



Biotechnology And Its Applications Important Questions With Answers

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1. Which Indian plants have either been patented or attempts have been made to patent them by western nations for their commercial use?

- a) Basmati rice b) Turmeric c) Neem **d) All of these have been targeted**

Solution : -

India is a country rich in tradition and expertise in natural medicines, spices, food preparations, biological pesticides and diverse agriculture. Through patenting without consent, foreign companies have collared at least 22 plants for their beneficial derivatives. Patents have been taken out on plants such as black pepper (*Piper nigrum*), basmati rice (*Oryza sativa*), indian mustard (*Brassica campestris*), pomegranate (*Punica granatum*), turmeric (*Curcuma domestica*) and neem (*Azadirachta indica*). US, Japanese and German companies are the principal patenting pirates.

2. CryIIAb and cryIAb produce toxins that control

- a) cotton bollworms and corn borer respectively** b) corn borer and cotton bollworms respectively
c) tobacco budworms and nematodes respectively d) nematodes and tobacco budworms respectively

3. The organisation which makes decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services is

- a) Genetic Engineering Approval Committee b) Genome Environment Action Committee
c) Genetic Environment Approval Committee d) Genetics and Ethical Issue Action Committee

Solution : -

Genetic modification of organisms can have unpredictable results when such organisms are introduced into the ecosystem. Therefore, the Indian Government has set up organisations such as GEAC (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public service.

4. Molecular probes are used for many genetic disorders like

- a) Duchenne muscular dystrophy b) cystic fibrosis c) Tay-Sachs disease **d) all of these**

5. Biopiracy means

- a) use of biopatents b) thefts of plants and animals c) stealing of bioresources
d) exploitation of bioresources without authentic permission

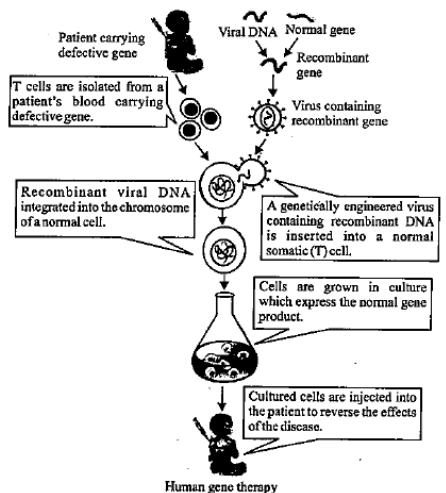
6. The two polypeptides of human insulin are linked together by :

- a) Phosphodiester bond b) Covalent bond **c) Disulphide bridges** d) Hydrogen bonds

Solution : -

Insulin consists of two short polypeptide chains: chain A and chain B, that are linked together by disulphide bridges.

7. Figure given below depict the procedure for gene therapy. Pick up the disorders for which this technique has been applied successfully.



- a) **Adenosine Deaminase (ADA) Deficiency** b) AIDS c) Myasthenia gravis d) Both (a) and (c)
8. Bt toxins are
- a) intracellular lipids **b) intracellular crystalline proteins** c) extracellular crystalline proteins
d) intracellular polysaccharides

9. How many recombinant therapeutics are being marketed in India?
a) 8 **b) 12** c) 15 d) 30

Solution : -

In India, 12 recombinant therapeutics are presently being marketed.

10. Which of the following is the nematode that attacks the roots of tobacco plants?
a) *Agrobacterium tumefaciens* b) *Rhizobium leguminosarum* **c) *Meloidogyne incognita***
d) *Taenia solium*
11. Though Green Revolution has been a resounding success in terms of agricultural production, yet it has failed in its overall social objectives because
- a) it has not succeeded in making India totally and permanently self-sufficient in food
b) use of agrochemicals becomes very expensive for Indian farmers as well as these have harmful effects on environment
c) in regional terms, only Punjab and Haryana states, and the eastern plains of river Ganges in West Bengal state, showed reasonably good results, but results were less impressive in other parts of India
d) all of these

Solution : -

The development of several high yielding varieties of wheat and rice in 1960 increased yields per unit area. This phase is often called the Green Revolution. However, for farmers in the developing world, agrochemicals are often too expensive, and further increase in yield with existing varieties are not possible using conventional breeding. Thus, it has not fully succeeded in making India totally self-sufficient in food with only some parts showing impressive results.

