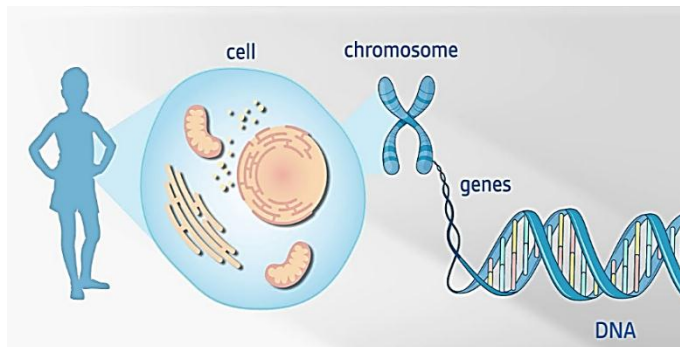


Define biotechnology?

Biotechnology is use of living cells and organisms to develop products and processes that enhance various aspects of human life.

Genes:

- Genes are the basic units of heredity.
- These are instructions to make proteins.



Short questions

Define biotechnology as the use of living cells and organisms in products and processes that can improve the quality of life.

Illustrate how biotechnology is a discipline/field that has the potential to transform how we live.

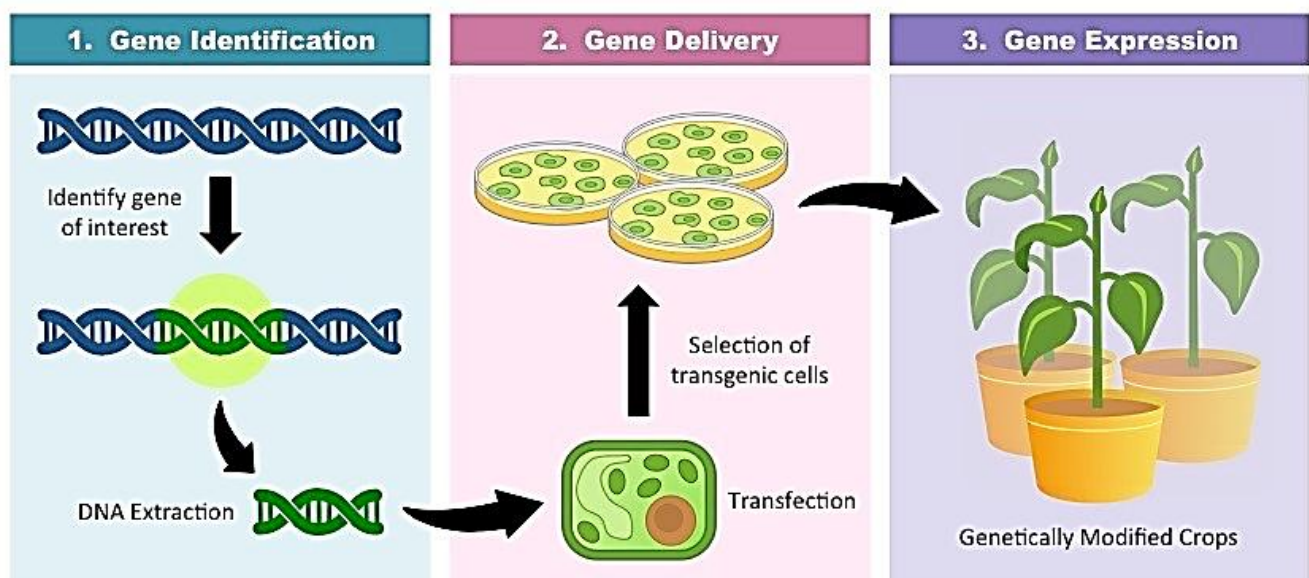
Short questions

What are genes?

Define genetic engineering.

Genetic engineering:

Genetic engineering is an advanced technique in biotechnology in which scientists select and isolate the useful gene from one organism and insert it into another organism.





