute to our understanding of fundamental immunological principles. By studying immune responses in animals, researchers can elucidate the mechanisms of antigen recognition, T cell activation, antibody production, and memory formation. These insights inform the design and optimization of vaccines by identifying key immunogenic targets and adjuvants that enhance vaccine efficacy.

Exploring Immunogenicity and Vaccine Design

One of the central goals of vaccine development is to induce robust and durable immune responses that confer long-lasting protection against infectious agents. Animal models play a critical role in assessing the immunogenicity of vaccine candidates and optimizing vaccine design.

By administering vaccines to animals and monitoring immune responses, researchers can evaluate the magnitude, kinetics, and durability of vaccine-induced immunity. These studies provide crucial data on the optimal vaccine formulation, antigen dosage, and route of administration. Moreover, animal models help identify adjuvants (substances that enhance immune responses) that can improve vaccine efficacy and longevity.

Translational Research and Ethical Considerations

The insights gained from animal studies serve as a bridge between basic research and clinical application, facilitating the translation of promising vaccine candidates from the laboratory to human trials. Animal models play a central role in the preclinical development pipeline, providing essential data on safety, immunogenicity, and efficacy that guide the design and execution of human clinical trials.

Despite their invaluable contributions, the use of animal models in vaccine development raises ethical considerations and challenges. Researchers are committed to upholding ethical standards and minimizing animal suffering through the implementation of humane treatment protocols and the reduction of unnecessary experimental procedures.

Furthermore, advancements in alternative methodologies, such as in vitro models, organoids, and computational simulations, aim to reduce reliance on animal experimentation while maintaining scientific rigor. These alternative approaches offer complementary tools for studying vaccine biology and can help refine experimental designs, reduce costs, and accelerate the pace of vaccine development.

Conclusion

In conclusion, animal models represent indispensable tools in the quest for effective vaccines against infectious diseases. From elucidating pathogenic mechanisms to assessing vaccine safety and efficacy, animal models provide essential insights that drive innovation and progress in vaccine development. Moving forward, interdisciplinary collaborations, technological advancements, and ethical considerations will shape the future of vaccine research, paving the way for novel vaccines that safeguard global health and well-being.

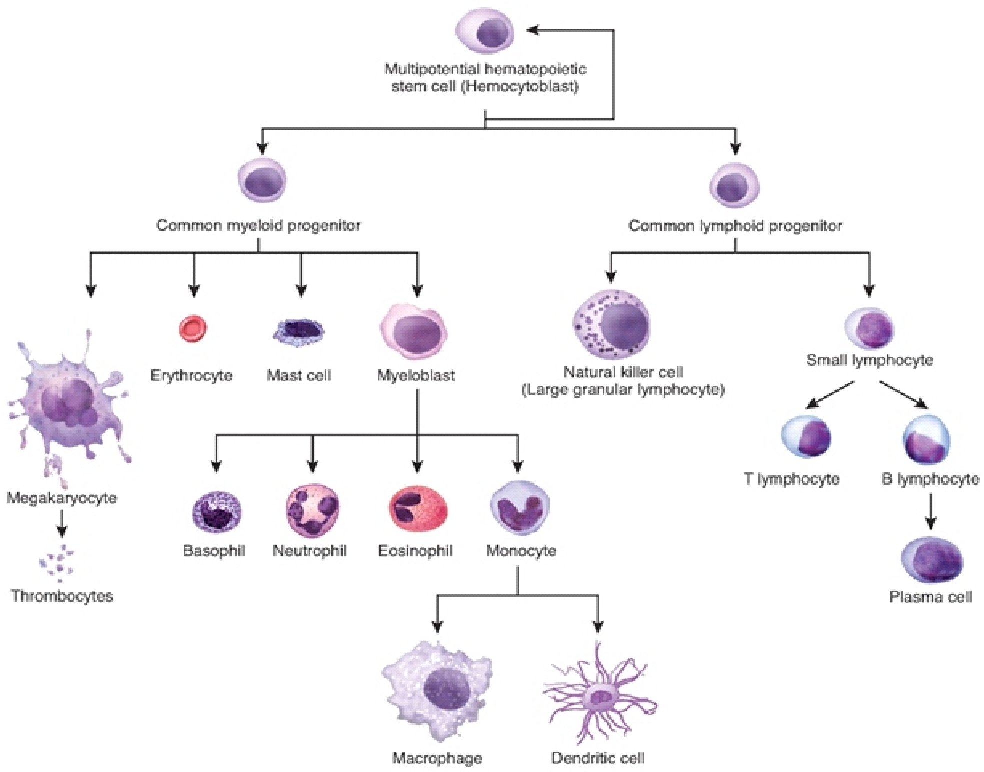
Shivangi Verma
Batch: 2018-2022

Stem Cell and it's Preservation

Stem cells are being used to treat an expanding number of diseases and disorders. For example, hematopoietic stem cells (HSCs), which have traditionally been used to treat leukemia are now being used to treat heart damage from myocardial infarction, hereditary blood disorders and autoimmune disease. Bone marrow is a complex mixture of cells including cells from hematopoietic, mesenchymal and endothelial origin. The mesenchymal fraction of the cells has been shown to create bone, cartilage and muscle-like cells when cultured under defined conditions. Clinical uses of mesenchymal stem cells (MSCs) include cardiac repair and to improve engraftment of hematopoietic stem cells. Human embryonic stem cells (hESCs) hold tremendous promise as not only a tool for understanding disease but also as a basis for cell based therapies. hESCs have specific challenges (controlling differentiation of the cells) but overcome many of the challenges associated with adult stem cells (availability). The Food and Drug Administration has approved the first U.S. clinical trial of hESC-based therapies in humans for the treatment of spinal cord injuries.

