



Recent Trends In Animal Sciences And Plant Sciences And Their Applications

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Abstract

Animal Sciences and Plant Sciences are fascinating fields where scientists are making incredible progress and unravelling information regarding cellular functions, signalling pathways and molecular causes of diseases. Behind these victories we find the dedication and hard work of many scientists who are exchanging ideas and information at a faster rate as the world has become a global village. Several advances have taken place in various branches of Biological Sciences in recent years which are discussed in detail below

RECENT TRENDS IN ARTIFICIAL INTELLIGENCE BASED TECHNOLOGIES: -

One of the recent trends in biological sciences is application of Artificial Intelligence (AI) based technologies. AI based technologies have immense potential in recent years and have emerged as a highly effective approach in Bio Sciences. AI's great achievement is that it is capable of recognizing objects and making decisions using many of the cognitive and perceptual abilities of live systems

Artificial Intelligence is the ability of any machine to stimulate the intelligence of higher organisms. An ideal AI can logically solve problems, learn from experience and react with external environment just like human intellect. AI is of two types-weak AI and strong AI. Weak AI can perform only one task at a time but strong AI can efficiently perform numerous tasks simultaneously

AI in Medical Science:

In medical science AI is used in disease diagnosis, Predictive Epidemiology manufacture of precision- based medicines and studying host pathogen interactions. AI based biomarkers help doctors to predict and analyse patient responses to the treatment and survival of the patient and distinguish between benign and malignant tumours. With the help of AI personalised medicine is developing at a fast pace in which drugs are tailored basing on the body's needs and adaptability. Researchers are using AI in DNA,

RNA, and protein studies and helping in creation of appropriate treatment plan for a patient depending on the patient's medical history, personal data and genetic make-up. AI based system of personalised medicine helps in reducing treatment costs, minimizes side effects, saves time and improves patient care. AI simplifies gene editing, radiography and helps in building electronic health records with evidences and helps to forecast major adverse effects of prolonged medications

Artificial Intelligence was found to be useful in early diagnosis and treatment of Myopia. Deep learning algorithms can detect metastatic breast cancer from biopsies very accurately and also diagnose heart malfunctioning through cardio vascular imaging. Algorithms combined with medical expertise can do wonders in Medical field. AI can also be used to forecast genetic disorders and thus prevent occurrence of inherited diseases.

AI in Pharmaceutical Industry: -

One of the applications of AI is open targets which shows the link between genes and diseases. SPIDER an AI technique helps to use natural products in drug manufacture.

AI in Agriculture: -

Agriculture can be transformed using AI in areas of soil management, water management, precise mapping of the need of fertilizers, pesticides herbicides and insecticides, to predict the amount of yield and overall management of crops. Drones and robots are being used to harvest crops at a much faster rate than traditional methods. AI helps in forecasting weather fluctuations and arrival of monsoons. AI based biosensors help in early detection of diseases in crop plants even in the absence of symptoms and thus reduce product loss. Drone technologies such as Efficient Net V2 can detect classify plant diseases very accurately, precisely and thus helps to monitor plant health. AI can be used to manipulate genes and design effective synthetic promoters to improve the agronomic traits in plants. Recurrent Neural Network (RNN) and Temporal Convolutional Network (TCN) algorithm can be utilised to estimate greenhouse crop yields very accurately. AI and machine vision based smart sprayer sprays pesticide specifically on weed targets thus reducing overuse of weedicide and contamination of the environment. Thus, AI helps to improve environmental sustainability

AI and Industrial Biotechnology: -

AI based computer models, robotics and machine learning are being used to develop best optimum growth conditions for the strains and thus increase the productivity. For ex: Response Surface Methodologies (RSM) which is an AI based approach helped in high level production of amylases from *Rhizopus* microporous. Integrated ANN Taguchi method model was used to predict biomass feedstock properties, bioenergy supply chains and thus attain maximum biofuel yield up to 98.95%. The availability of Omics data has helped in using machine learning for host strain selection, metabolic pathway reconstruction, fermentation and optimization of metabolic flux.

AI based technologies generally use high resolution lenses, infrared cameras, competent programs and highly expensive sensors. More over to operate drones, farmers need authorization according to its operative and regulative provisions of the law of land. To design protocols thorough knowledge of the effects of algorithms as well as data sets are essential to meet bioindustry challenges. Efficient data integration is essential for proper functioning of AI and ML based models.

