

NCERT Solutions for Class 12 Biology

Chapter 10 – Biotechnology and Its Applications

10.1

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

Ans: The apical and axillary meristems of plants are best suited for making virus-free plants.

10.2

What is the major advantage of producing plants by micropropagation?

Ans: The major advantage of producing plants by micropropagation is that a large number of genetically identical plants (clones) can be produced rapidly from a single parent plant, in a short time and limited space.

10.3

Find out what the various components of the medium used for propagation of an explant in vitro are?

Ans: The various components of the medium used for in vitro propagation of an explant include:

- **Water** – Distilled water is used as the solvent and medium base.
- **Inorganic salts** – Provide essential macronutrients (like nitrogen, phosphorus, potassium) and micronutrients (like iron, manganese, zinc).
- **Carbon source** – Usually sucrose to provide energy.
- **Vitamins** – Such as thiamine, nicotinic acid, and pyridoxine, required for growth.
- **Amino acids** – Optional, but may enhance growth and development.
- **Growth regulators** – Such as auxins (e.g., IAA, NAA) and cytokinins (e.g., BAP, kinetin) to control organ development.
- **Gelling agent** – Like agar, to solidify the medium (if required).

10.4

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 encloses toxin in a special sac.

Ans: Toxin is inactive.

Explanation: Bacillus thuringiensis bacteria have an inactive form of Bt toxin, known as protoxin. When it penetrates the insect's gut, it becomes active in the presence of stomach acid.

10.5

What are transgenic bacteria? Illustrate using any one example.

Ans: The term transgenic bacteria comprises bacteria that have one or more genetic materials, typically obtained from an unrelated living thing, inserted within the genome of the organism. A transgene or altered bacterium is created, for instance, when the insulin gene from human beings is inserted into a separate plasmid of the E. coli bacteria, and then the recombinant DNA fragment is subsequently transformed into a new microbe.

10.6

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

Ans: Differences between advantages and downsides of genetically modified crops include:

| Advantages of Genetically Modified Crops | Disadvantages of Genetically Modified Crops |
|-------------------------------------------------|------------------------------------------------------------------------|
| i. Restoration of soil | i. The risk of creating super weeds |
| ii. Stress tolerance | ii. Introduction of an undesirable variety with a harmful combination. |
| iii. Exceptional productivity | iii. Significant risk of non-reproduction or lack of viability |
| iv. Reduced dependence on pesticides. | iv. The chemical produced may lead to rejection in human insecticide |

10.7

What are Cry proteins? Name an organism that produce it. How has man exploited this protein to his benefit?

Ans: A frequently encountered soil organism called *Bacillus thuringiensis* creates a protein poison that destroys certain kinds of bugs. A kind of protein known as crystal (Cry) constitutes the toxin. Cry proteins come in a variety of forms and are poisonous to certain insect species. The cry genome is the component of the genome that codes for the Cry protein. In order to create genetically modified crops that are immune to creatures such as insects, Bt cotton (which is immune to bollworms) & GM tobacco products (which are immune to hornworms), biotechnologists have successfully isolated the DNA sequence that produces the toxic substance & inserted the gene into a variety of organisms.