Preservation of stem cells is critical for both research and clinical application of stem-cell based therapies. Preservation permits development of cell banks with different major histocompatibility complex genotypes and genetically modified clones. As collection of stem cells from sources such as umbilical cord blood can be difficult to predict or control, the ability to preserve cells permits the banking of stem cells until later use in the research lab or clinical application. The ability to preserve cells permits completion of quality and safety testing before use as well as transportation of the cells between the sites of collection, processing and clinical administration. Finally, the ability to preserve cells used therapeutically facilitates the development of a manufacturing paradigm for stem cell based therapies.

The development of a cryopreservation protocol for a given cell type requires specification of



(1) pre-freeze processing;
(2) introduction of a cryopreservation solution;
(3) freezing protocol;
(4) storage conditions;
(5) thawing conditions and
(6) post thaw assessment.

A more comprehensive and historical review of hematopoietic stem cell preservation can be found in reviews by Sputtek and colleagues.

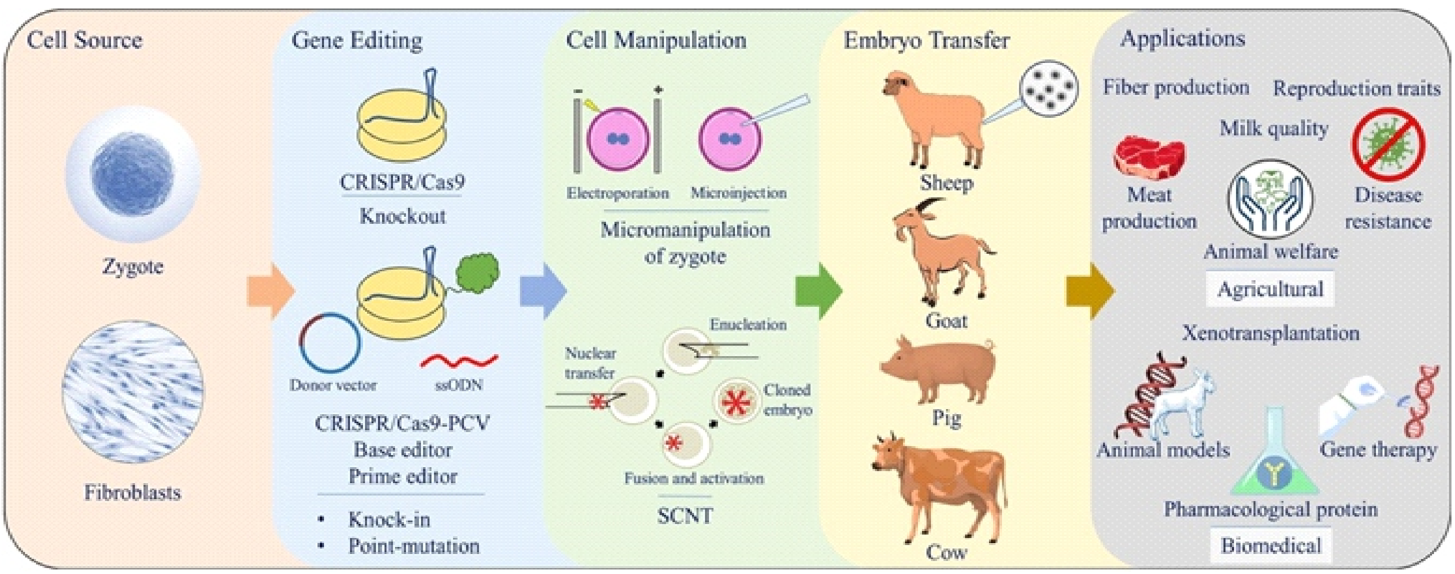
Abhishek Tripathi
Batch: 2017-2021

Role of Biotechnology in Animal Genetic Improvement

Conventional breeding programs are the backbone of animal genetic improvement, securing incremental, cumulative, and permanent genetic gains. Conventional breeding methods include selective breeding, hybridization, and chromosome set manipulation as well as assisted reproductive techniques such as cloning, embryo transfer, and artificial insemination. These are all used to accelerate and/or amplify the rate of genetic gain in animal breeding programs. Biotechnologies, including GnEd, allow modification of phenotypes in ways that can reduce the time and cost to accomplish breeding goals. Biotechnologies can be combined with conventional breeding methods and can also be used to introduce traits that are not available via conventional breeding.

Advances in genome sequencing have led to better understanding of the fundamental biology underlying economic traits and prediction of phenotypes associated with yield, production efficiency, animal health, well-being, and product quality. High-density sequencing in multiple livestock species has provided baseline information on genes, genome architecture, and genetic diversity. Public and private breeding programs can now rely on this information for decisions involving traits that are expensive or difficult to measure, typically measured postmortem, or expressed in only one sex. By combining this new resource with classical breeding programs, it is possible to accelerate rates of genetic progress in livestock, including shortening of the generation interval, which brings particular benefit in dairy cattle and other animals with long generation times. Moreover, genomic information offers useful insights for improvement opportunities through GnEd.

