

CHAPTER12: BIOTECHNOLOGY AND ITS APPLICATIONS

ONE MARK QUESTIONS AND ANSWER.

1) Which soil bacteria produces Bt-toxins?

Ans. *Bacillus thuringiensis*

2) Bt toxins produced in *Bacillus thuringiensis* is not toxic to it, why?

Ans. Bt toxins produced in *Bacillus thuringiensis* is not toxic to it because it is produced in an inactivated form, it gets activated in the gut of larvae because of alkaline secretion in gut of larvae

3) Name the American company , that prepared human insulin.

Ans. Eli Lilly.

4) What are genetically modified plants?

Ans. Genetically modified plants using r-DNA technology leading to alteration of gene

5) Write any four pest resistant plants.

Ans. Bt -cotton, rice, Bt- Corn, potato and tomato(any four)

6) Name the food plant produced to enhance the nutritional value of the food crop.

Ans. Golden rice (Vitamin A enriched rice)

7) Name cry Genes Which control the cotton bollworms

Ans. CryI_{Ac} or CryII_{Ab}

8) How does the Bt toxins kill the insects in bio-insecticide plants?

Ans. The activated toxins binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and eventually cause the death of the insects.

9) Name the bonds Connecting A-chain and B-Chain of functional insulin.

Ans. Disulphide bonds or Disulphide bridges

10) Plasmids of which bacteria were used to produce the A-chain and B-chain separately in the bacteria's.

Ans. *E. coli* or *Escherichia coli*

11) What is Gene Therapy?

Ans. Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or an embryo.

12) What are GMOs? Give two examples.

Ans. GMOs are the genetically modified organisms

Eg., Bt-cotton, rice, Bt-Corn, potato and tomato (any four)

13) Name the disease that can be cured through gene therapy.

Ans. SCID (Severe Combined Immuno Deficiency) Due to absence of ADA

14) Name the hormone produced by genetic engineering.

Ans. Human insulin.

15) Name the vector used to incorporate the cDNA of ADA into the lymphocytes in gene therapy.

Ans. Retrovirus.

16) Define biopiracy.

Ans. The term is used to refer to the use of bioresources by multinational companies and other organizations without taking the consent by the people concerned.

17) Mention the functions of GEAC (Genetic Engineering Approval Committee).

Ans. GEAC will make decisions regarding the validity of GM research and the safety of introducing GM-Organisms for the public services.

18) Name the protein produced by *Bacillus thuringiensis*.

Ans. Toxin protein (Insecticidal protein) in the form of crystals.

19) Define the term bioethics.

Ans. Ethics includes a set of standards by which a community regulates its behavior and

20) Which two patents on India's biological resources have been revoked?

Ans. On pesticides on Neem and healing properties of Turmeric decides as to which activity is legitimate and which is not.

21) Name the inactive form of insecticidal protein.

Ans. Protoxin

22) Expand BT.

Ans. *Bacillus thuringiensis*

TWO MARKS QUESTIONS

1) Insulin extracted from the pancreas of slaughtered cow and pigs cannot be used why?

Ans. Insulin extracted from the pancreas of slaughtered cow and pigs causes allergy and other types of reactions.

2).Mention the four areas which have been responsible for the recent advances in biotechnology

Ans. The areas in recent advances in biotechnology are (I) Agriculture (ii) Medicine (iii) Food industry and (iv) Environmental engineering.

3) What are transgenic bacteria? Illustrate using any one example.

Ans. When a foreign gene or series of genes are introduced into the genome of a bacteria , the bacteria becomes transgenic. For example, two DNA sequences (A and B chain of human insulin) introduced into the plasmids of bacteria *E.coli*. The transgenic bacteria starts producing insulin chains.

4) How many recombinant therapeutics are been approved for the use of humans?

Ans.At present, about 30 recombinant therapeutics have been approved for human use the world over, In India12 of these are presently being marketed.

THREE MARKS QUESTIONS

1) Write short on insulin.

Ans. Insulin is taken at regular intervals to manage diabetes. Insulin consists of two short polypeptide chains A-chain and B-chain that are linked together by a disulphide bridges. In humans ,insulin is synthesized as pro-hormone which contains an extra stretch called C-peptide. C-peptide is removed during maturation.

2) Name three group of insects killed by insecticidal protein.

Ans.Lepidopteron, Coleopterans and Dipterans.

3) What are cry genes? Mention the types and the specific insects they kill.

Ans. The genes that produce the Bt toxin are called cry genes there are a number of them, for example ,the protein encoded by the genes *cryI*Ac and *cryII*Ab control the cotton bollworm and the *cryI* Ab controls corn borer.

