Practical Biotechnology

Lab: 3

Biotechnology and Biotechnology Applications

Biotechnology: any technological application that uses living organisms (Animal, Plant and Microorganisms) , to produce or modify products according to human purposes for specific use.

History of biotechnology

The history ,mainly, can be divided into three stages:

1- **Ancient biotechnology (pre- 1800)**: includes plant cultivation , animal domestication, bread, cheese and fermentation like vinegar and wine. All which related to food.

One of the oldest examples of crossbreeding for the benefit of humans is mule. Mule is an offspring of a male donkey and a female horse.

2- **Classical biotechnology (**1800 - middle of the twentieth century): built on ancient biotechnology, include fermentation which promoted food production and medicine like production antibiotic and vaccines.

3- **Modern biotechnology**: include manipulates of genetic information in organism and genetic engineering.

General applications of biotechnology:

Biotechnology is such an any branch of science which has advanced rapidly and providing benefits in all the fields of human.

A. Biotechnology in agriculture

For about 10,000 years, farmers have been improving wild plants through the selection and breeding for some characteristics. In the twentieth century, breeding became more complex, as the traits of breeders select for include increased yield, disease and pest resistance and drought resistance etc. Traits are passed from one generation to the next through genes, which are made of DNA.

Agricultural biotechnology is a collection of scientific techniques used to improve plants, based on an understanding of DNA, with ability to transfer specific gene to certain crops, This crops which have modified genomic called genetically modified crops (GM crops or biotech crops) and the process called genetic engineering techniques.

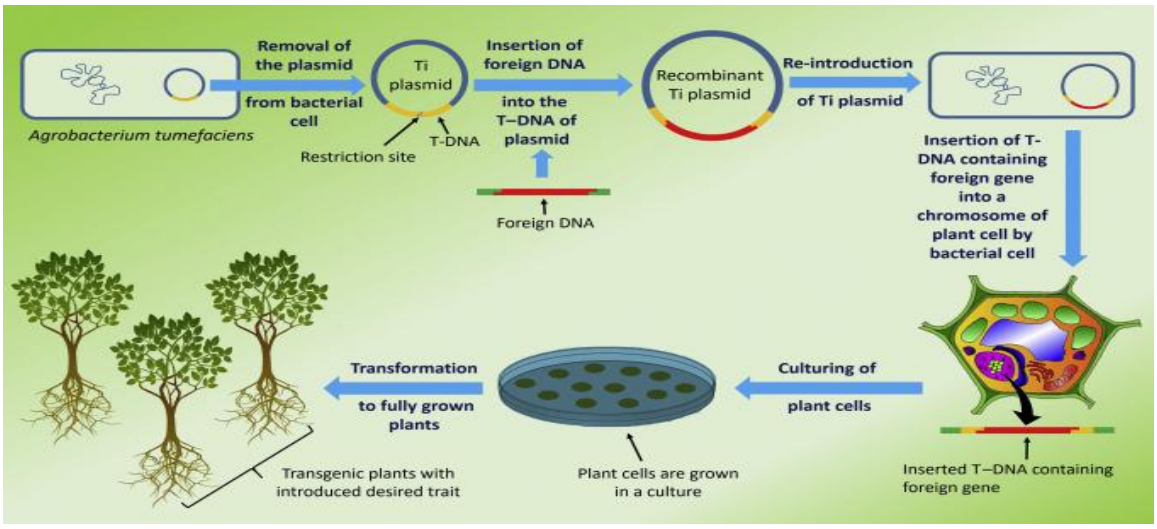
The transgenic plants may provide one or more Benefits of the following:

1- Resistance to insects, fungi, bacteria and virus

2- Highly resistant to herbicides, pesticides and other chemicals.

3- Drought, resistance, flood resistance, salinity resistance

4- High productivity and improved quality.