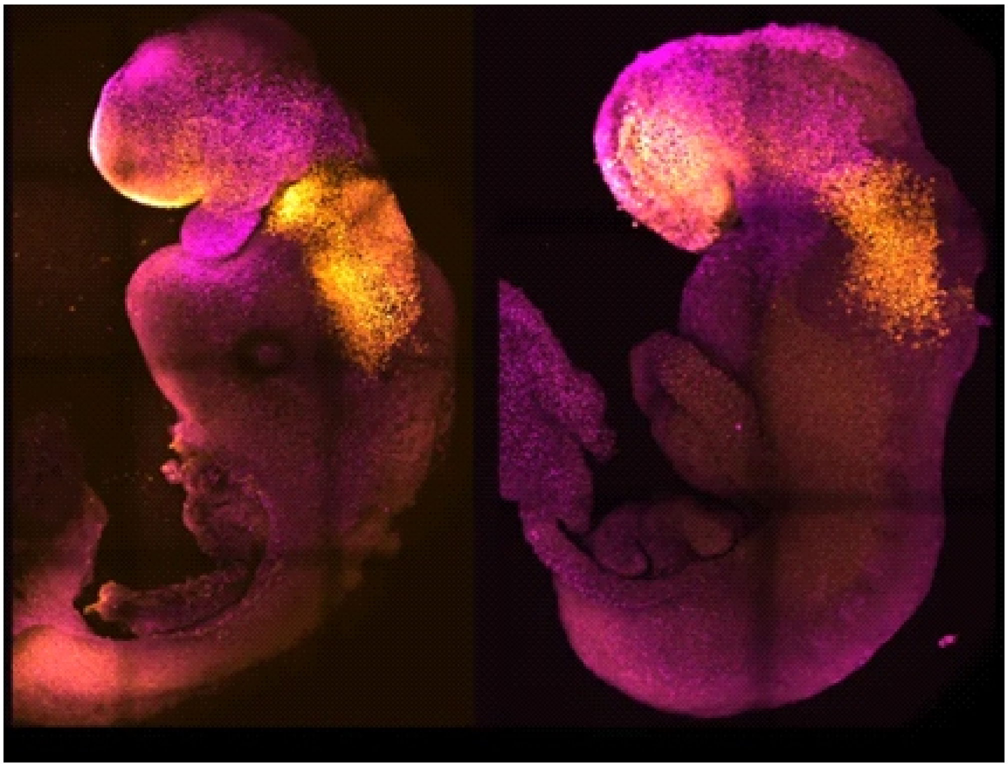
Introducing desirable traits from beef cattle into dairy cattle or from laying hens into broilers can be accomplished by using GnEd without severe setbacks in important traits, such as milk production in dairy cattle or growth rates in broilers, that occur during introgression in conventional breeding programs. For animal welfare traits, GnEd offers novel solutions to address critical aspects of animal husbandry. While conventional breeding programs have documented progress in some animal welfare traits, combining GnEd with conventional genetic selection could speed genetic progress, with simultaneous advances in animal welfare and productivity. GnEd could also provide rapid animal welfare solutions to existing animal husbandry practices that have not been achieved with conventional breeding, such as dehorning in cattle, debeaking in poultry, castrating pigs and sheep, and culling of day-old male chicks.



Km Taniya
Batch: 2017-2021

Unveiling the Synthetic Embryo: A New Era in Biotechnology

The creation of the world's first synthetic embryo is a groundbreaking achievement by Professor Zernicka-Goetz's team at Cambridge University. After a decade of research, they've unlocked the earliest stages of pregnancy, traditionally obscured due to embryo implantation. This synthetic model allows unprecedented access, revealing how extra embryonic cells communicate with embryonic cells, guiding development chemically and mechanically. This breakthrough holds immense promise for understanding fertility, regenerative medicine, and early human development. These develop outside of the mother and therefore can be easily visualized through critical developmental stages that were previously difficult to access. The researchers hope to move from mouse embryos to creating models of natural human pregnancies – many of which fail in the early stages, Zernicka-Goetz said By watching the embryos in a lab instead of a uterus, scientists got a better view into the process to learn why some pregnancies might fail and how to prevent it. Gianluca Amadei said, for now, researchers have only been able to track about eight days of development in the mouse synthetic embryos, but the process is improving, and they are already learning a lot. Zernicka-Goetz said, researchers see important uses for the future. The process can be used immediately to test new drugs. But in the longer term, as scientists move from mouse synthetic embryos to a human embryo model, it also could help build synthetic organs for people who need transplants.



Synthetic mouse embryo

Muskan Bansal
Batch: 2018-2022

Beyond the Barnyard: The Promise of Animal Biotechnology

From enhancing livestock productivity to advancing human health and environmental conservation efforts, the promise of animal biotechnology is vast and multifaceted and beckons with the tantalizing prospect of transformative change, offering solutions to some of the most pressing challenges facing humanity and the planet. As scientists delve deeper into the genetic makeup of animals and develop innovative tools for genetic engineering, the possibilities for leveraging this technology to benefit society continue to expand.

At the heart of animal biotechnology lies the ability to decipher and manipulate the genetic blueprint of living organisms. Through selective breeding, scientists can pinpoint desirable traits and accelerate the process of genetic improvement in livestock, poultry, and aquaculture species. This precision breeding not only enhances productivity and efficiency in agricultural systems but also enables the development of animals better suited to thrive in diverse environmental conditions.

One of the primary applications of animal biotechnology is improving livestock productivity and welfare. By selectively breeding animals with desirable traits, such as disease resistance, enhanced growth rates, and higher milk or meat yields, farmers can improve the efficiency and sustainability of animal husbandry. Additionally, advancements in reproductive biotechnologies, such as artificial insemination and embryo transfer, have enabled breeders to accelerate the genetic improvement of livestock populations while preserving valuable genetic diversity. Moreover, genetic engineering techniques, including gene editing and transgenesis, offer new avenues for introducing beneficial traits into livestock populations. For example, researchers have developed genetically engineered pigs with improved disease resistance and enhanced lean muscle growth, offering potential benefits for both animal health and meat production efficiency.

