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**COURSE CODE:** PHA210

**COURSE TITLE:** INTRODUCTION TO BIOTECHNOLOGY.

**QUESTION:** Discuss in details the aspects of medical biotechnology.

 Medical biotechnology is the use of living cells and cell materials to research and produce pharmaceutical and diagnostic products that help treat and prevent human diseases. It is the biotechnology applied to produce pharmaceuticals.

 There are four main aspects of medical biotechnology and they are:

1. Pharmacology
2. Gene therapy
3. Stem cells
4. Tissue engineering

**Pharmacology**

1. Insulin production: production of genetically engineered human insulin was one of the first breakthroughs of biotechnology in the pharmaceutical industry. Insulin was first produced in Escherichia coli through recombinant DNA technology in 1978. This is done for the mass production of human proteins, vaccines etc by genetically modifying bacteria or viruses. The human gene for insulin is placed into bacteria, are cultured and allowed to produce insulin which is collected, purified and sold worldwide.
2. Human growth hormone: production of human growth hormone was first done in 1979 using recombinant DNA technology. Scientists produce human growth hormone by inserting DNA coding for human growth hormone into a plasmid that was inserted into Escherichia coli bacteria.
3. Human blood clotting factor: production of human blood clotting factor was enhanced by recombinant DNA technology. Human clotting factor ix was the first to be produced using recombinant DNA technology using transgenic Chinese hamster ovary cells in 1986. Plasmids containing the factor ix gene, along with plasmids with a gene that codes for resistance to methotrexate were inserted into the Chinese hamster over cells through transfection.
4. Gene pill: the gene pill delivers DNA to the intestine. DNA is absorbed by gut cells. Protein drugs are synthesized inside the cell and after protein drug is secreted into the blood.
5. Monoclonal antibodies: they are so called because they are clones of an individual parent cell. This technology is primarily used to fight off cancer cells as these monoclonal antibodies can be trained to target markers that show up on cancer cells.

**Gene therapy**

 Gene therapy is the use of DNA as a pharmaceutical agent to treat disease. It derives its name from the idea that DNA can be used to supplement or alter genes within an individual’s cells as a therapy to treat disease. The most common form of gene therapy involves using therapy that encodes a functional therapeutic gene to replace a mutated gene. There are two types, somatic gene therapy and germ line gene therapy. Gene therapy has made important medical advance in the last two decades. It has moved from conceptual stage to technology development and laboratory research to clinical translational trials for verity of deadly diseases.

1. Hemophilia: patients born with hemophilia are unable to induce blood clot and suffer from external and internal bleeding that can be life threatening. The therapeutic gene was introduced into the liver of patients who then acquired the ability to have normal blood clotting time.

**Stem cells**

 A stem cell is a cell that has the potential to become any type of cell in the human body. Stem cells are possessed by all human but are very hard to access. Stem cells are introduced into a damaged area of the body where, under right conditions will replace the damaged area. Stem cells are currently being tested to treat everything from Chron’s disease to baldness. The main areas where the stem cells have proven their worth is in the bone marrow transplants, replacing damaged heart tissue after heart attacks and replacing damaged nerve tissue. Sources of stem cells include embryonic stem cells, infant and adult stem cells

**Tissue engineering**

 A form of regenerative medicine, tissue engineering is the creation of human tissue outside the body for later replacement. It usually occurs on a tissue scaffold, but can be grown on or in other organisms. This is the technique used:

1. Taking a tiny piece of cartilage tissue,
2. Dissolving away the white springy tissue to collect the actual cells inside,
3. Expanding the amount of cells by various methods in the lab.
4. Placing that increased volume of cells on or in mould that have a shape or an ear
5. Implanting the new ear into the patient

 Tissue engineers have created artificial skin, cartilage and bone marrow.