

Biotechnology and its Applications



1. Which part of the plant is best suited for making virus-free plants and why?

Ans: The meristem is the plant part that is best suited for making virus-free plants. This is because even when the plant is infected with a virus, the meristem (apical and axillary) remains infection free; it can be removed, grown in vitro to obtain virus-free plants.

2. What is the major advantage of producing plants by micropropagation?

Ans: Advantages of producing plants by micropropagation:
The number of plants can be obtained in very less time and in less space.
Plants can be obtained throughout the year.
Sterile plants can be multiplied by this method.
An economical and easy method of plant propagation.

3. Find out what the various components of the medium used for propagation of explants in vitro are?

Ans: The major components of medium used for propagation of explants in vitro are carbon sources such as sucrose, inorganic salts, vitamins, amino acids, water, agar-agar, and certain growth hormones such as auxins and gibberellins.

4. Crystals of Bt toxin produced by some bacteria do not kill the bacteria themselves because—

- (a) bacteria are resistant to the toxin**
- (b) toxin is immature;**
- (c) toxin is inactive;**
- (d) bacteria enclose toxin in a special sac.**

Ans: (c) Toxin is inactive.

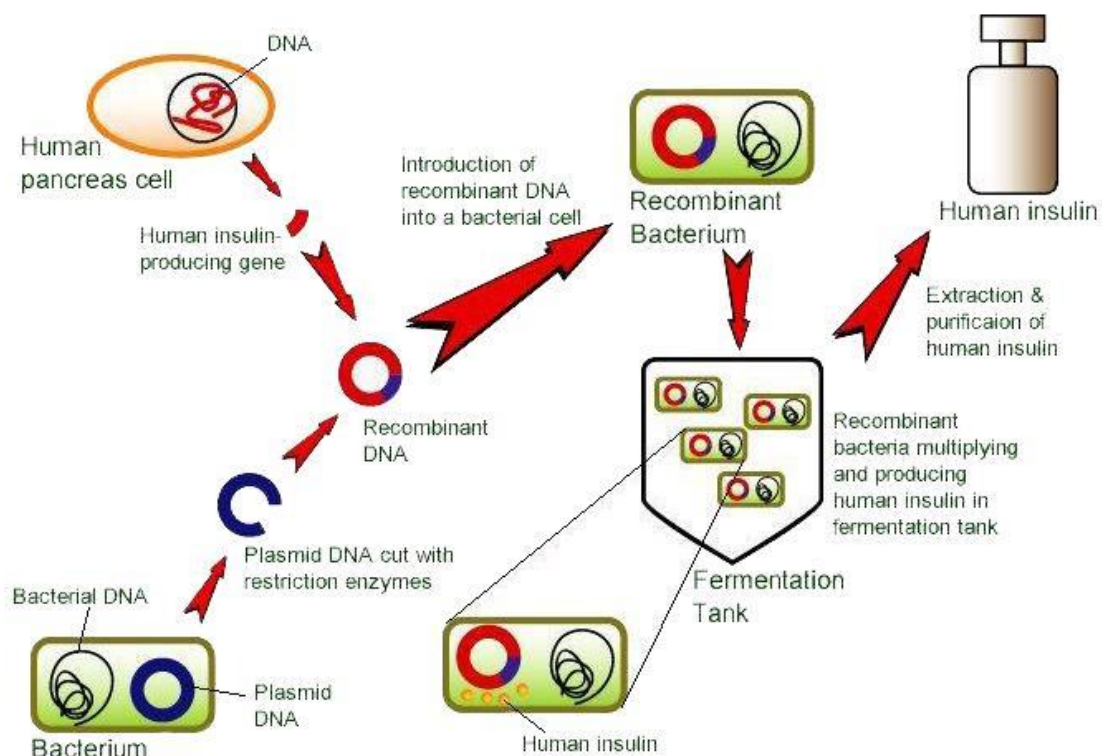
Explanation: An inactive form of Bt toxin, i.e., prototoxin is present in bacteria *Bacillus thuringiensis*. When it enters the insect's gut it gets activated in presence of stomach acid.

