International Journal of Recent Research and Review, Vol. XV, Issue 3, September 2022

ISSN 2277 – 8322

RECENT DEVELOPMENT IN BIOTECHNOLOGY: A REVIEW

Dr. Suman Kacholia
Department of Botany
B.B.D Govt. College, Chimanpura, Shahpura, Jaipur, Rajasthan

Abstract —Biotechnology uses biological processes or living things to design, develop, or produce goods. This in article goal is to assess the currently scope of biotechnology and look ahead to its potential. At the moment, biotechnology is essential to medicine, agriculture, and business. In medicine, antibodies and RNA/DNA probes have become crucial in detecting diseases and treating some diseases; gene editing and gene therapy make it possible to treat genetic diseases. Vaccines, which still rely on biological systems to create them, are the best instruments for preventing infectious diseases. In agriculture, biotechnology may produce crops with improved nutritional profiles, high yields, and minimal input requirements. It may also produce crops that require less pesticide application. In the industrial sector, biotechnology has been used to the manufacturing of chemicals, the processing of metal ores, the processing of food, and the reduction of pollution and energy use.

Keywords: Bioinformatics, Biosensor, DNA Vaccine, Gene Editing, Genetic Engineering, Genetically Modified (GM), Molecular Cloning, Monoclonal Antibody, Personalized Medicine, PCR, RNA Vaccine, Transgenic Animal.

I. INTRODUCTION

Biotechnology is a field of technology that develops, produces, or manufactures a wide range of goods using biological systems, living creatures, or their components. It can be seen as a subset of biology because it is based on biology. Although the term "biotechnology" is currently popular, people have been using microbes' biological processes for over 6,000 years to produce valuable foods like bread, beer, and cheese as well as to preserve dairy goods. Biotechnology now plays an even bigger part in enhancing our quality of life and the environment. To create desired products, biotechnology exploits living organisms or their biologically active portions.

Genetic engineering's introduction in the 1970s has created new opportunities for biotechnology development and application ,Traditionally, living things have either been used in their natural state or have undergone breeding to become more evolved. Because genetic engineering offers the new opportunity to make modifications to an organism's genetic material (DNA), modern biotechnology entails more sophisticated modification of the biological system or organism. This is because traditional breeding cannot create the desired goods that genetic engineering can.

II. BIOTECHNOLOGY USED IN PRODUCTION OF MEDICINES

The two primary purposes of medicine are illness prevention and disease and injury treatment. Biotechnology has played a crucial role in both of these tasks and will continue to do so in the future. In the following ways, biotechnology aids in the development and success of medicine: 1) providing new new techniques, and medications for the treatment of diseases;

3) enablingpersonalised medicine and the use of gene therapy to treat inherited and congenital diseases.

III. NEW DRUGS WHICH USED FOR PREVENTION,DIAGNOSIS AND TREATMENT

This chapter's objectives are to introduce the fundamental ideas behind biotechnology, assess its position today, and look ahead to its potential. The remaining chapters are structured as follows: Next, a section on biotechnology in medicine is introduced, followed by one on biotechnology in agriculture. The fourth section then looks at industrial biotechnology, the fifth section introduces bioinformatics, and the sixth section examines the effects of biotechnology on the environment and how it can be used to address environmental issues. The chapter is concluded with a summary of the chapter's main points.

IV. PREVENTION OF DISEASES VIA VACCINATION

Immunoreaction is the physiological process for vaccination, or inoculation with vaccines, and it is typically induced by pathogen infection in the human body. Immunoreaction creates immunity against infection by that pathogen in the future. Around 1000 AD, traditional Chinese physicians first used smallpox patient materials to create a mild illness in order to stop more severe infections .The most striking prophylactic achievement to date, which eventually resulted in the eradication of smallpox from the planet, was Jenner's discovery of using the considerably less deadly cowpox to immunise people against smallpox, a viral illness with a high fatality rate (Riedel, 2005; Willis, 1997), which is why Jenner's cowpox vaccine was successful. Other vaccinations typically use attenuated or inactivated microorganisms, which have been killed.