B. Biotechnology in medicines and health care:

In medicine, modern biotechnology finds applications in areas such as pharmaceutical drug discovery and production and antibiotic .The first genetically engineered products were medicines designed to treat human diseases. One example, in 1978 Genentech developed synthetic insulin by joining its gene with a plasmid vector inserted into the bacterium *Escherichia coli*. Insulin, widely used for the treatment of diabetes.

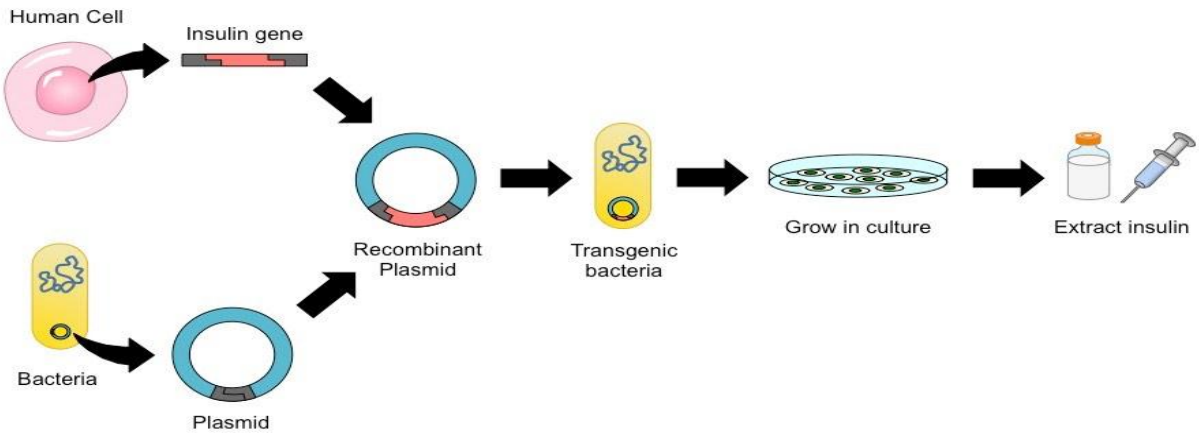
Some Application of Biotechnology in medicines field

1- DNA monoclonal antibodies are used as tools for diagnosis of diseases.

2- Many value drugs and antibiotics are also produced on large scale by using biotechnological processes.

3- Human insulin was the first therapeutic product to be made commercially by genetically engineered bacterium.

4- Gene therapy: is the method of curing genetic diseases (or acquired diseases) by the replacement of an abnormal gene by a therapeutic gene.



C. Industrial biotechnology

Is the application of biotechnology for industrial purposes, including

1-industrial fermentation which includes the using cells such as micro-organisms, or components of cells like enzymes, to generate industrially useful products such as food and feed, detergents.

2-The use of some agricultural crops such as corn instead of using petroleum in the production of some chemicals

3- Bioleaching: is the use of bacterial microorganisms to extract precious metals, such as gold, and copper from electronic wastes.

D. Biotechnology in energy and fuels

1- Biotechnology is contributing to increase biogas, Certain bacteria produce large amount of methane with CO_2 and H_2, This bacterium is *Methanobacterium*.

2- The microbes involved in fermentation can also be engineered for conversion of substrate into biofuel.

3- There are certain plants which produce hydrocarbons and are called as petro-plants. e.g. rubber plants and certain algae.

E. Biotechnology and environment

1. Genetically engineered microbes are used for efficient treatment of industrial waste water.

2. Bio- fertilization for example rhizobium bacteria which able to fix atmospheric N_2 by reducing it to ammonia NH_4.

3. Bioremediation of pollutants is an effective method of removal the earth's pollution. **Bioremediation** means the utilization of biological organisms for reducing pollution or for the removal of environmental pollutants.

The bioremediation of organic toxic pollutants is mainly based on the microorganisms and thus it is called as **microbial bioremediation.** On the other hand, the bioremediation of inorganic contaminants is carried by certain plant species and therefore it is termed as **phytoremediation.**