NCERT solutions for class 12 biology chapter 12 biotechnology and its applications

Q1. 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.

Answer:

(c). Toxin is inactive

The Bt toxin remains inactive in the bacteria. It gets activated after entering the insect gut due to the alkaline pH of the gut.

Q2. What are transgenic bacteria? Illustrate using any one example.

Answer:

Transgenic bacteria are the bacteria whose genes have been manipulated by transferring foreign genes into its genome through recombinant DNA technology. For example, transgenic E.coli was developed by introducing in it, two DNA sequences of A and B chains of human insulin in order to produce insulin to treat diabetic patients.

Q3. Compare and contrast the advantages and disadvantages of production of genetically modified crops.

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Answer:

GM crops are genetically modified crops that can be made by transferring desirable characteristics in them. The main advantage of GM crops is that they are highly productive and they yield an increased amount of produce. The other advantages of the production of genetically modified crops in order to increase the yield are as follows:

1. GM crops can be developed for increasing the nutritional quality of crop products. For example golden rice with enhanced vitamin, A content is a GM crop.

2. Many GM crops are developed to have insect pest resistance, thus, decreasing our dependence on chemical-based insecticides/pesticides.

3. GM crops are made to be highly tolerant of environmental conditions.

4. Gm crops are highly tolerant to abiotic conditions

5. GM Crops minimises post-harvesting losses.

GM crops possess some disadvantages also. The presence of a transgene in commercial crops endangers wild species. The gene for Bt toxin expressed in pollen endangers pollinators such as honeybees. These crops supply allergens and transfer antibiotic resistance markers. They are damaging to the genetic environment.

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Q4. What are Cry proteins? Name an organism that produces it. How has man exploited this protein to his benefit?

Answer:

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Cry proteins are toxin protein encoded by cry genes. These are produced by a bacteria named*Bacillus thuringiensis* which itself remain safe from cry toxins *b* y having methylated DNA. Cry proteins act as insecticides as they are toxic to insects. This property of Cry proteins has been exploited in producing genetically modified crops such as Bt cotton, Bt brinjal etc. These crops are resistant to insects of order Lepidoptera.

Q5. What is gene therapy? Illustrate using the example of adenosine deaminase (ADA) deficiency.

Answer:

Gene therapy refers to a collection of methods and technologies allowing correction or replacement of a defective or dysfunctional gene. While correcting, a normal gene is transferred into the individual's embryo to replace and perform the function of the original defective gene. One well-established example of gene therapy is ADA deficiency. This is caused by the deletion of a gene encoding for enzyme adenosine deaminase. The gene therapy for ADA deficiency was carried out in a 4-year-old patient by the following method:

1. The lymphocytes of a patient were grown in a culture in vitro.

2. A functional ADA cDNA was introduced in these lymphocytes using a retroviral vector.

3. The transformed lymphocytes were introduced back into the blood of the patient.

4. The patient is regularly infused with transformed lymphocytes

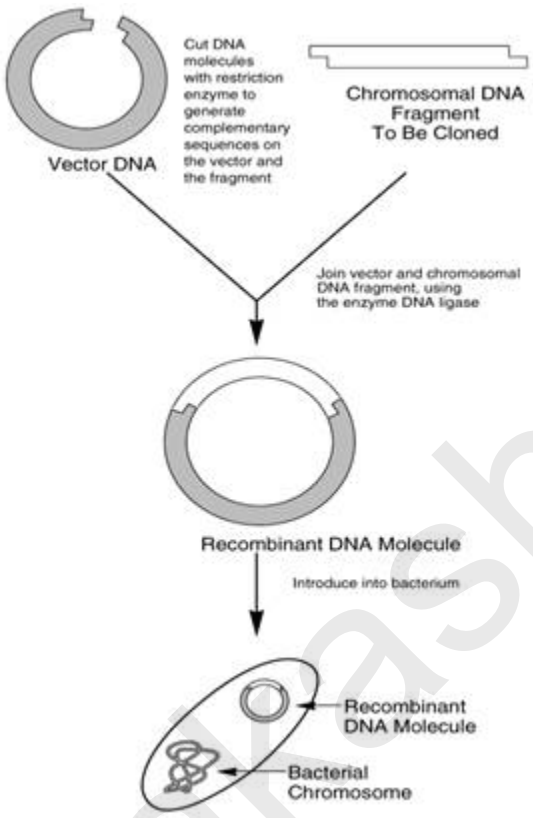
5. For a permanent cure of ADA deficiency, a gene isolated from bone marrow cell is introduced in the patient in the early stage.

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Q6. Diagrammatically represent the experimental steps in cloning and expressing a human gene (say the gene for growth hormone) into a bacterium like E. coli?

Answer:

Diagrammatic representation of steps in DNA cloning



Q7. Can you suggest a method to remove oil (hydrocarbon) from seeds based on your understanding of rDNA technology and chemistry of oil?

Answer:

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Recombinant DNA technology is a technique by which the genome of an organism can be manipulated Oils are made of glycerols and fatty acids. So using recombinant DNA technology we can silence the genes coding for glycerol and fatty acids and remove oil (hydrocarbon) from seeds.

Q8. Find out from internet what is golden rice.

Answer:

Golden rice is a variety of rice crop, genetically engineered to synthesise beta carotene which is a precursor of vitamin A. The normal rice produces beta carotene but in leaves, to increase the production of vitamin A, beta carotene should be synthesised in the endosperm. Golden rice was developed by transferring two beta-carotene biosynthesis genes into the rice genome. These genes include *psy* (phytoene synthase) from a plant named *Narcissus pseudonarcissus* (daffodil) and *crtI*(phytoene desaturase) from the soil bacterium *Erwinia uredovora.* These genes were under endosperm-specific promoter so that they will show expression in the endosperm.

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Q9. Does our blood have proteases and nucleases?

Answer:

Proteases and nucleases are two enzymes that catalyse the hydrolysis of proteins and nucleic acids respectively. These enzymes are not found in blood, instead, blood contains protease inhibitors protecting the proteins being broken down. Similarly, nucleases are also absent in blood.

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Q10. Consult internet and find out how to make orally active protein pharmaceutical. What is the major problem to be encountered?

Answer:

Orally active protein pharmaceuticals contain biologically active proteins, peptides etc. These are taken into the body by oral route in various formulations. The production of these protein pharmaceuticals involves encapsulation of proteins or peptides in liposomes using penetration enhancers. These proteins or peptides are used for the treatment of diseases and they can also be used as vaccines.

The major problem encountered in the administration of these pharmaceuticals is that they are ingested orally, and digested by the proteases present in the stomach before showing results. This is why such pharmaceuticals are directly ingested into the target site.

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