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Question: Discuss in details the aspects of medical biotechnology

Medical biotechnology is a combination of different science-oriented subjects, namely Cell Biology, Genetics, Nanotechnology, Bioinformatics, etc., to carry out advancements in the field of medicine. It makes use of recombinant DNA technology in different therapeutic forms.

In medical biotechnology, one learns how diseases affect the human body at the cellular level. Its aim is prevention and treatment of the disorders, thereby increasing the lifespan of an individual; for example- improving the accessibility for people with disabilities. They use living cells as well as cell materials in their research and develop pharmaceutical and diagnostic products, which will be useful for the treatment and prevention of diseases thus offering a lot of scope for a Career in Medical Biotechnology.

The most significant advantage of using this technique is that it can overcome the problems of graft rejection. One of the typical examples is the production of insulin. During the initial days, insulin was made from the pancreas of pigs and cattle, which lead to immunological reactions. Still, Medical Biotechnology solved this problem by producing insulin from E.coli by genetic engineering.

Medical biotechnology is also called Red biotechnology because of its application in the manufacturing of pharmaceuticals like vaccines, enzymes, antibiotics, etc.; as well as for molecular diagnostic purposes. These applications offer a lot of careers in Medical Biotechnology.

Various applications of medical biotechnology include:

- Pharmacology
- Gene therapy
- Stem cells
- Tissue engineering

- Monoclonal antibodies
- Bioprocessing
- Genome sequencing

Pharmacology: One of the new and growing fields is pharmacology in combination with biotechnology. It includes the principles of biotechnology for the development of drugs. A vast number of therapeutic drugs that come in the market are bio formulations like nucleic acid products, antibodies, and vaccines. These bio formulations are developed in multiple steps i.e. it includes considering the principles related to health and disease, the molecular mechanism conducted in relation to function of biomolecules, their synthesis, and purification, determining the shelf life of the product, their stability, immunogenicity and toxicity, drug delivery systems, clinical trials as well as patenting.

Gene therapy: It involves the use of DNA as a pharmaceutical agent to treat a particular disease. Mainly it involves replacing a mutated gene with a therapeutic gene. Gene therapy has made significant advances over the past two decades. Within a short duration, it has transformed from a theoretical stage to a technological phase as well as clinical trials against a variety of deadly diseases. The most notable advancement included gene therapy for many genetic disorders like Severe combined Immunodeficiency, Chronic granulomatous disorder, Hemophilia, Cancer, Parkinson's disease, Influenza, HIV, and many more acquired diseases. For a Career in Medical Biotechnology thorough knowledge of this filed is a must.

Stem Cells: A stem cell is a cell that has the potential to develop into any cell type in the human body. Usually, stem cells are introduced into the damaged areas of the body where, under the right conditions, it will be replacing the damaged area. More often, these stem cells are grown in the lab, first to ensure the proper condition, and after that, it is inserted into the sick person. The main area where the stem cells have proven their worth is in bone marrow transplants, replacing damaged heart tissue after a heart attack and replacing damaged nerve tissue for those having spinal cord injury. Stem cells are currently being used for the treatment of many diseases right from Crohn's disease to baldness. The richest source of stem cells is from the embryo itself. Stem cell research is a major source of

Careers in Medical Biotechnology.

Tissue engineering: It involves the creation of human tissues outside the body for later use. Tissue engineers so far have created bone marrow, artificial skin, and cartilage. Currently, people are working on creating artificial liver, bladder, and pancreas.

Monoclonal antibodies: They are named so because they are clones of an individual parent cell. And basically, antibodies are the proteins that attack invading pathogens. It's a vital tool for finding small molecules in biological samples. There are many protein therapeutics developed so far which includes insulin for diabetes, somatotropin and somatostatin for growth disorders, erythropoietin for anemia, tumor necrosis factor for cancers, interferons for controlling viral infections, lymphokines like Interleukin-2 which has the ability to restore the immune system to fight against cancer, certain infections and some diseases etc.

Bioprocessing: It is one of the current areas of research wherein mass production of human proteins, vaccines, etc. are made by genetically modifying bacteria and viruses. This leads to the production in large quantities of the desired product within a short period of time with relatively less expenditure. One of the significant applications of Bioprocessing is insulin, the human protein which is responsible for reducing the blood sugar level after intake of food. They did this by placing the human gene for insulin in bacteria, cultured, and allowed to produce insulin, which is collected, purified, and sold to diabetes worldwide.

Genome Sequencing: One of the future approaches of medical biotechnology is in genome sequencing. Years back, a research team had mapped the entire DNA sequence of human chromosome 22. Thereafter technology has become so advanced that the number of genomes was either wholly or partially sequenced. In fact, doctors can identify whether a particular was inherited from one generation to the other.

BIOPHARMACEUTICAL: Through advanced methods in biotechnology, biopharmaceuticals were produced safely and quickly for treating illnesses. Furthermore, biopharmaceuticals do not contain any chemicals and use targeted organisms to synthesize the medicine successfully. Big molecules of proteins are the typical origin of biopharmaceuticals. When they are inside the human body, they target dangerous and hidden parts of the

disease and obliterate them. Today, scientists and researchers are aiming to extend and develop biopharmaceutical medicines which can be used to fight diseases related to heart, hepatitis and cancer.

PHARMACOGENOMIC: Pharmacogenomics is the technique that leverages the person's heredity information to choose the best biotechnological medicine for their illness. This studies the body system's response to certain medications. To put it simply, this is the combination of advances in pharmaceuticals along with genomics. The end goal of this application is to improve medicines that are specifically targeted to a person in lieu with his genetic makeup to ensure effective treatment of illness. The end goal of this branch of medical science is to effectively produce biotechnological medicines which are placed in the patient's body in accordance with his genetically makeup.

With the use of pharmacogenomics, medical companies can produce medicines that depend on the proteins, compounds, and RNA particles based on the chosen qualities and infections applicable. Synthesized medicines are almost guaranteed to improve remedial effects, in addition to diminishing harm to other nearby cells. With the knowledge of the person's hereditary inclinations, specialists can ascertain how well the patient's body can prepare and process a medication and decide the correct amount of medication doses. As a result, an accurate prescription will be given, and the chance of overdose is mitigated.

RAPID DEPLOYMENT OF VACCINES: A global pandemic is a real issue and has always proven its powerful grip on humanity. Through Biotechnology, scientists and researchers can quickly pinpoint precursors or markers that can cause severe illnesses and diseases. As a result, they can synthesize vaccines quickly against any dangerous pandemic sickness. In a study on vaccines and biotechnology, researchers found a great decline in illnesses when patients were administered with a vaccine produced through biotechnology.