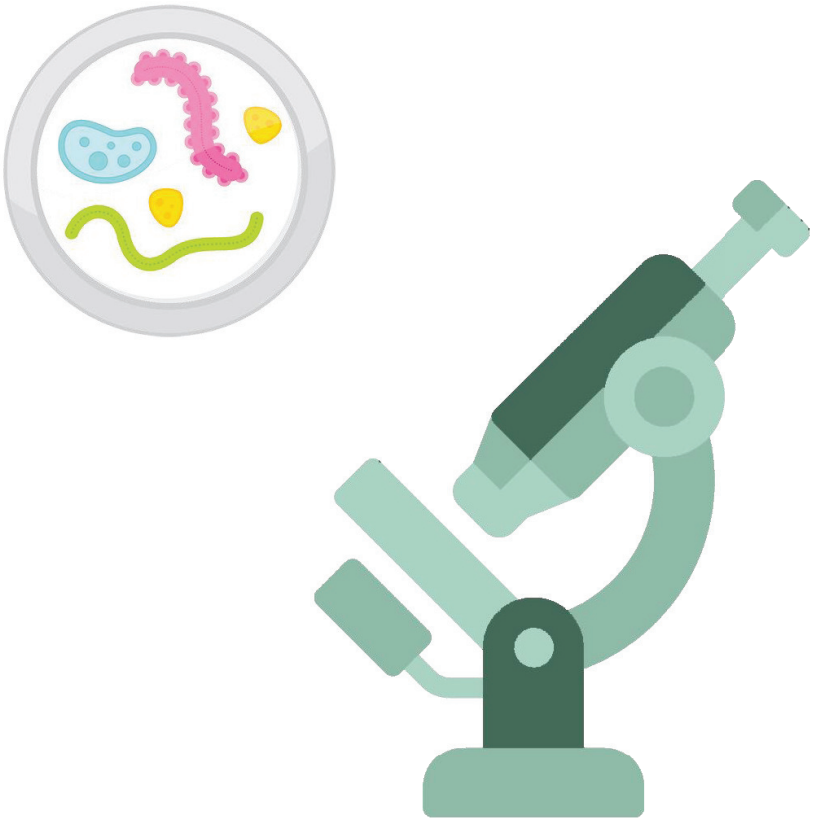
BIOTECHNOLOGY
PRINCIPLES AND PROCESSES



BIOTECHNOLOGY PRINCIPAL AND PROCESSES

Biotechnology Principles and Processes:

Biotechnology is the field of biology which is used to develop various technologies that help in the production of certain products that result in the welfare of human beings. It consists of various applications in different fields that include therapeutics, processed food, diagnostics, waste management, genetically modified crops, energy production, etc. The definition of biotechnology given by the European Federation of Biotechnology states that "The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services."

Principles of Biotechnology:

Modern biotechnology is based on two core techniques that are:

Genetic Engineering: Genetic engineering is the direct manipulation of an organism's gene by the use of biotechnology which is used to change the genetic makeup of the cell. The set of technologies are used for the genetic makeup of the cells which includes the transfer of genes in the species boundaries for the production of improved organisms, most importantly called clones resulting in gene cloning.

Maintenance of a Sterile Environment in Chemical Engineering Processes: It helps in the growth of only those microbes that are required and this process helps in the manufacturing of vaccines, antibiotics, drugs, etc.

Basic Principles of Biotechnology:

Genetic engineering involves the isolation and introduction of only those genes into an organism that is desired and does not introduce undesirable genes. The steps involved in genetic engineering are:

- Development of recombinant DNA (rDNA).
- Cloning of the desired gene.
- Transfer of the cloned gene into the suitable host organism.

Origin of Replication (ori): The sequence of chromosomes in the DNA that helps in the initiation of the relocation of DNA. The foreign DNA that is inserted into the host organism needs to be attached to the origin of relocation and this results in the formation of multiple copies of the DNA while if the foreign gene is not attached to the origin of replication then it may not result in the multiplication of DNA.

Cloning: The process of formation of several identical copies of the DNA template.

Plasmid: An extrachromosomal, circular DNA material that helps in the replication of DNA. they are used as cloning vectors and also helps in the process of gene expression. Here, a foreign gene is inserted into the plasmid which then multiplies and results in the formation of several copies of the desired gene.

Antibiotic Resistance Gene: In the case of certain microorganisms there are several genes that have the ability to grow when there is a specific antibiotic present while the genes provide resistance against them. These genes are found to be located on the plasmids and are used in the process of cloning and transformation.

Restriction Enzymes: These enzymes are responsible for the cutting of DNA fragments at specific sites, thus they are called the "molecular scissors". These enzymes cut the DNA at a particular site that is specific for each restriction enzyme. They help in the process of cutting the sedated gene which is then inserted into the specific locations of the vector or the host DNA.

Vectors: They are the plasmids that help in the process of multiplication and then the transfer of genes from one organism to the other.

Ligase: They are those enzymes that joined together the fragrant of DNA that contains the desired gene and the DNA of the host. They help in the sticking of fragments of DNA together.

The basic steps in the genetic modification of an organism:

- Identification of desired DNA fragments.
- Introduction of desired DNA fragments into a suitable host.
- Maintaining foreign DNA in the host and its transfer to the progeny.