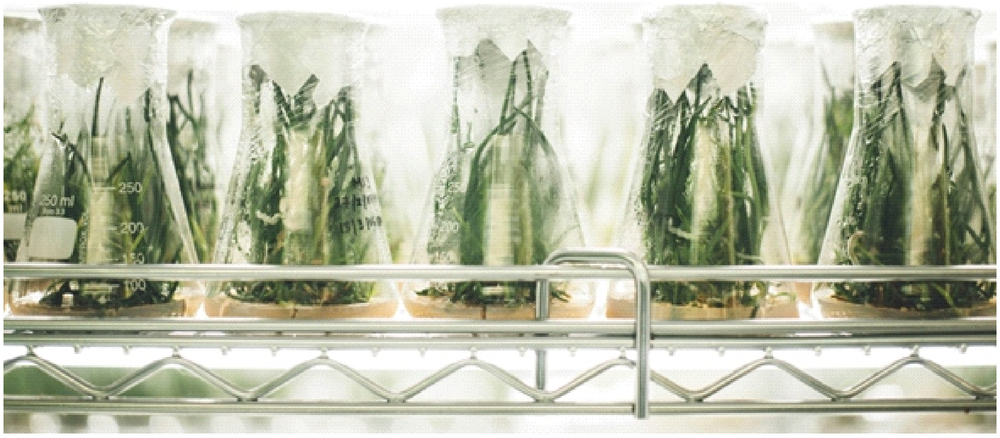
Animal biotechnology also plays a critical role in advancing human health through biomedical research. Genetically modified animals, such as mice and pigs, serve as invaluable models for studying human diseases, developing new therapies, and testing the safety and efficacy of pharmaceuticals. These animal models enable researchers to gain insights into the underlying mechanisms of diseases, identify potential drug targets, and accelerate the development of novel treatments for conditions ranging from cancer and cardiovascular disease to neurodegenerative disorders. Furthermore, animal biotechnology has paved the way for the production of valuable biopharmaceuticals using transgenic animals as bioreactors. For instance, goats and cows have been genetically engineered to produce therapeutic proteins, including antibodies and clotting factors, in their milk, offering a cost-effective and scalable approach to manufacturing life-saving drugs. In addition, the field also holds promise for conserving biodiversity and protecting endangered species. Moreover, genetic engineering techniques offer innovative solutions for addressing.

Vaishnavi Sharma

Batch: 2018-2022

Engineering Tomorrow's Harvest: Plant Biotechnology's Role in Addressing Global Challenges

In a world marked by rapid population growth, climate change, and dwindling natural resources, the future of agriculture hangs in the balance. Meeting the food demands of a burgeoning global population while safeguarding the environment and ensuring sustainable resource management has emerged as one of the defining challenges of our time. In this landscape of uncertainty, plant biotechnology stands as a glimmer of light, offering innovative solutions to address pressing agricultural and environmental challenges.



The agricultural sector faces a multitude of interconnected challenges that threaten global food security and environmental sustainability. Population growth, urbanization, and changing dietary preferences are driving increased demand for food, placing immense pressure on agricultural systems. Meanwhile, climate change is exacerbating environmental stressors such as droughts, floods, and temperature extremes, disrupting agricultural productivity and aggravating food insecurity. In this context, the need for transformative solutions that enhance agricultural resilience, mitigate environmental degradation, and promote sustainable resource management has never been more urgent. Plant biotechnology, with its ability to harness the power of genetics and molecular biology to improve crop traits, offers a pathway to address these challenges and engineer a more sustainable future for agriculture. It also plays a pivotal role in phytoremediation, leveraging the natural abilities of plants to clean up contaminated environments.

At the forefront of this field are genetically modified organisms (GMOs) or transgenic plants, which have revolutionized agriculture by conferring desirable traits such as pest resistance, herbicide tolerance, and drought tolerance to crops. GMOs have been instrumental in increasing crop yields, reducing agricultural inputs, and mitigating the impacts of pests and diseases. However, they have also been the subject of intense scrutiny and debate, with concerns raised about their potential environmental, health, and socio-economic implications. While GMOs have been a cornerstone of plant biotechnology, recent advancements have expanded the toolkit available to researchers and breeders. Genome editing holds tremendous promise for accelerating crop improvement efforts and addressing some of the regulatory and public acceptance challenges associated with GMOs by enabling more precise and predictable modifications to plant genomes.

Moving forward, realizing the full potential of plant biotechnology will require a concerted effort to address regulatory, ethical, and socio-economic considerations. Ensuring equitable access to biotechnological innovations, fostering transparent communication, and engaging stakeholders across the value chain will be essential for building public trust and promoting responsible innovation in plant biotechnology. As we look to the future, the role of plant biotechnology in addressing global challenges cannot be overstated. By harnessing the power of science and innovation, we can engineer a more sustainable, resilient, and equitable food system that nourishes both people and the planet. The seeds of change are being sown today, and with continued investment and commitment, we can cultivate a brighter future for tomorrow's harvest.