Production of vaccines is safer, more effective, and possible to use live pathogens that have been attenuated or rendered non-virulent thanks to in vitro cultures. When there is no naturally occurring mild version of a disease, such as cowpox, Pasteur discovered that cultivating bacteria or viruses under specific conditions may diminish their severity and allow for the creation of vaccines. can be produced using molecular cloning technology, and these proteins can then be conjugated with other substances to serve as a vaccine.

V. IDENTIFY OF PATHOGEN AND DIAGNOSIS AND TREATMENT

Finding and identifying these microorganisms, bacteria, fungus, viruses, mycoplasma, chlamydia, and protozoans is a crucial step in the diagnosis and treatment of infectious disorders. Growing bacteria on a media (bacterial culture) and colouring them for viewing and preliminary classification under a

microscope were common early methods of studying microorganisms. The criteria for determining which bacterium is to blame for a certain sickness were established by Robert Koch, according to Koch's hypotheses. that only replicate inside the live cells of an organism, they are more challenging to grow and detect.

Pathogen identification is done using later biochemical and immunological reactions. Due to immunoreaction's specificity and sensitivity, it first worked with antiserum, Immunofluorescence techniques, immunocytochemistry, immunohistochemistry, enzyme link immunosorbent assay (ELISA), radioimmunoassay, and other methods have all significantly improved the detection sensitivity of antigens that point to the presence of infections in vitro or in situ. The manufacture of antibodies against a single antigenic determinant or epitope is made possible by monoclonal antibody technology (Waldmann, 1991).In order to monitor health conditions or assist in the diagnosis of various diseases, immunoassay is also used to assess a number of significant compounds in the blood. Following the development of each of these technologies, a plethora of new biotech firms sprang up due to the prospects for the sale of test toolkits, reagents, and equipment.

The toolkits for detecting pathogens have been considerably improved by the growth of molecular biology. Automated DNA sequencing has been around for a while, making it possible to quickly identify a virus that causes a new disease. From the time the first COVID-19 case was found until the SARS-CoV-2 RNA was sequenced, it took only about a month (Zhu et al., 2020). The polymerase chain reaction (PCR) technology, which was created and subsequently improved with heat-resistant enzymes, offers an essential tool for molecular biology and quick pathogen detection. The production of the antibodies can take a lot longer than the production of DNA or RNA probes for hybridization detection.So, the production of test kits and diagnostic reagents by biotech companies was made possible as soon as the SARS-CoV-2 RNA was sequenced. Currently, the principal method for detecting SARS-CoV-2 is viral nucleic acid testing. DNA microarray is a technology that automates and miniaturises DNA detection samples so that certain systems may perform up to a million tests simultaneously (Heller, 2002). This considerably increases the throughput of DNA detection.

VI. NEW METHODS AND MATERIALS USED IN PHARMACY RESEARCH

The treatment as well as the enhancement of human health depend heavily on biomedical and pharmacological research. Research advancements in the biomedical field have stimulated biotechnology development, which in turn creates new tools and techniques for biomedical and pharmaceutical research. For instance, by lowering variability or offering specific desired traits, inbred animals have aided scientific research (Festing, 2010).In comparison to in vivo research, tissue culture and cell lines provide for more controlled testing environments. Compared to studies utilising subcellular fractions, cell-based

experiments are also more comparable to the interactions between substances and cells in real life. Cell-based testing, in conjunction with automation, miniaturisation, and the potential for high throughput screening, enable the identification of drug candidates.

