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PHA 210(INTRODUCTION TO BIOTECHNOLOGY)

Question : write in details the aspects of medical biotechnology

Answer:

Medical biotechnology is an application of biotechnology that endorses the lives of individuals every day. Medical biotechnology also called as red biotechnology is the use of organisms and organisms-isolated materials for research and to produce diagnostic and therapeutic products that help to treat and prevent human diseases. The aim of medical biotechnology is the Prevention, Diagnosis and Treatment of diseases. The principles of medical biotechnology are applied in pharmacology, gene therapy, stem cells and tissue engineering. Medical biotechnology is a rapidly evolving field integrating knowledge obtained in molecular, cell biological, genetic and immunological scientific areas.

The medical biotechnology field has helped bring to market microbial pesticides, insect-resistant crops, and environmental clean-up techniques. Numerous examples of discoveries in the field of medical biotechnology include growth hormone and insulin. This discovery was the result of research studies related to deoxyribonucleic acid. Many scientists in the medical biotechnology field study genetic engineering which involves isolating, identifying, and sequencing the human genes to determine their functions.

ASPECTS

The main topics in medical biotechnology are mainly as follows each of which requires a complete description:

1. **Gene therapy(testing)**
2. **Recombinant vaccines(DNA)**
3. **DNA vaccines**
4. **Bioinformatics**
5. **Genomics(pharmacogenomics)**
6. **Proteomics**
7. **Biomedicine and biopharmaceuticals**

Biomedicine or biopharmaceutical

Biopharmaceuticals are proteins (including antibodies), nucleic acids (DNA, RNA or antisense and Oligonucleotides) used for treatment or diagnostic purposes (in vivo) with a biological source. Human

recombinant insulin was the first approved treatment. The greatest biotechnology legacy of the twentieth century was Alexander Fleming's discovery of penicillin from the mold penicillin. However, biosynthetic insulin was the first biopharmaceutical material made by recombinant DNA technology in 1982 that entered the market. In the late 1990s, many developments in the field of production and biopharmaceutical process occurred including recombinant DNA and hybridomas technologies. On the other hand, they caused a great revolution in the treatment of malignant diseases, diabetes and other diseases. More than 150 Biotech medicines made through biotechnological processes have been introduced throughout the world.

Recombinant vaccines

It can be said that biotechnology techniques are used and will be used in the production of all types of vaccines. However, the pinnacle of potentials of modern biotechnology can be observed in the fourth generation of recombinant vaccines (and also DNA vaccines). So far, the vaccine of attenuated or killed microorganisms or their components (naturally extracted from them) has been used. This caused significant side effects in patients. But with the development of recombinant DNA techniques, a fourth-generation vaccine produced in which the effective ingredient in inducing immunity (immunogenic) of microorganisms is used such as Hepatitis B vaccine. A recombinant vaccine production process is very long and complex. First, biotechnologists should detect the most immunogenic component of the microorganisms (Usually proteins or membrane glycoproteins) according to long and complex processes. Second, after identification the location and sequence of the gene in the genome of the microorganism, they attempt to replicate the gene and put amplified fragments into special cloned plasmids. Next, transfer of recombinant plasmid into the host cell for the production of protein will be performed. A cell bank , a bank of cells with the recombinant plasmid and the plasmid constructs are prepared if there is a economic success in the production of a protein candidates for vaccine. They will be used for next steps. Many process must be followed (may be for several years) to approve this vaccine effectiveness, efficiency and harmlessness to humans (or animals) (Clinical Trials). A large investment is required for industrial and commercial production of vaccines. Some part of this investment should be allocated to create a standard environment in accordance with the GMP (Good

Manufacturing Practice), facilities and installations in accordance with GMP standards, professional trained staff and create a system to maintain stable quality. The first recombinant vaccine licensed to be used for humans was hepatitis B vaccine. This vaccine was obtained with colonization of hepatitis virus B (HBsAg) surface antigen gene and its expression in yeast cells. It is indicted that recombinant hepatitis B vaccines produce protective antibodies.One of vaccination strategies investigated for a number of diseases is using of plasmid DNA encoding the protein antigen. The vaccine is injected directly into the receptor muscle. They remove DNA muscle cells and represent antigen proteins encoded by them. This leads to two types of humoral immune and cellular responses.

Pharmacogenomics (a combination of pharmacology and genomics) is the technology that analyses how genetic makeup affects an individual's response to drugs.[31] Researchers in the field investigate the influence of genetic variation on drug responses in patients by correlating gene expression or single-nucleotide polymorphisms with a drug's efficacy or toxicity.[32] The purpose of pharmacogenomics is to develop rational means to optimize drug therapy, with respect to the patients' genotype, to ensure maximum efficacy with minimal adverse effects.[33] Such approaches promise the advent of "personalized medicine"; in which drugs and drug combinations are optimized for each individual's unique genetic makeup.

Genetic testing allows the genetic diagnosis of vulnerabilities to inherited diseases, and can also be used to determine a child's parentage (genetic mother and father) or in general a person's ancestry. In addition to studying chromosomes to the level of individual genes, genetic testing in a broader sense includes biochemical tests for the possible presence of genetic diseases, or mutant forms of genes associated with increased risk of developing genetic disorders. Genetic testing identifies changes in chromosomes, genes, or proteins.[38] Most of the time, testing is used to find changes that are associated with inherited disorders. The results of a genetic test can confirm or rule out a suspected genetic condition or help determine a person's chance of developing or passing on a genetic disorder. As of 2011 several hundred genetic tests were in use.[39][40] Since genetic testing may open up ethical or psychological problems, genetic testing is often accompanied by genetic counseling.