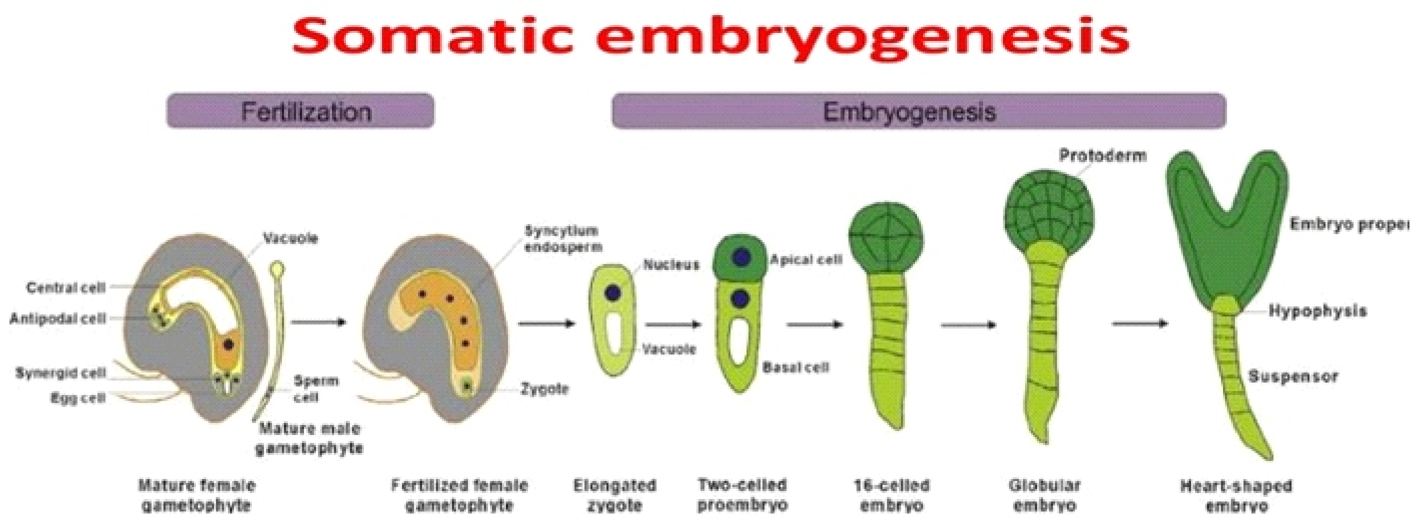
Kapil Kumar

Batch: 2019-2023

Somatic Embryogenesis

Somatic embryogenesis is a complex process in plant tissue culture that involves the development of embryos from somatic cells, bypassing the normal sexual reproduction pathways. This technique holds significant importance in plant propagation, genetic engineering, and conservation of endangered species. The process typically begins with the isolation of explants, such as immature zygotic embryos, meristematic tissues, or even single cells, from a donor plant. These explants are then cultured in a nutrient-rich medium supplemented with specific plant growth regulators, such as auxins and cytokinin's. The hormonal balance in the culture medium plays a crucial role in triggering the embryogenic response.

The initiation phase involves the dedifferentiation of somatic cells into a totipotent state, resembling embryonic cells. This is often followed by the formation of a callus, an undifferentiated mass of cells. Through subsequent stages, certain cells within the callus undergo further differentiation and organization to develop into somatic embryos. The maturation of somatic embryos is facilitated by adjusting the hormonal composition of the medium. As embryos mature, they acquire a bipolar structure with distinct shoot and root meristems. Once developed, somatic embryoscan be transferred to a suitable medium to induce germination and further development into complete plantlets.



Somatic embryogenesis offers numerous advantages in plant biotechnology, such as the rapid production of clonal plants, the regeneration of transgenic plants, and the conservation of elite or endangered species. However, the efficiency of somatic embryogenesis varies among plant species and is influenced by factors like genotype, explant source, and culture conditions. Despite its challenges, the technique continues to be a valuable tool in advancing plant science and agriculture.

Niti Choudhary
Batch: 2019-2023

Advancements and Implications of Precision Livestock Farming

Livestock farming plays a crucial role in global food production, providing meat, dairy, and other animal products to meet the nutritional needs of a growing population. However, traditional methods of livestock management are often resource-intensive, laborious, and environmentally unsustainable. In response to these challenges, precision livestock farming (PLF) has emerged as a transformative approach to enhance efficiency, productivity, and sustainability in animal agriculture.

Principles of Precision Livestock Farming: At its core, precision livestock farming involves the use of advanced technologies to monitor, analyze, and optimize various parameters related to animal health, welfare, behaviour, and production.

The key principles of PLF

- Real-time Monitoring: PLF systems utilize sensors, wearable devices, and other monitoring technologies to collect real-time data on individual animals and herd-level parameters.
- Data Analytics: Advanced analytics techniques, including machine learning and data mining, are employed to analyse large volumes of data generated by PLF systems, extracting meaningful insights and actionable information.
- Decision Support Systems: PLF systems integrate data analytics with decision support tools, enabling farmers to make informed decisions regarding animal management, health interventions, feed optimization, and resource allocation.
- Technologies used in Precision Livestock Farming: A wide range of technologies are employed in PLF systems, including:
- Sensor Technologies: Temperature sensors, accelerometers, GPS trackers, and RFID tags are used to monitor parameters such as body temperature, activity levels, location, and individual animal identification.
- Imaging and Vision Systems: Cameras and computer vision algorithms enable automated monitoring of animal behavior, health, and feed intake, facilitating early detection of health issues and behavioral anomalies.
- Environmental Monitoring Systems: Sensors for monitoring air quality, temperature, humidity, and other environmental parameters help optimize housing conditions and mitigate stress factors for livestock.
- Precision Feeding Systems: Automated feeding systems equipped with sensors and actuators deliver precise amounts of feed tailored to the nutritional requirements of individual animals or groups, reducing feed waste and optimizing feed conversion efficiency.
- Health Monitoring and Diagnostics: Wearable devices, biosensors, and smart collars enable continuous monitoring of vital signs, disease symptoms, and health markers, facilitating early disease detection and timely intervention.
- Applications of Precision Livestock Farming: Precision livestock farming finds applications across various

sectors of animal agriculture, including:

- Dairy Farming: In dairy production, PLF systems are used to monitor milk yield, milk composition, reproductive performance, rumination patterns, and cow comfort, enabling proactive management practices to optimize milk production and animal welfare.
- Beef Cattle Production: PLF technologies aid in monitoring feed efficiency, growth rates, body condition scores, and disease prevalence in beef cattle, allowing producers to make informed decisions regarding herd management, breeding strategies, and health interventions.
- Poultry Farming: In poultry production, PLF systems track parameters such as egg production, feed consumption, water intake, environmental conditions, and bird behaviour, facilitating efficient management practices and early detection of health issues.
- Swine Production: PLF technologies assist swine producers in monitoring pig growth, feed conversion ratios, respiratory health, and environmental conditions in hog barns, optimizing production efficiency and minimizing disease outbreaks.
- Sheep and Goat Farming: In small ruminant production, PLF systems enable monitoring of reproductive performance, lambing rates, grazing behaviour, and health status, enhancing productivity and profitability for sheep and goat producers.
- Benefits of Precision Livestock Farming: Precision livestock farming offers several potential benefits to farmers, consumers, and the environment, including:
- Improved Animal Health and Welfare: PLF systems enable early detection of health problems, proactive disease management, and enhanced monitoring of animal welfare indicators, leading to improved health outcomes and reduced stress for livestock.
- Enhanced Productivity and Efficiency: By optimizing feed efficiency, reproductive performance, growth rates, and resource utilization, PLF technologies help farmers maximize production output while minimizing input costs and environmental impact.
- Data-Driven Decision Making: PLF systems provide farmers with real-time insights and data-driven decision support tools, empowering them to make informed choices regarding animal management, health interventions, and resource.