Biochemical, physiological, and pharmacological studies are made easier by genetically modified cell lines that express particular receptors, ion channels, and enzymes. Electrophysiological research has frequently exploited the expression of cloned receptors or ion channels in Xenopus oocytes to characterise those receptors and ion channels. Fluorescent protein-expressing cells and animals have been created through genetic engineering. They offer effective and practical tools for examining physiological processes and cellular reactions to bioactive substances because their fluorescence change reveals differences in physiological and biochemical circumstances.

VII. GENE THERAPY IN BIOTECHNOLOGY

Pharmacogenomics is a field of study that examines how a person's genetic make-up influences how they react to medications.It is well known that different persons react to the same medication in terms of effectiveness and side effects. A medicine may have mild side effects in some people while curing numerous patients with no apparent negative consequences.Once the relationship between the two has been thoroughly established, practitioners can utilise this information to personalise drug therapy for each patient, or practise "personalised medicine". According to the patients' genotype, its goal is to provide optimum efficacy with a minimum amount of side effects so that medications and drug combinations are tailored to each person's particular genetic profile (Squassina et al., 2010). Genetic testing enables the early detection of faulty or mutated genes before they result in serious issues. Such faulty or mutant genes are the root cause of numerous genetic disorders, many of which were previously incurable. Instead of utilising medications or surgery, gene therapy aims to treat these and other problems by introducing a gene into the patient's cells (Verma et al., 2000). Gene therapy is being tested using a variety of methods.

VIII. NEW BIOMATERIALS USED FOR TREATMENT AND TRANSPLANTATION

Cancer treatment methods have included lymphocyte treatments. It was discovered that peripheral blood mononuclear cells (PBMC) cultured in the presence of interleukin-2 (IL-2) can produce lymphokine-activated killer (LAK) cells, a form of non-specific killer cell that can destroy various tumour cells. Then, in adoptive immunotherapy, it is used with IL-2 to treat specific cancer types. TIL therapy, which uses lymphocytes isolated from tumours and cultivated in the presence of IL-2 for one to two weeks, is another form of adoptive cell therapy used to treat cancer. It looks that TIL therapy is more successful than LAK therapy. Stem cells are distinguished by their capacity to divide and produce additional stem cells as well as their capacity to differentiate and mature into other types of cells with specific roles. As a result, they could be utilised as a

tool for repair to replace other cells that are exhausted or harmed.

Adult stem cell transplants, one of the most popular forms of stem cell therapy, are used to treat a number of blood malignancies and diseases, including leukaemia, lymphoma, and multiple myeloma. Bone marrow or peripheral blood stem cells can be used for this operation, and the U.S. FDA has approved a number of hematopoietic progenitor cell products made from cord blood (Food and Drug Administration, 2020). In the near future, stem cells are anticipated to be very important in treating a variety of ailments.

IX. BIOTECHNOLOGY USED IN AGRICULTURE

By creating crops with high yields and fewer inputs, improving crop flavour or nutrition profiles, enhancing crop herbicide tolerance, lowering crop chemical requirements, and facilitating the use of more environmentally sustainable farming practices.

The major goals of applying biotechnology in agriculture are to increase crop production, enhance flavour and nutritional content, and finally utilise fewer pesticides and other chemicals, as well as less labour and energy, in the process. Early humans domesticated plants and animals through a process known as selective breeding. Humans have employed selective breeding for thousands of years to increase the yield of crops and livestock. In selective breeding, organisms are crossed to generate offspring with the desired traits, which are subsequently enhanced with each succeeding generation.

This method has resulted in the production of delicious maize, aromatic rice, chickens that lay more eggs as well as those that grow quickly to provide more meat, etc. Numerous crops with desired traits, such as high yield or tolerance to diseases, pests, drought, and saline soil, have been produced through traditional breeding through hybridization. The rapid increase in grain production in China over the past forty years has been largely attributed to hybrid rice strains.