5. What are transgenic bacteria? Illustrate using any one example.

Ans: The other name used for transgenic bacteria is genetically modified bacteria. These kinds of bacteria have been specially designed to carry a foreign gene that has been introduced artificially into its genome so that it can express the desired gene to produce or create products having commercial importance.

Example: *Escherichia coli* is a transgenic bacterium that carries two DNA sequences corresponding to the A and B insulin chains of humans as a foreign gene to produce those insulin chains. Given below is an illustration showing the process of formation of human insulin.

Human Insulin Production



6. Compare and contrast the advantages and disadvantages of production of genetically modified crops.

Ans: Differences between advantages and disadvantages of genetically modified crops are:

Advantages of genetically modified crops	Disadvantages of genetically modified crops
i. Beneficial in pest resistance	i. Known to cause harm to the pollinators and therefore, affects pollination.
ii. Provides high nutritional value to the crops	ii. May prove to be less palatable as compared to the natural crops.
iii. Greater productivity rate	iii. May lead to the growth of super-weeds.
iv. Possess certain antibiotic properties.	iv. Due to the consumption of crops having antibiotic properties, the

	antibiotic medications may become less efficient.
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7. What are Cry proteins? Name an organism that produce it. How has man exploited this protein to his benefit?

Ans: Cry proteins are those poisonous proteins that are insecticidal and are known to be secreted in crystal form and the toxin is produced by a gene which is known as cry.

An organism that produces this protein is a bacterium called *Bacillus thuringiensis*.

In recent times, man has exploited this protein to produce crops that are transgenic such as BT cotton, BT brinjal and many more which has developed resistance against the insects.

8. What is gene therapy? Illustrate using the example of adenosine deaminase (ADA) deficiency.

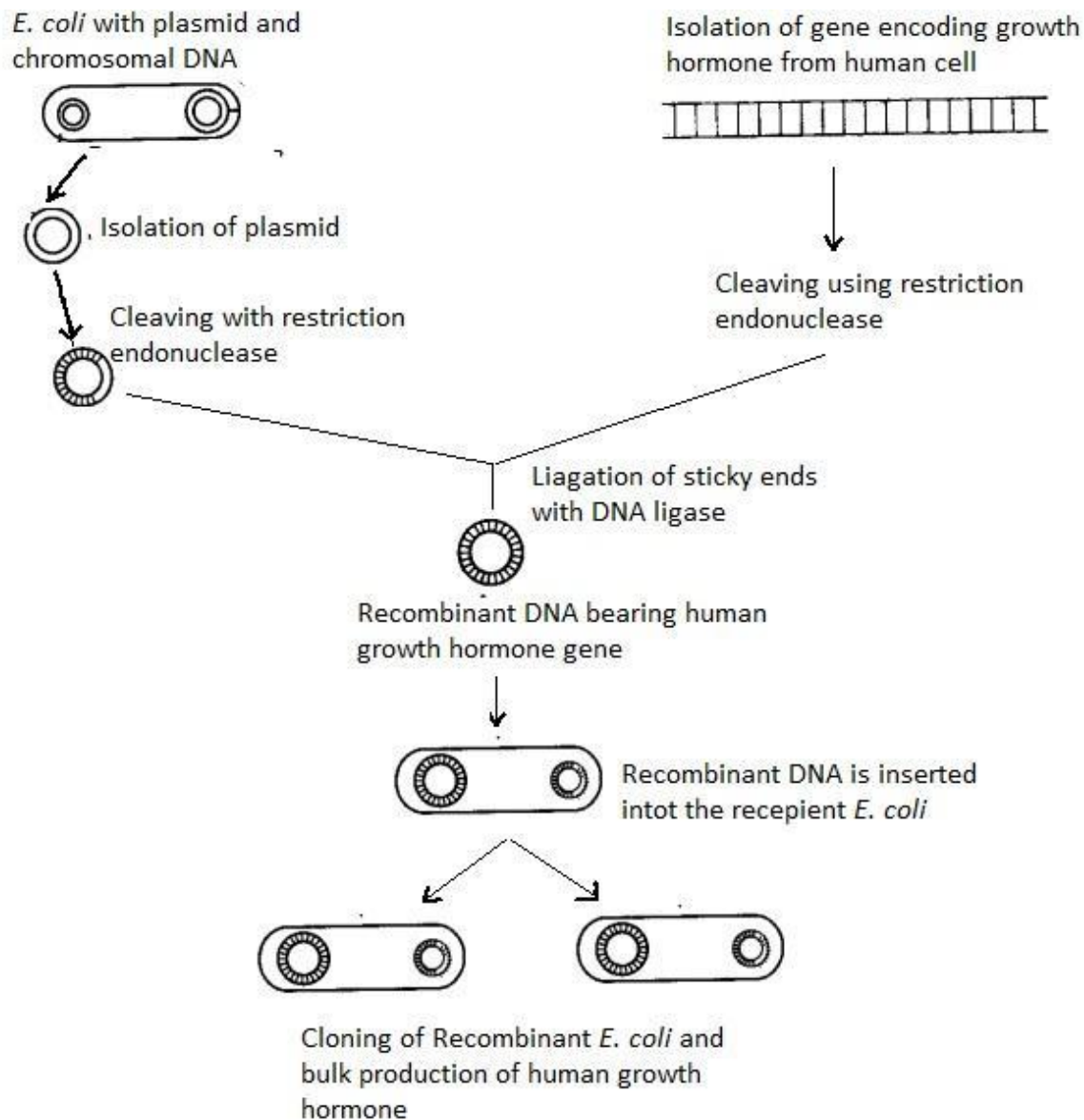
Ans: Gene therapy is a technique that believes in utilizing genes to treat or prevent diseases. However, it can either replace a mutated gene that can cause disease or it is also capable of inactivating a mutated gene that fails to function normally.