Tools for Genetic Engineering (Recombinant DNA Technology):

Restriction enzymes also called molecular scissors are used to simply cut the DNA which is then inserted into the vector. These restriction enzymes help in the addition of the methyl groups to the DNA that results in the restriction of the digestion of their own DNA. These enzymes cut DNA fragments at their particular recognition sequences.

Recognition Sequences: The bases of the DNA sequence that are specific for each restriction enzyme and act as the site for restriction or cutting resulting in the formation of the palindromic sequences.

There are two types of restriction enzymes: endonucleases and exonucleases.

Endonucleases: These enzymes are responsible for the cutting of the DNA in the middle while the exonucleases enzymes are responsible for the cutting of the DNA at the ends. Examples of restriction endonucleases are ECoR1, Hind III, etc. Restriction enzymes cut the DNA molecule at a specific site that is known as a restriction site. Each endonuclease characterized the restriction site by a specific recognition sequence. Each restriction endonuclease is responsible for the identification of the specific palindromic nucleotide sequence in the DNA. The Palindromic DNA sequence of the base pairs is present on the two strands of DNA in the same order when the orientation of reading is kept the same.

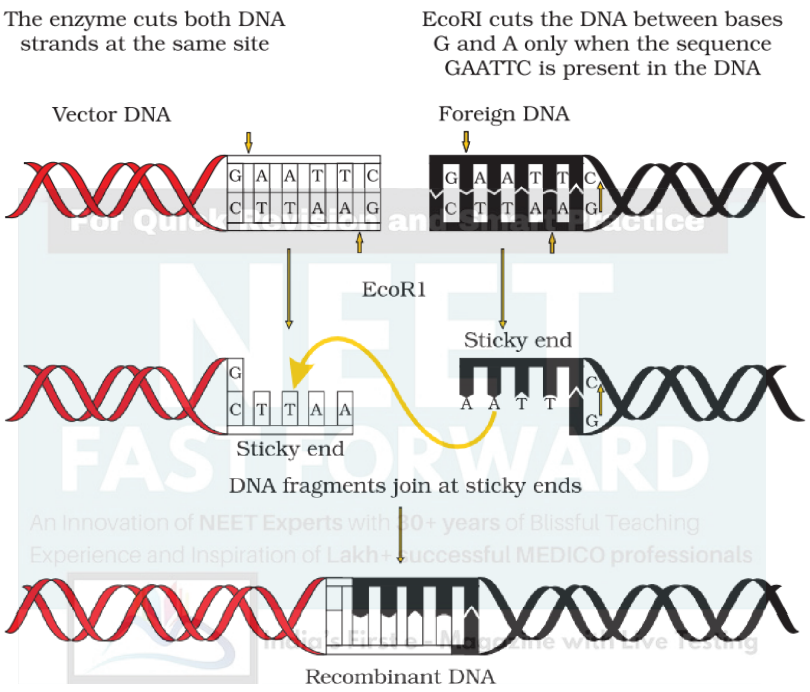
Ligases: Ligases are the enzyme that is responsible for the joining of the two DNA fragments. The process of ligation occurs in the presence of sticky ends (they are the similar overhanging sequences formed due to the action of the same

restriction enzyme).

Palindromic nucleotide sequences: Each restriction endonuclease functions by 'inspecting' the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbones Each restriction endonuclease recognizes a specific palindromic nucleotide sequences in the DNA.

Restriction Enzymes: the two enzymes responsible for restricting the growth of bacteriophage in Escherichia coli were isolated. One of these added methyl groups to DNA, while the other cut DNA. The later was called restriction endonuclease.

Action of Restriction enzyme



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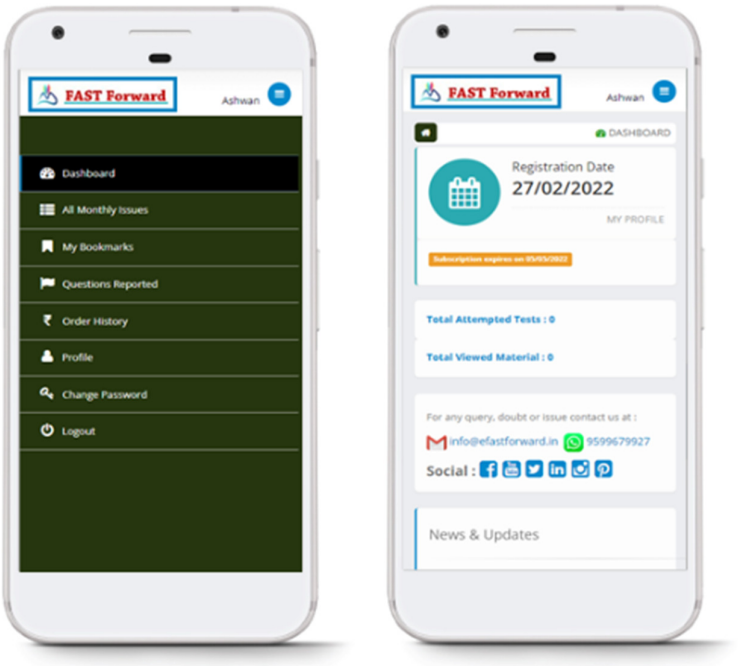

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