X. BIOTECHNOLOGY USED IN INDUSTRY

There is a very lengthy history of using biotechnology to prepare specific foods and beverages. which are now used to make wine, beer, cheese, and various cooking sauces. The same fundamental biological mechanisms are still used in modern commercial fermentation processes. and then alcohol is produced by adding certain yeasts to create beer. Lactic acid fermentation has resulted in the preservation of foods like soy sauce. Fermentation is also used to make leavened bread. These fermentation processes constitute the first uses of biotechnology to transform a food source into another form.

BIOINFORMATICS

It’s an interdisciplinary science that uses computational methods to comprehend biological data to solve biological problems. It is also sometimes called computational biology. The fields of bioinformatics also include the analysis of literature and the creation of bioinformatics software.

Bioinformatics has developed methods that enable the extraction of valuable information

from massive amounts of unprocessed data. It supports the investigation of gene and protein expression and regulation as well as the sequencing and annotation of genomes for genetic studies. It plays a crucial role in structural biology .Proteomics, structural genomics, and functional genomics all significantly rely on bioinformatics, which is becoming a crucial part of the biotechnology and pharmaceutical industries. Bioinformatics has several uses, including the prediction of protein structures.

XI. BIOTECHNOLOGY, ENVIRONMENT AND LAW

Worry about the unfavourable effects of human resource exploration, which have led to the extinction of some species and damage of the natural type. Additionally, human activities generate a lot of garbage that may be too much for nature to process and absorb, making the environmental problem worse. However, biotechnology might also offer answers to issues with the environment. The use of biotechnology to address environmental issues is known as environmental biotechnology.

XII. CONCLUSION

The current condition of biotechnology and its impact on the environment, economics, and health of people have been examined in this chapter. Human society depends on biotechnology for everything from the domestication of crops and cattle to the creation of beer, wine, cheese, leavened bread, vaccinations to protect humans from infectious diseases, and antibiotics to cure bacterial ailments. Nearly every significant discovery or idea in the field of biotechnology generates business potential right away, and new firms proliferate. humankind's capacity to alter the genomes .

The only thing that biotechnology is intended to help mankind accomplish is the development of products and procedures that will enhance their quality of life and ability to better understand biological processes. By 2030, we can anticipate that, thanks to the genetic engineering field's rapid advancements, medical biologics for the non-hereditary diseases. In addition to antibodies and modified cytokines playing important roles in the treatment of numerous diseases, Gene therapy research and biologic drug production continue to offer a wide range of business options. The usage of artificial organs made from cell culture may soon begin.

By 2035, technology to enhance cattle and crops for more nutrient-dense and scrumptious foods may blur the distinction between plant-based and animal-based foods and nutritional properties into the genomes of plants and fungi. This will significantly improve the energy efficiency of food production. The usage of genetically altered microbes in numerous industrial processes will increase. Artificial organs will be employed more widely in the medical field. By 2040, we can anticipate that the mechanisms underlying regeneration will be thoroughly known, and regenerative technologies will be used to heal illnesses and wounds. To replace the lost or injured organs, new ones might be produced in place or transplanted. The average lifespan of people will rise significantly.

