

BIOTECHNOLOGY – ITS APPLICATION

1. Which of the following is a desirable character of golden rice as a transgenic crop?

- (A) Insect resistance
- (B) High amino acid content
- (C) High protein content
- (D) High vitamin – A content

2. Read the given statements and select the correct option.

Statement 1: Ti plasmid obtained from *Agrobacterium tumefaciens* is effectively used as a vector for gene transfer in plant cells.

Statement 2: The part of Ti plasmid transferred into the DNA of plant cells is called as T-DNA.

- (A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
- (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is correct and statement 2 is incorrect.
- (D) Both statements 1 and 2 are incorrect.

3. Study the following statements and select the incorrect ones.

- (i) 'Bt' in 'Bt cotton' indicates that it is a genetically modified crop produced through biotechnology.

- (ii) The anticoagulant 'hirudin' is being produced from transgenic *Brassica napus* seeds.
- (iii) 'Flavr Savr' transgenic tomatoes remain fresh for a longer period than the normal tomato variety.
- (iv) Golden rice is a transgenic variety of *Oryza sativa*, which is rich in β -carotene and helps to prevent night blindness.

- (A) (i) only
- (B) (i) and (iv)
- (C) (ii) and (iii)
- (D) (i), (ii), (iii) and (iv)

4. Which of the following statements are correct regarding the process of RNA interference?

- (i) This is used to prevent the infestation of protozoans.
- (ii) It takes place in some eukaryotic and all prokaryotic organisms as a method of cellular defense.
- (iii) The method involves silencing of a specific mRNA due to a complementary dsRNA molecule.
- (iv) It is a novel strategy to produce pest-resistant plants.

- (A) (iii) and (iv)
- (B) (i) and (iii)
- (C) (i) and (ii)
- (D) (ii), (iii) and (iv)

5. The genes encoding resistance to antibiotics are considered:

- (A) As selectable markers
- (B) As replication ori
- (C) As vectors
- (D) As plasmids

6. Which of the following genes were introduced in cotton to protect it from cotton bollworms?
- (A) *Cry* Ac and *Cry* Ab (B) *Bt* Ac and *Bt* Ab
(C) *Cry* IAc and *Cry* II Ab (D) *Nif* genes
7. Which is NOT a biotechnological application of food production?
- (A) Apiculture
(B) Agro-chemical based agriculture
(C) Organic farming
(D) Genetically engineered crop-based agriculture
8. Agro-chemical based agriculture includes ___
- (A) Fertilizers (B) pesticides
(C) Genetically modified crops (D) Both A and B
9. Bt toxin genes have been expressed in plants in order to provide resistance against
- (i) lepidopterans and fungi
(ii) animals and bacteria
(iii) bacteria and fungi
(iv) coleopternas and dipterans
(v) lepidopterans
- (A) (ii) and (iii) (B) (i), (ii) and (iv)
(C) (iii) and (v) (D) (iv) and (v)

10. Which organism secretes cry proteins?
- (A) *Bacillus thuringiensis*
 - (B) *Meloidogyne incognita*
 - (C) *Agrobacterium tumefaciens*
 - (D) *Penicillium expansum*
11. Bt corn has been made resistant from corn borer disease by introduction of the gene
- (A) *Cry I Ab*
 - (B) *Cry II Ab*
 - (C) *ampR*
 - (D) *Trp.*
12. Read the given statements and select the correct option.
- Statement 1: The transgenic food may cause toxicity and product allergy in human beings.
- Statement 2: The bacteria present in alimentary canal of human beings may become resistant gene that is present in the GM food.
- (A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
 - (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
 - (C) Statement 1 is correct and statement 2 is incorrect.
 - (D) Both statements 1 and 2 are incorrect.
13. Read the given statements and select the correct option.

Statement 1: Foods derived from transgenic crops are called as GM foods.

Statement 2: Health and food safety concerns have been raised to ensure the safety of GM foods.

(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.

(B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.

(C) Statement 1 is correct and statement 2 is incorrect.

(D) Both statements 1 and 2 are incorrect.

14. 'Nif' gene for nitrogen fixation in cereal crops like wheat, jowar etc. is introduced by cloning

(A) *Rhizobium meliloti*

(B) *Bacillus thuringiensis*

(C) *Rhizopus stolonifer*

(D) *Agrobacterium tumefaciens*

15. Read the given statements and select the correct option.

Statement 1: GMO tomato 'Flavr Savr' has increased shelf life and better nutrient quality.