12. Given are names of some transgenic animals. Identify the name of transgenic sheep.
a) Rosie b) Dogie **c) Tracy** d) ANDI

Solution : -

In 1990, Tracy, the transgenic ewe was born in Scotland.

13. What is true about Bt toxin?

- a) Bt protein exists as active toxin in the Bacillus.
- b) The activated toxin enters the ovaries of the pest to sterilise it and thus prevent its multiplication.
- c) The concerned Bacillus has antitoxins.
- d) The inactive protoxin gets converted into active form in the insect gut.**

Solution : -

The inactive protoxin gets converted into active form in the insect gut. Bacillus thuringiensis toxin is an inactive protoxin which gets converted into active form in the insect gut in the presence of alkaline pH. It works as an insecticide.

14. Human insulin is being commercially produced from a transgenic species of

- a) Mycobacterium
- b) Rhizobium
- c) Saccharomyces
- d) Escherichia**

15. Which type of pH conditions are required for action by Bt toxin?

- a) 8.6**
- b) 1
- c) 7.0
- d) 6.8

16. A monopoly granted to a person who has either invented a new and useful article, made improvement in an existing article or invented a new process of making an article is called

- a) biopiracy
- b) bioethics
- c) patent**
- d) genetic modification

Solution : -

A patent is the right granted by government to an inventor to prevent others from commercial use of his invention. When patents are granted for biological entities and for products derived from them, these patents are called biopatents. Primarily, industrialised countries, like U.S.A., Japan and members of European Union, are awarding biopatents.

17. Choose the correct option regarding retrovirus.

- a) An RNA virus that can synthesise DNA during infection**
- b) A DNA virus that can synthesise RNA during infection
- c) A ssDNA virus
- d) A dsRNA virus

Solution : -

A retrovirus is an ss RNA virus that stores its nucleic acid in the form of a mRNA genome and targets a host cell as an obligate parasite. Once inside the host cell cytoplasm the virus uses its own reverse transcriptase enzyme to produce DNA from its RNA genome (the reverse of usual pattern, thus retro).

18. Which of the following agricultural challenges cannot be solved with transgenic techniques?

- a) Crops are damaged by frost or drought
- b) Crops are damaged by insect pests
- c) Public concern about safety of synthetic pesticides
- d) Public preference for organic vegetables**

19. Assertion: Bacillus anthracis exemplifies how biotechnology can be used for destructive processes.

Reason: The spores of anthrax bacterium were spread via letters in the form of powder.

- a) If both assertion and reason are true and reason is the correct explanation of assertion
- b) If both assertion and reason are true but reason is not the correct explanation of assertion**
- c) If assertion is true but reason is false
- d) If both assertion and reason are false

20. Tobacco plant resistant to a nematode have been developed by the introduction of DNA that produced in the host cells:

- a) Both sense and anti-sense RNA**
- b) A particular hormone
- c) An antifeedant
- d) A toxic protein

Solution : -

Using Agrobacterium vectors, nematode-specific genes were introduced into the host plant. The introduction of DNA was such that it produced both sense and anti-sense RNA in the host cells. These two RNAs being complementary to each other formed a double stranded (dsRNA) that initiated RNAi and thus, silenced the

specific mRNA of the nematode

21. Which of the following Bt crops is being grown in India by the farmers?

- a) **Cotton** b) Brinjal c) Soyabean d) Maize

Solution : -

Bt Cotton is grown in India by the farmers. Various types of Bt crops have been made by scientists like Bt Cotton, Bt corn, Soyabean, Rice, tomato, Potato etc. Bt. Crops are genetically modified crops in which genes of *Bacillus thuringiensis* (Rt) responsible for producing toxin proteins are introduced by rDNA technology.

22. Use of bioresources by multinational companies and organisations without authorisation from the concerned country and its people is called:

- a) Biodegradation b) **Biopiracy** c) Bio-infringement d) Bioexploitation

Solution : -

Fact.

23. Match the following columns and select the correct option.

| Column - I | Column - II |
|-------------------------|------------------------------------|
| (a) Bt cotton | (i) Gene therapy |
| (b) Adenosine deaminase | (ii) Cellular defence deficiency |
| (c) RNAi | (iii) Detection of HIV infection |
| (d) PCR | (iv) <i>Bacillus thuringiensis</i> |

Select the correct option.