Despite a few drawbacks AI in medicine will save millions of lives and reduce medical costs. AI in agriculture leads to precision farming and will in future help to reduce world's rising population's demand for food. The efficient production of bio -enzymes using AI will reduce production costs and revolutionize biotech industry

Recent trends in Embryology:

In In -vitro fertilisation method multiple embryos are transferred in a single cycle which may lead to multiple pregnancies. Therefore, only a single embryo should be transferred. So many advances have occurred in embryo selection methods. Some of the recent embryo selection methods are evaluation of pronuclear morphology, pre implantation genetic diagnosis and pre implantation screening, which help to see the potential chromosomal abnormalities in the nucleus of the embryo.

Pre implantation genetic diagnosis helps to diagnose chromosomal abnormalities using modern technique such as PCR. Pre implantation genetic screening uses technologies based on comparative genomic hybridization (CGH) or single nucleotide polymorphism (SNP) arrays which prevents miscarriages or implant failure.

Metabolomic or Protein Serotome Profiling is a recent approach which gives a complete picture of an embryo's metabolism and gene expression patterns. Oxygen consumption and amino acid turnover which are found in protein serotome profiling helps to know the viability of the embryo.

Time lapse imaging techniques help to follow the divisions of the embryo and know the developmental potential of the embryos.

There are several advanced techniques in embryo transfer also such as Ultrasound guided embryo transfer. The transfer of embryos was performed blindly in traditional methods. Traditional method resulted in accidental tubal transfers or sub endometrial transfers which resulted in miscarriages. But ultra sound guided ET provides better results and helps to transfer embryo to lower uterine cavity rather than at the fundus that may improve pregnancy rates.

Recent trends in Biotechnology: -

Biotechnology is the study of manipulation of living organisms to create new products and processes that can improve health and standards of living. Recently some amazing tools have developed in biotechnology and they are as follows.

1) CRISPR based Gene editing.

This helps, us to modify DNA precisely and thus cure genetic disorders. Gene modification helps to create superior transgenic plants and animals, treat genetic disorders by adding, replacing or silencing specific genes. US based iE cure is developing gene editing therapies to treat rare genetic liver diseases in children. It uses in vivo gene insertion technology .US based Plastomics has developed chloroplast editing which will help in modifying photosynthetic pathways and metabolic pathway.

2) Micro biome manipulation: Studying of microbes and manipulation of these microbes helps in curing various diseases.

3) Living medicines: Taking pills with good bacteria which have been programmed to fight our specific illness is called living medicine. It may cure chronic diseases in near future.

4) Lab grown organs: Transplant medicine can be revolutionized by taking patient's own cells and growing organs to replace damaged organs or eliminate need for organ donors or reduce the risk of organ rejection.

5) Epigenetic and Digital therapeutics: Epigenetics helps in giving precise medicine for genetic disorders and digital therapeutics helps to increase healing outcomes.

6) Brain mapping: 1 millionth section of the human brain has been mapped by Google and Harvard in 1921. If we map the whole brain traumatic injuries or neurological disorders and diseases can be better under stood.

7) Autonomous Therapeutic systems: It is one of the most significant future medical technology which will reduce human error and medical care costs. It helps to analyse, determine and autonomously control patient's medical condition.

8) Alpha Fold is a major breakthrough in protein folding. By knowing how a protein folds we can design better drugs that will bind to their targets with greater specificity and affinity.

9) Sophisticated wearables: Sophisticated wearables not only help to monitor heart beat but also sleep apnea and arrhythmias etc. We need not go to hospital to be closely monitored.

10) Bioluminescent imaging: By this imaging we can know how a drug travels and affects the different parts of the living organism.

11) Brain computer interfaces: Instead of using electrodes neurable-compatible headphone will monitor the way we learn, work and communicate.