Transgenic organisms:

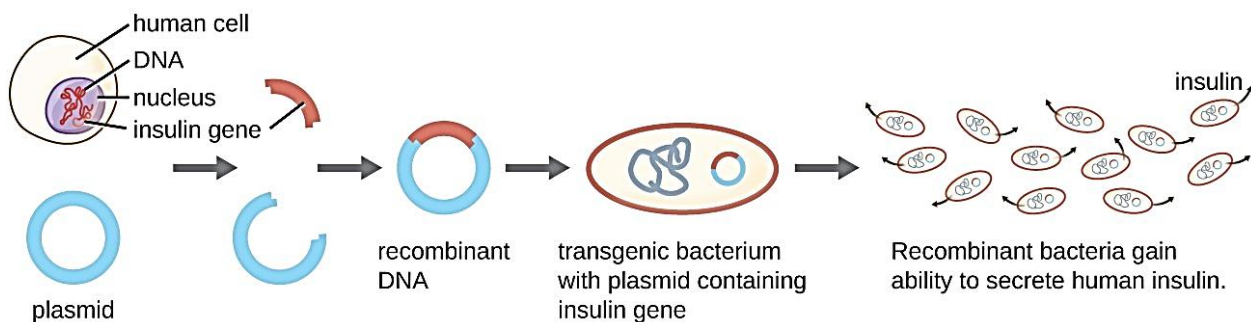
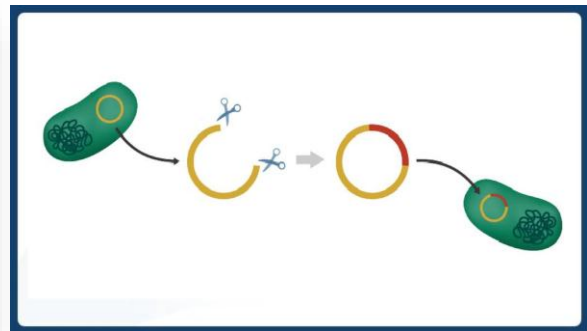
The organisms that contain a foreign gene in their cells are called transgenic organisms.

For example: Bacteria.

Short question

What are transgenic organisms?

What are plasmids?



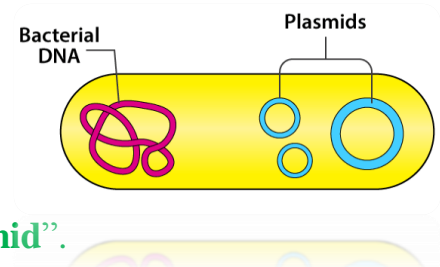
Benefits of using bacteria in genetic engineering:

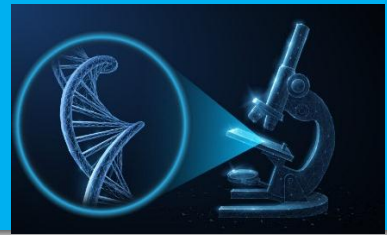
Bacteria are very useful in genetic engineering because:

- They are cheap.
- They are colonial.
- Simple and easy to grow.
- Multiply quickly.
- Can be stored at -80°C indefinitely
- Bacteria have additional circular DNA called “**plasmid**”.

Short question

Why bacteria are beneficial in genetic engineering?





Steps of genetic engineering:

The steps to introduce a gene into bacterium are following:

- **Identification and Isolation:** Identify and isolate the desired gene (e.g., the gene for insulin).
- **Restriction Enzymes:** Use restriction enzymes to cut the gene of interest.
- **Cutting Plasmid DNA:** Cut the plasmid DNA using restriction enzymes.
- **Attachment:** Attach the isolated gene to the plasmid.
- **Ligase Enzyme:** Use ligase enzymes to bind the gene and plasmid together.
- **Recombinant DNA:** The combination of the gene of interest and the plasmid is now called “recombinant DNA”.