Istuti Gupta

Batch: 2018-2022

Exploring the Cutting-Edge: Latest Trends in Plant Biotechnology

In the realm of agriculture, the intersection of science and technology has ushered in a new era of possibilities, and plant biotechnology stands at the forefront of this transformative wave. As we navigate the challenges of a rapidly changing world, the latest trends in plant biotechnology are offering innovative solutions to enhance crop productivity, nutritional content, and environmental sustainability.

The convergence of molecular biology, genetics, and computational techniques has revolutionized our understanding of plant systems and empowered scientists to engineer crops with precision and efficiency. From CRISPR-Cas9 genome editing to synthetic biology and omics technologies, the landscape of plant biotechnology is evolving at a rapid pace. This article delves into the latest trends shaping the field and explores their implications for agriculture, food security, and sustainable development.

1. CRISPR-Cas9 and Precision Genome Editing

At the heart of modern plant biotechnology lies CRISPR-Cas9, a groundbreaking technology that has revolutionized genome editing. Originally derived from the bacterial immune system, CRISPR-Cas9 allows scientists to precisely target and modify specific regions of the plant genome with unprecedented accuracy. Unlike traditional genetic modification techniques, which often involve the insertion of foreign DNA, CRISPR-Cas9 enables precise modifications without introducing exogenous genetic material.

The versatility and simplicity of CRISPR-Cas9 have transformed the landscape of crop improvement. Researchers can now edit genes responsible for desirable traits such as disease resistance, drought tolerance, and nutritional content. By harnessing the power of CRISPR-Cas9, scientists are accelerating the development of crops that are more resilient, nutritious, and environmentally sustainable.

2. Gene Editing for Crop Improvement

Building upon the foundation laid by CRISPR-Cas9, gene editing technologies are driving innovation in crop improvement. These tools enable scientists to make targeted modifications to specific genes, unlocking the potential to enhance crop traits in a precise and controlled manner. From improving yield and quality to enhancing pest and disease resistance, gene editing holds immense promise for addressing the complex challenges facing modern agriculture.

One of the most exciting applications of gene editing is the development of climate-resilient crops capable of withstanding environmental stressors such as drought, heat, and salinity. By identifying and modifying genes associated with stress tolerance, researchers are creating crops better suited to thrive in changing climatic conditions. Additionally, gene editing offers new opportunities for the development of nutritious and flavourful varieties tailored to meet the evolving demands of consumers.

3. Synthetic Biology and Metabolic Engineerin

Synthetic biology represents a paradigm shift in our approach to crop improvement, offering the ability to engineer plants with novel traits and functionalities. At the forefront of synthetic biology is metabolic engineering, which involves the redesign of metabolic pathways within plants to optimize the production of desired compounds. From pharmaceuticals and biofuels to specialty chemicals and biomaterials, synthetic biology holds promise for creating crops that serve as bio-factories for valuable products.

By reprogramming plant metabolism, scientists can enhance the production of secondary metabolites with therapeutic or industrial applications. For example, the engineering of medicinal plants to produce high-value pharmaceuticals offers a sustainable alternative to traditional extraction methods. Similarly, metabolic engineering can be used to enhance the production of biofuels from renewable plant sources, reducing dependence on fossil fuels and mitigating climate change.

4. Omics Technologies Revolutionizing Plant Analysis

Advances in omics technologies, including genomics, transcriptomics, proteomics, and metabolomics, are revolutionizing our understanding of plant biology at the molecular level. These high-throughput techniques enable comprehensive analysis of the genetic, transcriptomic, proteomic, and metabolic profiles of plants, providing valuable insights into their complex biological processes and regulatory networks.

Genomics, the study of an organism's complete set of DNA, has facilitated the identification of genes associated with important agronomic traits such as yield, disease resistance, and nutritional content. Transcriptomics, which examines the complete set of RNA transcripts in a cell, offers insights into gene expression patterns and regulatory mechanisms underlying plant development and stress responses.

Proteomics and metabolomics complement genomics and transcriptomics by providing insights into the composition and dynamics of proteins and metabolites within plant cells. By integrating data from multiple omics platforms, scientists can unravel the intricate networks of molecular interactions that govern plant growth, development, and responses to environmental stimuli.

5. Climate-Resilient Crops

In the face of climate change and increasing environmental variability, the development of climate-resilient crops is of paramount importance for global food security. Plant biotechnologists are employing a variety of strategies to enhance the resilience of crops to environmental stressors such as drought, heat, and salinity. By understanding the genetic and physiological mechanisms underlying stress tolerance, researchers can identify targets for genetic modification and breeding programs aimed at developing resilient crop varieties.

One approach involves the identification and characterization of genes associated with stress tolerance traits, such as enhanced water use efficiency, osmotic adjustment, and antioxidant capacity. Through genome editing and marker-assisted breeding, scientists can introduce these beneficialtraits intocropvarieties, enabling them to thrive in harsh and unpredictable environments.