- a) (ii) (iii) (iv) (i) b) (i) (ii) (iii) (iv) c) **(iv) (i) (ii) (iii)** d) (iii) (ii) (i) (iv)

Solution : -

(a) Bt toxin is produced by a bacterium called *Bacillus thuringiensis* (Bt for short). Bt toxin gene has been cloned from the bacteria and been expressed in plants to provide resistance to insects without the need for insecticides; in effect created a bio-pesticide. Examples are Bt cotton, Bt corn, rice, tomato, potato and soybean etc.

(b) The first clinical gene therapy was given in 1990 to a 4- year old girl with adenosine deaminase (ADA) deficiency.

(c) RNAi (RNA interference) is a biological process in which RNA molecules inhibit gene expression or translation, by neutralizing targeted rRNA molecules and takes place in all eukaryotic organisms as a method of cellular defense.

(d) Polymerase chain reaction can be used in detection of HIV infection as it defects the genetic materials of HIV i.e its RNA.

24. The crops engineered for glyphosate are resistant and tolerant to _____.

- a) Bacteria b) Insects c) **Herbicides** d) Fungi

Solution : -

The crops engineered for glyphosate are resistant and tolerant to herbicides. Glyphosate is a herbicides which is used to destroy weeds of broad leaves and grasses.

25. Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of _____.

- a) Vitamin C b) Omega 3 c) **Vitamin A** d) Vitamin B

Solution : -

Golden rice is genetically modified crop plant where the incorporated gene is meant for biosynthesis of Vitamin-A.

26. What is ANDI?

- a) Transgenic cow b) Transgenic dog c) Transgenic sheep d) **Transgenic monkey**

Solution : -

ANDI is the first transgenic monkey. It has been named ANDI, the acronym of "inserted DNA". In this DNA of a fluorescent jelly fish was introduced into an unfertilised egg of a Rhesus monkey in test tube.

27. In Bt Cotton, the Bt toxin present in plant tissue as protoxin is converted into active toxin due to:
- a) **Alkaline PH of the insect gut**
 - b) Acidic pH of the insect gut
 - c) Action of gut microorganism
 - d) Presence of conversion factors in insect gut

Solution : -

Bt toxin protein, an inactive pro toxins is converted into an active form once an insect ingests it. This is due to the alkaline pH of the gut.

28. During the processing of proinsulin into the mature insulin
- a) C-peptide is added to proinsulin
 - b) C-peptide is removed from proinsulin**
 - c) B-peptide is added to proinsulin
 - d) B-peptide is removed from proinsulin
29. Which of the following features of genetic code does allow bacteria to produce human insulin by recombinant DNA technology?
- a) Genetic code is redundant
 - b) Genetic code is nearly universal**
 - c) Genetic code is specific
 - d) Genetic code is not ambiguous

Solution : -

In recombinant DNA technology bacteria is able to produce human insulin because genetic code is nearly universal.

30. The first clinical gene therapy was given for treating:
- a) Diabetes mellitus
 - b) Chicken pox
 - c) Rheumatoid arthritis
 - d) Adenosine deaminase deficiency**

Solution : -

The first clinical gene therapy was given in 1990 to a 4-year old girl with adenosine deaminase deficiency (ADA).

31. Which of the following has been covered under the broad patent category?
- a) Triticum
 - b) Oryza**
 - c) Pisum sativum
 - d) Brassica
32. Bacillus thuringiensis forms protein crystals which contain insecticidal protein. This protein:
- a) Binds with epithelial cells of midgut of the insect pest ultimately killing it**
 - b) Is coded by several genes including the gene cry
 - c) Is activated by acid pH of the foregut of the insect pest
 - d) Does not kill the carrier bacterium, which is itself resistance to its toxin

Solution : -

Bt toxin protein exist as inactive protoxins but once an insect ingest the inactive toxin, it is converted into an active form of toxin due to the alkaline pH of the gut which solubilise the crystals. The activated toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis and eventually cause death of the insect.