- **Insertion:** Insert the recombinant DNA back into the bacterium.
- **Genetically Modified Bacterium (GMB):** This bacterium is now a genetically modified bacterium or transgenic bacterium.
- **Culturing:** The transformed bacteria are cultured in large fermentation tanks. As they grow and divide, they use the inserted gene to produce the desired product, such as insulin.
- **Extraction:** The product (e.g., insulin) is extracted from the culture medium.

Short questions

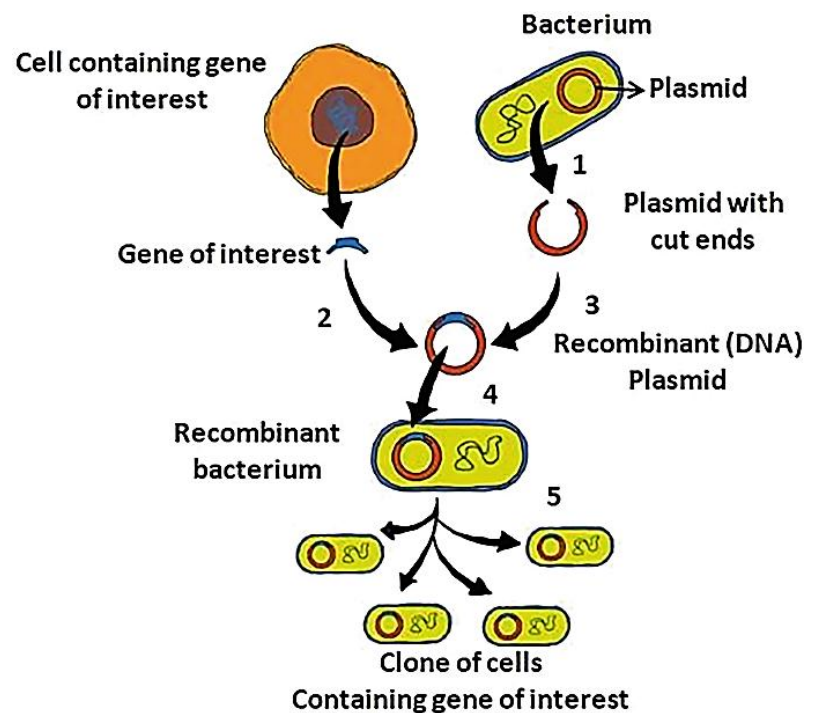
Define recombinant DNA.

Which enzymes are used to cut and join DNA of different organisms?

What is genetically modified bacterium?

Write different steps of genetic engineering.

How desired protein is obtained?





Multiple choice questions

1. The additional circular pieces of DNA present in a bacterial cell are called:

- a. RNA b. Nucleotides c. Chromatids d. Plasmids

Explanation: Plasmids are small, circular, double-stranded DNA molecules that are separate from the chromosomal DNA and can replicate independently within a bacterial cell.

2. Plasmid and attached foreign gene with it are collectively called:

- a. Recombinant cell b. Recombinant DNA c. Recombinant plasmid d. Recombinant chromosome

Explanation: When a foreign gene is inserted into a plasmid, the resulting combination is called a recombinant plasmid.

3. The organisms whose cells and plasmids are usually used in genetic engineering.

- a. Bacteria b. Fungi c. Algae d. Virus

Explanation: Bacteria often contain small, circular pieces of DNA called plasmids. Scientists can insert genes of interest into these plasmids and then introduce the plasmids back into the bacteria.

4. Sections of DNA serving as codes for developing characters in an organism are called:

- a. Genes b. Nucleotides c. Plasmids d. Proteins

Explanation: Genes are segments of DNA that contain the instructions for the development of specific traits in an organism.