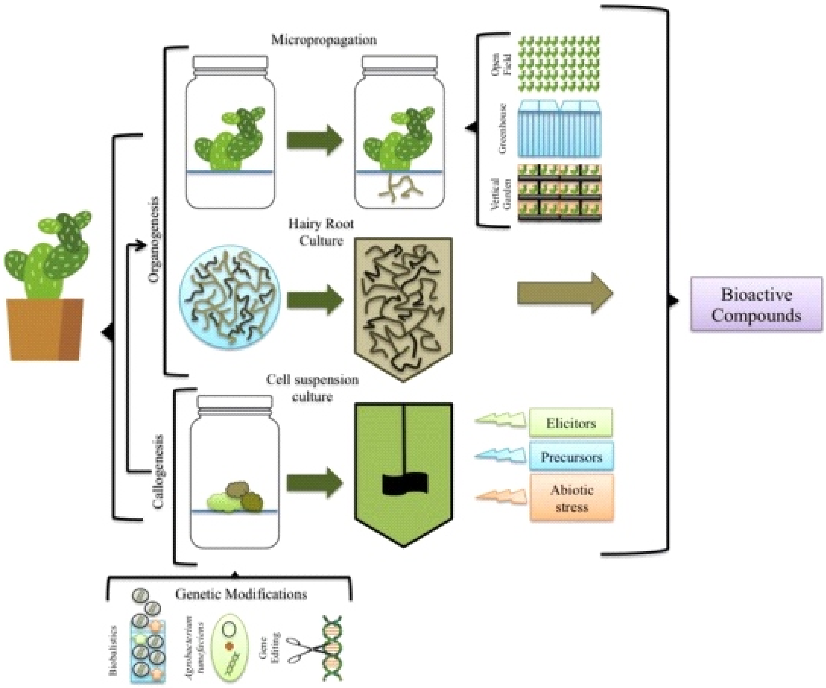
Conclusion

The latest trends in plant biotechnology signify a paradigm shift in our approach to agriculture. From precision genome editing to the development of climate-resilient crops, researchers are pioneering solutions to address the complex challenges facing our food systems. As these trends continue to evolve, the future of plant biotechnology holds immense promise for creating a more sustainable, resilient, and nutritionally enriched global agricultural landscape. By embracing innovation, collaboration, and responsible stewardship, we can harness the power of plant biotechnology to nourish a growing population and safeguard the health of our planet for generations to come.

Akanksha Singh
Batch: 2019-2023

In Vitro Plant Tissue Culture: Means for Production of Biological Active Compounds

Plant cell and tissue culture uses nutritive culture media and controlled aseptic conditions for the growth of plant cells, tissues and organs. Since its first establishment by Haberlandt in the early twentieth century, this type of culture has evolved into an essential tool for plant research at both the basic and applied levels. *In vitro* culture techniques are now indispensable for the production of disease-free plants, rapid multiplication of rare plant genotypes, plant genome transformation, and production of plant-derived metabolites of important commercial value (Fig.)



Due to the diversity of the methods and applications of available culture techniques, the subject of plant cell/tissue culture is extensively covered in the existing literature. Some works have even focused on the use of in vitro tissue culture for the production of secondary metabolites. This work aims to provide an updated overview on the use of in vitro culture for the production of medicinally or commercially important plant metabolites and bioengineered products, nevertheless because of the ample range of information available not all works within the scope of the article could be included, we apologize to those authors. The objective of this review is, therefore, to summarize the main molecules currently being produced using plant cell/tissue culture, their applications in areas such as medicine and food technology, and the plant material cultured for their production. The review also covers new trends in in vitro cell/tissue culture and plant transformation.

The use of in vitro tissue culture remains a feasible strategy for the production of structurally complex and high-value natural products, especially if the plant source material is an overexploited, slow-growing or low-yielding plant. However, due to the higher costs, a cost–benefit analysis of in vitro culture is wise before implementation of the technique. Similarly, the production of pharmaceuticals using plant culture systems can offer significant advantages, including reduction in costs, rapid production, low burden of human pathogens and scalability; all these advantages are plant product specific and depend on the production efficiencies compared to those offered by alternative sources. In the next decade, tissue culture should reach its full potential with the use of novel technologies such as gene editing and environmental factor manipulation.

Ashutosh Vasisth

Batch: 2017-2021

Events Organized

Online
Poster and Oral Presentation
Competition on
Expedited career opportunities after covid-19
pandemic in life sciences

Events Organized

Webinar on How to Become an Entrepreneur

Online Faculty Development Program on "ADVANCES IN BIOTECHNIQUES"

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बायो टेक्नोलॉजी में अग्रिम नवाचार को लेकर एमआईईटी में एफडीपी का शुभारंभ

पवित्र भारत ब्यूरो

मेरठ। मेरठ इंस्टिट्यूट ऑफ इंजीनियरिंग एंड टेक्नोलॉजी एमआईईटी के डिपार्टमेंट ऑफ बायो टेक्नोलॉजी में तीन दिवसीय फैकेल्टी डेवलपमेंट प्रोग्राम का शुभारंभ आज से किया जाएगा। जिसका विषय बायो टेक्नोलॉजी के क्षेत्र में अग्रिम नवाचार रहेगा। कार्यक्रम का आयोजन सोसाइटी ऑफ बायो लॉजिकल केमिस्ट इंडिया के सहयोग से किया जाएगा। कार्यक्रम में मुख्य अतिथि के तौर पर डिपार्टमेंट ऑफ बायो टेक्नोलॉजी, भारत सरकार के साइंटिस्ट डॉ असलम और प्रेसिडेंट एसबीसी डॉ राजेंद्र प्रसाद रहेंगे। फैकल्टी डेवलपमेंट प्रोग्राम में देश-विदेश से लगभग 500 शिक्षकों ने पंजीकरण करा लिया है। जो बायो टेक्नोलॉजी में उपयोग होने वाली विभिन्न नवीनतम तकनीकों के विषय में जानेंगे आने वाले 3 दिनों में देश के विभिन्न उत्कृष्ट संस्थानों से मुख्य वक्ता नवीनतम तकनीकों के विषय में अपना व्याख्यान देंगे। एफडीपी के मुख्य वक्ता डॉ रंजीत रंजन कुमार, डॉ पूनम चौधरी, डॉ मीना गुप्ता, डॉ नरेश, डॉ पवन कुमार दुबे और डॉ चौकीलिंगम मुख्य वक्ता के तौर पर व्याख्यान देंगे। एफडीपी के मुख्य कोऑर्डिनेटर डॉ आशिमा कथुरिया और गौरव मिश्रा नीरज अग्रवाल रहेंगे, जो विभिन्न गतिविधियों को संचालित करेंगे।