REFERENCES

1. Anderson, J., DiCicco, D., Ginder, J., Kramer, U., Leone, T., Raney-Pablo, H., & Wallington, T. (2012). High octane number ethanol–gasoline blends: Quantifying the potential benefits in the United States. Fuel, 97, 585-594.
2. Arranz-Otaegui, A., Carretero, L. G., Ramsey, M. N., Fuller, D. Q., & Richter, T. (2018). Archaeobotanicalevidence reveals the origins of bread 14,400 years ago in northeastern Jordan. Proceedings of the National Academy of Sciences, 115(31), 7925-7930.
3. Bassett, R. K. (2002). To the digital age: Research labs, start-up companies, and the rise of MOS technology. Baltimore and London: Johns Hopkins University Press. Becquemont, L. (2009). Pharmacogenomics of adverse drug reactions: practical applications and perspectives. Pharmacogenomics, 10(6), 961-969.
4. Behring, E. v. (1890). Ueber das zustandekommen der diphtherie-immunität und der tetanus-immunitätbeithieren. Deutsche medizinscheWochenschrift, 16, 1113–1114.
5. Bergveld, P. (1985). The impact of MOSFET-based sensors. Sensors and Actuators, 8(2), 109-127.
6. Bordenave, G. (2003). Louis Pasteur (1822–1895). Microbes and infection, 5(6), 553-560. Clark Jr, L. C., & Lyons, C. (1962). Electrode systems for continuous monitoring in cardiovascular surgery. Annals of the New York Academy of sciences, 102(1), 29-45.
7. Cohen, A. M., &Hersh, W. R. (2005). A survey of current work in biomedical text mining. Briefings in bioinformatics, 6(1), 57-71.
8. Cohen, S. N., Chang, A. C., Boyer, H. W., &Helling, R. B. (1973). Construction of biologically functional bacterial plasmids in vitro. Proceedings of the National Academy of Sciences, 70(11), 3240-3244.
9. Cooper, D. K., Gollackner, B., & Sachs, D. H. (2002). Will the pig solve the transplantation backlog? Annual review of medicine, 53(1), 133-147.
10. Daniell, H., Streatfield, S. J., &Wycoff, K. (2001). Medical molecular farming: production of antibodies, biopharmaceuticals and edible vaccines in plants. Trends in plant science, 6(5), 219-226.
11. Darwin, C. (1968). On the origin of species by means of natural selection. 1859. London: John Murray. Dawson, W. K., Maciejczyk, M., Jankowska, E. J., &Bujnicki, J. M. (2016). Coarse-grained modeling of RNA 3D structure. Methods, 103, 138-156.
12. Dietrich, O., Heun, M., Notroff, J., Schmidt, K., &Zarnkow, M. (2012). The role of cult and feasting in the emergence of Neolithic communities. New evidence from GöbekliTepe, south-eastern Turkey. Antiquity, 86(333), 674-695.
13. Domingo, J. L., &Bordonaba, J. G. (2011). A literature review on the safety assessment of genetically modified plants. Environment International, 37(4), 734-742.
14. Dudley, M. E., Wunderlich, J. R., Shelton, T. E., Even, J., & Rosenberg, S. A. (2003). Generation of tumor-infiltrating lymphocyte cultures for use in adoptive transfer therapy for melanoma patients. Journal of immunotherapy (Hagerstown, Md.: 1997), 26(4), 332-342.

15. Evans, A. S. (1976). Causation and disease: the Henle-Koch postulates revisited. The Yale journal of biology and medicine, 49(2), 175-195.
16. Evans, W. E., &Relling, M. V. (1999). Pharmacogenomics: translating functional genomics into rational therapeutics. Science, 286(5439), 487-491.
17. Ezezika, O. C., & Singer, P. A. (2010). Genetically engineered oil-eating microbes for bioremediation: prospects and regulatory challenges. Technology in Society, 32(4), 331-335.
18. Ferrante, R. J., Andreassen, O. A., Jenkins, B. G., Dedeoglu, A., Kuemmerle, S., Kubilus, J. K., . . . Beal, M. F. (2000). Neuroprotective effects of creatine in a transgenic mouse model of Huntington's disease. Journal of Neuroscience, 20(12), 4389-4397.
19. Festing, M. F. (2010). Inbred strains should replace outbred stocks in toxicology, safety testing, and drug development. Toxicologic pathology, 38(5), 681-690.
20. Folegatti, P. M., Ewer, K. J., Aley, P. K., Angus, B., Becker, S., Belij-Rammerstorfer, S., Clutterbuck, E. A. (2020). Safety and immunogenicity of the ChAdOx1 nCoV-19 vaccine against SARS-CoV-a preliminary report of a phase 1/2, single-blind, randomised controlled trial. The Lancet, 396(10249), 467-478.