Gene therapy is described below using the example of adenosine deaminase deficiency:

- Due to adenosine deaminase deficiency, production of severe immunodeficiency as well as functions of T, B and natural killer cells impairment can be seen.
- These complications can be resolved with the help of gene therapy which contains CD34⁺ enriched cells subjected to transduction with a retroviral vector and the immune reconstitution can be done.

9. Diagrammatically represent the experimental steps in cloning and expressing a human gene (say the gene for growth hormone) into a bacterium like *E. coli*?

Ans: The following diagram represents the experimental steps in cloning and expressing a human growth hormone gene in *E. coli*.



10. Can you suggest a method to remove oil (hydrocarbon) from seeds based on your understanding of rDNA technology and chemistry of oil?

Ans: Recombinant DNA technology is one of the methods to remove oil (hydrocarbon) from seeds.

The seed oils have glycerol and fatty acids as the main constituents. To remove oil from seeds we need to find those genes which produce those fatty acids and glycerol. Then appropriate genes can be removed by restriction endonuclease and reseal the DNA by ligases. Those cells can be grown in an artificial medium and new plants can be formed by micropropagation. These plants will contain seeds without oil.

11. Find out from internet what is golden rice.

Ans: Golden rice can be rightly defined as the product of genetic engineering by performing biosynthesis of beta-carotene which is known to be the precursor of Vitamin A. The main reason behind producing golden rice is to introduce a nutritionally high dietary fibre in areas having a scarcity of dietary vitamins. Since rice is considered to be the staple diet and is quite cosmopolitan in distribution, therefore, this crop has been engineered genetically to curb the problem of nutrition deficiency globally.

12. Does our blood have proteases and nucleases?

Ans: No, human blood doesn't have enzymes such as proteases and nucleases, at least not in active condition. If such enzymes are present in the blood, they would break down the proteins in the blood and the nucleic acids in the blood cells.

13. Consult internet and find out how to make orally active & protein pharmaceutical. What is the major problem to be encountered?

Ans: To make orally active and protein pharmaceuticals, the drugs must be undergone coating with the help of a film that is protein degrading enzyme resistant.

The problem associated with the pharmaceutical drugs which can be consumed orally is that those drugs, if made without proper coating or film, can be easily degraded by the enzymes such as proteases that are present in our alimentary canal.