Faculty development program on "Advances in Biotechniques"

Transparent News Bureau

Meerut : Department of Biotechnology, MIET, Meerut organizes an online Faculty development program on Advances in Biotechniques from 9th October to 11th October 2020. The FDP program was inaugurated on the 9th October 2020 by Chief Guest Dr. Aslam Nominee Director BIRAC, Scientist "G" DBT New Delhi. Chief Guest, Dr. Rajendra Prasad President Society of biological chemists (India). Mr. Puneet Agrawal, Vice-Chairman MIET, Dr. Mayank Garg Executive Director MIET, Dr. D. K. Sharma Dean Academics MIET, Dr. Nitin Sharma, Head Department of Biotechnology, MIET. Meerut.

The Chief Guest and participants were welcomed by Dr Ashima Khaturia. Dr. Aslam and Dr Rajendra prasad addressed the FDP participant and appreciated the MIET group for organizing three days FDP program on Advances in Biotechniques. Mr. Puneet Agrawal, Vice-chairman of MIET Group addressed the gathering by focusing on the opportunities for biotechnologists and novel technologies which could be adopted as a career in the future. After the inauguration, the first session was addressed by the speaker Dr. Meenu Gupta, Head Department of Botany JD Women's college Patliputra University Patna, she delivered her lecture on nano factories, the bio-based approach of nano-particles synthesis, and discussed the details of the mechanism for green synthesis of nanoparticles using microorganisms, their properties characterization techniques, and applications, in the second session Dr. Poonam C Singh Principal Scientist, Division of microbiology technologies NBRI Lucknow, delivered her lecture on role of microscopy in studying plant microbes interaction. She discussed in detail about phase contrast, confocal, fluorescence microscopy and SEM, TEM, for the extensive study of mechanical interaction between plants and microorganisms. The event was coordinated by FDP coordinator Dr Ashima Khaturia, Dr. Gourav Mishra, and Neeraj Aggarwal. All the faculty members of the biotechnology department, MIET were contributed and participated in the FDP.

Events Organized

MIET GROUP OF INSTITUTIONS

Online Faculty Development Program on

"ADVANCES IN BIOTECHNIQUES"

9-11th October, 2020

Organized by

Department of Biotechnology, MIET, Meerut

In Association with

Society of Biological Chemists (India), Bangalore

INAUGURATION (10.30 - 11.00 am)

Chief Guest:
Dr. Aslam
Nominee Director,
BIRAC
Scientist 'G',
DBT, New Delhi

Chief Guest:
Dr. Ranjendra Prasad
President, SBC(I)
[Retd.Prof., JNU]
Director, AIB
Amity University, Gurugram

Patron:
Mr. Puneet Agarwal
Vice-Chairman
MIETGroup of Institutions

EMINENT SPEAKERS

Date	Session I (11.00 am -12.30 pm)	Session II (2.00 pm - 3.30 pm)
09th Oct. 2020	Role of Microscopy in Deciphering Plant-Microbe Interactions **Dr. POONAM CHAUDHARY** Principal Scientist, Division of Microbial Technologies, NBRI, Lucknow	Living Nano-factories Sustainable Approach in the field of Bio Medicine **Dr. MEENU GUPTA** Head, Department of Botany J D Women's College, Patliputra University, Patna
10th Oct. 2020	3D Bioprinting: New Avenues in Medical Biotechnology **Dr. NARESH KASOJU** Scientist-C, Division of Tissue Culture, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum	Umbilical Cord Stem Cells: Applications in Maternal and Child Health **Dr. PAWAN KUMAR DUBEY** Assistant Professor Centre for Genetic Disorders BHU, Varanasi
11th Oct. 2020	Advances in Proteomics: A Challenging but Powerful Tool for Crop Improvement **Dr. RANJEET RANJAN KUMAR** Senior Scientist, Division of Biochemistry, IARI, New Delhi	Flow Cytometry: Application in Biological Research **Dr. CHOCKALIGAM** Assistant Professor, Department of Biotechnology NIT Warangal

IMPORTANT

Last date for Registration: 8th October, 2020
No Registration or Participation fee
The presentations will be done on Zoom.
Link for the lectures will be provided to all the registered candidates timely before the lectures.

E-certificate will be provided to each registered participant.

FDP Coordinator
Dr. Ashima Kathuria, Assistant Professor

Co-Incharges
Dr. Gourav Mishra, Assistant Professor
Er. Neeraj Agarwal, Assistant Professor

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www.miet.ac.in ; Phone no. : 9411023950

About Department of Biotechnology

Courses Offered:

- B.Tech.
- M.Tech.

Approvals & Accreditations:

- Approved by AICTE
- Affiliated with AKTU
- NBA Accredited

Laboratory Facilities:

- DST-FIST Center
- Medical Translational Biotechnology Research Lab
- Nanotoxicity & *Drosophila* Research Lab
- Analytical Biochemistry Lab
- Cellular and Microbiology Lab
- Instrumentation Lab
- Bioinformatics Lab
- Bioprocess and Protein Engineering Lab
- Plant Tissue Culture Lab
- Genetics and Molecular Biology Lab

Extracurricular Activities:

- Sanskriti - The Tradition Goes On...
- Abhivyakti - The Literary Lore
- Odyssey, The Literati....
- Sports Committee
- The Land of Art
- RIM4.0
- AHIMSA- Quest for Peace and Change

Other Important Activities:

- Personality Development Programs
- Alumni Connect Sessions
- Mentoring Classes

Department Of Biotechnology

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