33. There was great excitement around the world when the sheep 'Dolly' was cloned using a nucleus derived from an adult cell of its 'mother' which was then transplanted into an enucleated egg. There is also excitement when it is announced that genes causing human diseases, like muscular dystrophy, have been cloned. Which statement about these two examples of cloning is correct?
- a) They both involve cutting a piece of DNA from the genome
 - b) One involves the cloning of a nucleus and the other is the cloning of a piece of DNA
 - c) They both produce products genetically identical to the original donor of cellular material**
 - d) They raise no ethical questions

Solution : -

The sheep 'Dolly' was produced by transferring entire nucleus into an enucleated cell while cloning of genes like genes of muscular dystrophy involves cutting the DNA piece containing the particular gene and transferring it through a vector or through other methods into a host cell. Tools of recombinant DNA technology like restriction enzymes, etc., are not used in first experiment while they are essential for the second. In the first experiment, cells express all the genes of the donor while cells in the second experiment, express only the desirable gene that is transferred.

34. Select the correct statement regarding an improved variety of transgenic basmati rice i.e., golden rice
- It does not require the use of chemical fertilisers
 - It is completely resistant to all insect pests and diseases.
 - It gives high yield but no characteristic aroma
 - It gives high yield and is rich in vitamin A**
35. Which genes encode the protein to control bollworms infection in cotton plants?
- cry IIAb
 - cry IAc
 - Both (1) & (2)**
 - Cry IAb
36. Read the given statements and select the correct option.
- Statement 1: The transgenic food may cause toxicity and produce allergy in human beings.
- Statement 2: The bacteria present in alimentary canal of human beings may become resistant to the antibiotics by taking up the antibiotic resistant gene that is present in the GM food.
- Both statements 1 and 2 are correct**
 - Statement 1 is correct but statement 2 is incorrect
 - Statement 1 is incorrect but statement 2 is correct
 - Both statements 1 and 2 are incorrect
37. Assertion: The RNAi can be introduced in an organism by insertion of gene encoding complementary RNA only.
Reason: There are no methods by which in vitro synthesised complementary RNA can be inserted in an organism to induce RNAi (RNA interference).
- If both assertion and reason are true and reason is the correct explanation of assertion
 - If both assertion and reason are true but reason is not the correct explanation of assertion
 - If assertion is true but reason is false
 - If both assertion and reason are false**

Solution : -

RNAi (RNA interference) takes place in all eukaryotic organisms as a method of cellular defense. This method involves silencing of a specific mRNA due to a complementary dsRNA molecule that binds to and prevents translation of the mRNA. There are two methods to induce RNA interference in any organism. The complementary RNA can be synthesised in vitro and then annealed to produce dsRNA and inserted into cells or the cells are genetically modified to produce the two complementary RNA strands or duplex form in vivo by transcription. However, the first method i.e., insertion of in vitro synthesised complementary RNA inhibits target gene expression for only 4-6 days and their re-introduction is required. But the second method i.e., the DNA vector construct once transfected into the cells will keep on generating RNA interference and thereby, cause a permanent inhibition of the damage.

38. First genetically modified plant commercially released in India is
- golden rice
 - Flavr Savr
 - Bt brinjal
 - Bt cotton**

Solution : -

Bt cotton is the first genetically modified crop of India. This has been developed by MAHYCO (Maharashtra Hybrid Seeds Company) in collaboration with American company, Monsanto.

39. Match column I containing transgenic organisms with their specific characteristics in column II and select the correct option from the given codes.

| Column I | Column II |
|----------------|-----------------------------|
| A. Golden rice | (i) Protein - enriched milk |
| B. Bt cotton | (ii) Increased shelf life |

| | |
|---------------|------------------------------------|
| C. Flavr Savr | (iii) Enriched with vitamin A |
| D. Rosie cow | (iv) High yield and pest resistant |

- a) **A-(iii), B-(iv), C-(ii), D-(i)** b) A-(iii), B-(ii), C-(iv), D-(i) c) A-(ii), B-(iv), C-(iii), D-(i)
d) A-(i), B-(iv), C-(ii), D-(iii)

40. Maximum application of animal cell culture technology today is in the production of _____.

- a) edible proteins b) insulin c) interferons **d) vaccines**

Solution : -

Animal cell culture is culture of extracted animal cells in aseptic laboratory with environmental conditions same as in vivo. Cultured animal cells are used in the production of vaccines producing viruses. Vaccines for polio, rabies, chickenpox, measles and hepatitis B are produced using animal cell culture. Insulin production includes insertion of chemically synthesized A and B chain DNA sequences into plasmids followed by transformation of E. coli with plasmid carrying the gene. Replication of recombinant plasmid in E. coli produces insulin. Interferon is a carbohydrate-containing protein that is produced by fibroblasts and leukocytes in response to immune stimuli. It has antiviral and anticancer properties and is produced by transformation of E. coli with recombinant plasmid carrying the gene for interferon. Edible proteins are produced by molecular farming, i.e., transfer of genes of proteins to plants and animals for production of proteins.