- 12) Lab grown meats: Instead of traditional animal farming, lab grown or cultured meat is obtained directly from animal cells. Thus, animals will not be slaughtered and will lead to environmental sustainability.
- 13) Organoid intelligence helps the computer 3D brain cell structure to think which is really fascinating.
- 14) 3D bio printing will help in constructing 3D biological structures using living cells. This will help in organ transplants, precise drug testing and precision medicine.
- 15) Plastic Eating Bacteria: Plastic is the reason for major pollution and scientists have recently grown plastic eating bacteria which will degrade plastic and save the environment.
- 16) Cellular Anti-aging research can actually reverse aging and help people to live longer.
- 17) Biomanufacturing: Protinea a US based start-up develops mass produced insect larvae as mini bioreactors for recombinant production instead of using conventional bio reactors. Deep branch a British start-up is converting CO₂ to single cell protein called Proton which can be used as animal feed as it has high amino acid profile, high protein content and vitamin content. ALICE start-up has produced 500 proteins by adding the gene in a plasmid to a lysate. Ribbon biolabs an Austrian start-up is developing new methods for DNA synthesis which helps in constructing DNA libraries for antibody screening.
- 18) Microfluidics: Eden Tech a French start-up is using microfluidics to develop artificial organ tissue engineering. By tissue engineering tissue grafts can be produced for treating burns. Cardiac tissue engineering will help to treat heart diseases. Alaph Farms an Israeli start-up is separating cells from cows and growing sustainable meat alternative. It helps to grow food in long term space missions also.

Recent trends in Microbiology

Metagenomics involves studying genetic material directly extracted and also understand the diversity and functional potential of microbial population and bioremediation. CRISPR-CAS technology helps to manufacture gene editing tools that can target and modify specific DNA sequence in micro-organisms. This is called gene manipulation. This can also be used to produce bio fuels or drugs.

Micro fluidics involves manipulating small amounts of fluids within micro channels allowing precise control over experiments involving microbes. High Throughput Sequencing helps to develop sequences rapidly and large volumes of DNA or RNA. Bio-informatics involves developing software and algorithms to analyse biological data including genomic sequencing and integrate vast microbial data efficiently.

Nanotechnology in microbiology:

This helps to integrate nano scale materials and techniques to study, manipulate and interact with micro-organisms. Helps in targeted drug delivery, imaging and developing antimicrobial agents.

Mass spectrometry-based proteomics helps to learn microbial metabolism, protein interactions, responses to environmental changes, microbial physiology biomarker identification.

Microbial electrochemistry: involves interaction of micro-organisms with electrodes, enabling energy production through microbial fuel cells and facilitates bioremediation of pollutants, waste water treatment also.

Digital PCR: It provides accurate quantification of rare microbial species or genetic mutations, critical diagnosis and research.

Bio sensors: Helps in rapid and sensitive detection of pathogens, toxins and other biomolecules and thus will help in improving health care and environmental monitoring.

Microbial nano cellulose: It can produce nano cellulose which can be used in wound healing, drug delivery & tissue engineering.

Recent trends in Aquaculture:

Several advanced techniques such as in vitro tissue culture for detection and isolation of pathogenic viruses. DNA probes for early detection of fish diseases, use of Quantitative Real Time PCR, standard PCR, spectrophotometer, tissue homogenizer, Gel documentation system for screening of pathogens in fishes are being used. Biodiesel is made from irrigated vegetable oils, fish scrap recycled greases.

Development of aqua pod cages, sea station fish pens, smart floating farms and Sal Mar Ocean farming which consists of nets that adjust to the motion of the waves and currents preventing rips and escapes. Hav farms consist of six cages built into boats each measuring 50x50 size with nets of 60m deep.

Recent trends in Cancer treatment:

Cancer is one of the diseases that is causing enormous deaths and is caused by the uncontrolled growth of cells in the body.

One of the latest advancements in cancer treatment is immunotherapy i.e. using the body's immune system to fight against the disease. Targeted therapy targets the genes or proteins involved in the growth of cancer cells and destroys them. Photodynamic therapy uses light activated drug to kill cancer cells. When the light sensitive drug is exposed to the light it produces chemical reaction that kills cancer cells.

Hypothermia: This method uses heat to kill cancer cells using heat lamp, radio frequency waves or heated drugs or probes internally.

These new technologies in Animal Sciences and Plant Sciences are giving new hope to many people as more treatment options are available than ever and success rates are increasing and life span is increasing. Hence with development of these new and advanced technologies the future is looking very bright , creating access to new horizons and reaching unimaginable heights.

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