10.8

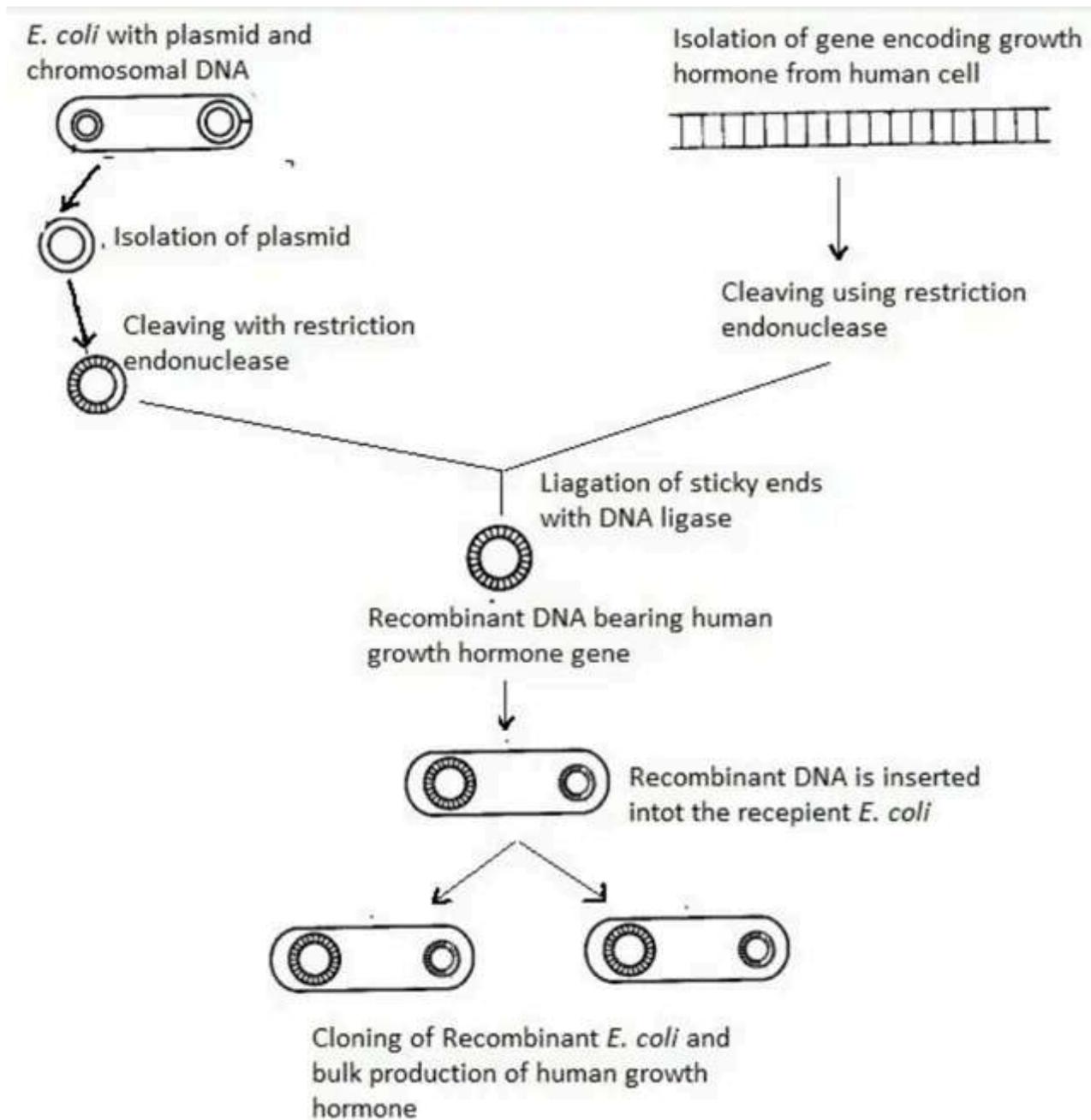
What is gene therapy? Illustrate using the example of adenosine deaminase (ADA) deficiency.

Ans: The treatment of genes is the process of fixing or injecting the right version to fix a gene that is defective gene. Adenosine deaminase deficiency (ADA) is an extremely uncommon genetic condition caused by a mutation in the adenosine deaminase gene. Because the body's defenses work, a particular enzyme is essential. Therapy with genes may be employed to cure it. For extended periods of time, the corresponding gene gets translated into skeletal marrow's initial cells during development.

10.9

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

Ans:



10.10

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

Ans: It is necessary to identify the gene sequences that allow the plant's seeds to produce petroleum products. Restriction endonucleases need to be employed to eliminate the relevant genes. DNA ligases must subsequently be used to repair the damaged terminals that contain this DNA. Once cultured meticulously on nutritional media, these stem cells can transform into an entirely novel plant with oil-free seeds of their own.

10.11

Find out from internet what is golden rice.

Ans: The transgenic rice (*Oryza sativa*) known as “golden rice” has high levels of β -carotene, or provitamin A, which acts as the primary supplier of vitamin A. Golden rice gets its name from the fact that β -carotene gives the rice’s kernels their yellow hue. It was created at the Swiss Federal Institute of Technology with Peter Beyer & Lecturer Ingo Potrykus.

10.12

Does our blood have proteases and nucleases?

Ans: To put it simply, human blood does not include enzymes like nucleases and proteases, at least not while functional. The blood’s proteins and the nucleic acids in its cells would be broken down by these enzymes if they were present.

10.13

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

Ans: Historically produced oral functional protein products include vaccinations for avoiding viral illnesses like influenza, herpes, and hepatitis B. Antigen-producing genes are extracted from microorganisms, then cultivated in an antimicrobial environment alongside chopped potato leaves as substrate. Callus forms, and recombinant or genetically modified potatoes containing vaccine-producing genes are produced.