41. Genetic engineering has been successfully used for producing _____.

- a) animals like bulls for farm work as they have super power.
b) transgenic mice for testing safety of polio vaccine before use in humans.
c) transgenic models for studying new treatments for certain cardiac diseases
d) transgenic cow - Rosie which produces high fat milk for making ghee.

Solution : -

Genetic engineering has been successfully used for producing transgenic mice for testing safety of polio vaccine before use in humans. Transgenic mice are used for testing toxicity of drugs. Transgenic animals carry genes which make them more sensitive to toxic substances than non-transgenic animals. Then, after altering their genetic material, they are exposed to the toxic substances and the effects are studied. In such animals, toxicity testing results are obtained in very less time.

42. What is true for monoclonal antibodies?

- a) These antibodies obtained from one parent and for one antigen.**
b) These antibodies obtained from parent and for two antigens.
c) These antibodies obtained from one parent and for many antigens.
d) These antibodies obtained from many parents and for many antigens.

Solution : -

Monoclonal antibodies are obtained by injecting the target antigen into a rat or mouse. Sometimes in the case of later, the spleen cells producing antibodies are isolated and fused with myeloma cells to produce monoclonal antibodies.

43. Which part of the tobacco plant is infected by *Meloidogyne incognita*

- a) Leaf b) Stem **c) Root** d) Flower

Solution : -

A nematode *Meloidogyne incognita* infects the roots of tobacco plants and causes a great reduction in yield

44. Which of the following statements is incorrect about gene therapy in ADA deficiency?

- a) Lymphocytes from patient's blood are taken out and cultured
b) A functional ADA-cDNA is introduced into these lymphocytes
c) Lymphocytes are then introduced in the body of patient
d) Patient does not require periodic infusion of genetically engineered lymphocyte

Solution : -

As a first step towards gene therapy, lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA-cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the body of the patient. However, as these cells are not immortal, the patient requires periodic infusion of such genetically engineered lymphocytes.

45. The most common substrate used in distilleries for the production of ethanol is _____.
a) corn meal b) soya meal c) ground gram **d) molasses**

Solution : -

The most common substrate used in distilleries for the production of ethanol is molasses. Molasses is a viscous product resulting from refining sugarcane or sugar beets into sugar.

46. Given below are certain features of mouse. Read them and select why mouse is the most preferred animal for studies on gene transfer.
(i) Short oestrous cycle and gestation period
(ii) Relatively short generation time
(iii) Convenient in vitro fertilisation
(iv) Production of several offspring per pregnancy.
a) (i) and (ii) only b) (i) only c) (i), (ii) and (iv) only **d) (i), (ii), (iii) and (iv)**

47. Which two of the above statements are correct?
a) 2 and 4 b) 3 and 4 c) 1 and 3 d) 1 and 2

48. Which of the following is not a benefit of transgenic animals?
a) Investigation of new treatments for diseases **b) Early detection of diseases**
c) Testing the safety of vaccines d) To produce useful biological products

Solution : -

Early diagnosis of a disease cannot be done by transgenic animals but through techniques such as PCR and ELISA.

49. 'Flavr Savr' variety of tomato which remains fresh for a longer period than normal tomato variety
a) has high amount of enzyme polygalacturonase **b) has reduced amount of enzyme polygalacturonase**
c) is a pest resistant variety d) is rich in vitamin A and prevents night blindness

Solution : -

The tomato variety 'Flavr Savr' presents an example where expression of a native tomato gene has been blocked. Fruit softening is promoted by the enzyme polygalacturonase, which degrades pectin. Production of polygalacturonase is blocked in the transgenic tomato variety 'Flavr Savr'. So, fruits of this tomato variety remain fresh and retain their flavour much longer than do the fruits of normal tomato varieties. Additionally, the fruits have a superior taste and increased total soluble solids.

50. Bt toxin gene has been cloned from the bacteria and expressed in plants to provide resistance to insects without the need for insecticides. Examples of such plants are
a) cotton and corn b) rice and potato c) tomato and soybean **d) all of these**