4) Write short notes on gene therapy.

Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or embryo. Genes are inserted into person's cells and tissues to treat a disease. It involves the delivery of a normal gene into the individual or embryo to take over the function of and compensate for the non-functional gene.

5) Explain briefly process of synthesis of human insulin?

Ans. Two DNA sequences coding for A and B chains of human insulin and introduced it into the plasmids of *E.coli* to produce the chain A and chain B separately. The chains are extracted and combined by creating disulphide bonds to form human insulin.

6) Write a note on ethical issues.

Ans. Genetical modification of organism can have unpredictable results such organisms are introduced into the ecosystems. Hence the manipulation of living organisms by human race cannot go on any further without regulation. Therefore ethical standards are required to evaluate the mortality of all human activities that might help or harm living organism.

7)What is gene therapy? Illustrate using an example.

Ans : gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or embryo.

e.g., ADA deficiency

8) Write a note on patenting with special reference to rice.

Ans. In 1997 an American company got patent rights on basmati rice through the U.S. patent and trade mark office. This allowed the company to sell a new variety of basmati in U.S. and abroad. This new variety of basmati had actually been derived from Indian farmer's variety. The farmers had produced this variety by crossing semi-dwarf varieties. If we are not vigilant and if we do not immediately counter these patent applications other countries / individuals may encash on our rich legacy and we may not be able to do anything about it.

9) Give a brief note on Indian Patent Bill.

Ans. The Indian parliament has recently cleared the second amendment of the Indian Patent Bill in which patent terms, emergency provisions and research and development initiatives are added.

10) Write short notes on Indian Basmati.

Ans. The diversity of rice in India is one of the richest in the world. Basmati rice is distinct for its unique aroma and flavor and 27 documented varieties of Basmati are grown in India. There is a century old reference to Basmati in ancient texts, folklore and poetry.

FIVE MARKS QUESTIONS

1) Discuss the biotechnological applications in agriculture. With special reference to Bt-cotton. **Bt Cotton**

Bacillus thuringiensis is a bacterium that produces proteins to kill certain insects such as lepidopterans (armyworm), coleopterans (beetles), and dipterans (flies/ mosquitoes). *B. thuringiensis* produces a protein crystal containing a toxic protein (inactivated state).

Inactivated toxin Activated toxin (gut of insect)

Activated toxin binds to the epithelial cells in the midgut of insect and creates pores that cause lyses and swelling and eventually death of insect.

This toxin is encoded by a gene called **Cry** in the bacterium. Genes encoded by *Cry IAc* and *Cry II Ab* control cotton bollworms and those encoded by *Cry IAb* control corn borer. Cry genes are introduced into the cotton plants to produce *Bt* cotton, which is an insect resistant variety of cotton.

2) What is gene therapy ? Explain the steps involved in the process.

Gene therapy is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or an embryo.

The gene therapy is performed to cure ADA enzyme deficiency. This enzyme is crucial for the immune system to function. This disorder is caused due to the deletion of the gene for adenosine deaminase.

As a first step towards gene therapy, Lymphocytes from blood of the patient are cultured outside the body.

Second a functional ADA c DNA is introduced into these lymphocytes by using retrovirus as a vector, which are subsequently returned to the patient.

The patient requires periodic infusion of such genetically engineered lymphocytes. However, if the genes isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

3) Discuss briefly the process of production of Bt cotton .

Bt Cotton

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4) write short notes on concept of 'biopiracy'

Biopiracy

Use of bio-resources by MNCs and other organizations without proper authorization from countries and people concerned without compensatory payment

Industrialized and developed nations are economically rich, but poor in biodiversity while opposite prevails for developing nations. Therefore, developed countries exploit traditional knowledge and resources of poor countries for commercialization.

This is a matter of injustice since inadequate compensation and benefit sharing is given to poor countries in return. Therefore, steps should be taken by developing countries to prevent this exploitation.

The Indian parliament has recently introduced second amendment of Indian patents bill to deal with these issues.

5) Write short notes on Ethical issues.

Ans. Genetically modification of organism can have unpredictable results such organisms are introduced into the ecosystems. Hence the manipulation of living organisms by human race cannot go on any further without regulation. Therefore ethical standards are required to evaluate the mortality of all human activities that might help or harm living organism.

The genetic modifications of organisms can have unpredictable results when such organisms are introduced into the ecosystems. Therefore Indian government has setup an organization such as GEAC(Genetic Engineering Approval Committee).Which will make decisions regarding the validity of GM research and safety of introducing GM organism for public service.