5. How do genetic engineers get insulin for diabetic patients?



- | | | | |
|--------------------------------|---|--|--------------------------------------|
| a. Isolate from human pancreas | b. Isolate from pancreas of other animals | c. Insulin gene inserted in human pancreas | d. Insulin gene inserted in bacteria |
|--------------------------------|---|--|--------------------------------------|

Explanation: The insulin gene is inserted into bacteria, which then produce insulin through recombinant DNA technology. This method is commonly used to produce human insulin.

6. Why do genetic engineers use bacteria in genetic engineering?

- The chromosomes of bacteria is made of DNA and proteins.
- Their nucleus is very big and easy to handle.
- They have many chromosomes.
- Bacteria divide very fast and make colonies

Explanation: Bacteria are used in genetic engineering because they reproduce rapidly, allowing for the quick production of large quantities of the desired genetic material.

7. A gene is inserted into a bacterium by:

- | | | | |
|-------------------|-----------------|-------------------|------------------------|
| a. Tissue culture | b. Fermentation | c. Biodegradation | d. Genetic engineering |
|-------------------|-----------------|-------------------|------------------------|

Explanation: Genetic engineering involves manipulating an organism's DNA to insert new genes, which is the method used to introduce a gene into a bacterium.

8. _____ is use of living cells and organisms to develop products and processes that enhance various aspects of human life.

- | | | | |
|------------|------------------|-----------|------------|
| a. Biology | b. Biotechnology | c. Botany | d. Zoology |
|------------|------------------|-----------|------------|



Explanation: Biotechnology is specifically focused on using biological systems and living organisms to create and improve products and processes for various purposes, such as medicine, agriculture, and industrial applications.

9. Application of knowledge in the areas like engineering and medicines is called:

- a. Technology b. Robotics c. Machine d. Information

Explanation: Technology involves applying scientific and technical knowledge to solve practical problems, including in fields like engineering and medicine.

10. Which organisms are used in making bread, yogurt, cheese etc.

- a. Plants b. Animals c. Microorganisms d. None

Explanation: Microorganisms such as yeast and bacteria are essential in the production of bread (yeast), yogurt (bacteria), and cheese (bacteria and sometimes mold).

11. Which of the following act as instructions to make specific substances (proteins)?

- a. Genes b. Molecules c. Proteins d. All of these

Explanation: Genes, which are segments of DNA, contain the instructions for synthesizing proteins. They are the blueprint for protein production in cells.

12. The organism that contains a foreign gene in its cell is called

- a. Edited b. Transgenic c. New organism d. Adult
organism organism organism

Explanation: A transgenic organism has had a foreign gene deliberately inserted into its genome. This is a common technique in genetic engineering to introduce new traits.



13. _____ is an advanced technique in biotechnology in which scientists select and isolate the useful gene from one organism and insert it into another organism.

- a. Fermentation b. Respiration c. Mechanical d. Genetic engineering

Explanation: Genetic engineering involves the direct manipulation of an organism's genes, including the transfer of specific genes from one organism to another to introduce new or enhanced traits.

14. Which term describes the introduction of foreign DNA into an organism?

- a. Transcription b. Translation c. Transformation d. None of these

Explanation: Transformation is a process where foreign DNA is introduced into a cell, leading to the incorporation of this DNA into the cell's genome.

15. What is the first step in genetic engineering?

- a. Inserting the gene into a new organism b. Identifying the gene of interest c. Cloning the gene d. Verifying gene expression

Explanation: Before any genetic engineering can begin, you need to determine which gene you want to manipulate or introduce. This involves identifying and isolating the gene of interest.

16. A bacterial cell divides into two in:

- a. 10 minutes b. 20 minutes c. 30 minutes d. 40 minutes



Explanation: A bacterial cell typically divides into two in approximately **20 minutes**, though this can vary depending on the species and environmental conditions.

17. This diagram shows:



a. Bacteria

b. Virus

c. Algae

d. Fungi

Explanation: It is a bacterial cell because it does not have any nucleus.