Statement 2: This is achieved by reducing the amount of cell wall degrading enzyme 'polygalacturonase' responsible for fruit softening.

(A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.

- (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is correct and statement 2 is incorrect.
- (D) Both statements 1 and 2 are incorrect.
16. Hirudin is
- (A) a protein produced by *Hordeum vulgare*, which is rich in lysine.
- (B) a toxic molecule isolated from *Gossypium hirsutum*, which reduces human fertility.
- (C) a protein produced from transgenic *Brassica napus* which prevents blood clotting.
- (D) an antibiotic produced by a genetically engineered bacterium *Escherichia coli*.
17. 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*
18. *Cry II Ab* and *Cry I Ab* 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.

19. First genetically modified plant commercially released in India is

(A) golden rice

(B) flavr savr

(C) Bt-brinjal

(D) Bt-cotton

20. Study the following statements regarding organic farming and select the correct ones.

(i) It utilizes genetically modified crops like Bt cotton.

(ii) It uses only naturally produced inputs like compost and biofertilizers.

(iii) It does not use pesticides and urea.

(iv) It produce vegetables rich in vitamins and minerals.

(A) (i) and (ii)

(B) (iii) and (iv)

(C) (ii) and (iii)

(D) (ii), (iii) and (iv)

21. The Bt toxin is not toxic to human beings because

(A) the pro Bt toxin activation requires temperature above human body temperature.

(B) the Bt toxin recognizes only insect-specific targets.

(C) the pro Bt toxin activation requires pH lower than that present in human stomach.

(D) conversion of pro Bt toxin to Bt toxin takes place in highly alkaline conditions.

22. Which of the following statements regarding the structure of proinsulin and mature insulin are not correct?

(i) Proinsulin is made up of three polypeptide chains – A, B and C.

(ii) C – polypeptide chain with 33 amino acids is removed prior to insulin formation.

(iii) Mature insulin is made up of 51 amino acids arranged in two polypeptide chains – A and B.

(iv) Polypeptide chain A has 30 amino acids and polypeptide chain B has 21 amino acids.

(v) Polypeptide chains A and B are interconnected by only one S – S linkage.

(A) (i) and (ii)

(B) (iii) and (iv)

(C) (iv) and (v)

(D) (iii), (iv) and (v)

23. Which of the following statements regarding gene therapy is/are correct?

(A) It is an application of biotechnology, in which a defective gene is manipulated by introduction of a normal, healthy and functional gene.

(B) The genetic disorders that are being investigated for gene therapy, range from sickle-cell anaemia to severe combined immune-deficiency (SCID).

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

(D) All of these

24. Read the given statements and select the correct option.

Statement 1: In recombinant DNA technology, human genes are often transferred into bacteria (prokaryotes) or yeast (eukaryotes).

Statement 2: Both bacteria and yeast multiply very fast to form huge populations which express the desired gene.

- (A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
- (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is correct and statement 2 is incorrect.
- (D) Both statements 1 and 2 are incorrect.

25. Read the given statements and select the correct option.

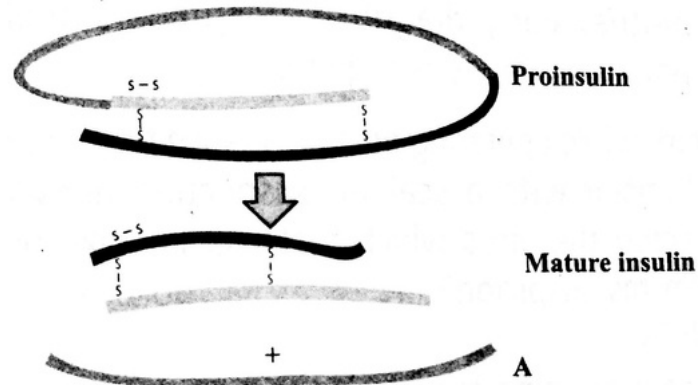
Statement 1: PCR technique is helpful in detecting bacterial and viral diseases even when symptoms of the disease are not yet visible.

Statement 2: Very log concentrations of bacteria or viruses in human body can be detected by amplification of their nucleic acids using the PCR technique.

- (A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
- (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is correct and statement 2 is incorrect.

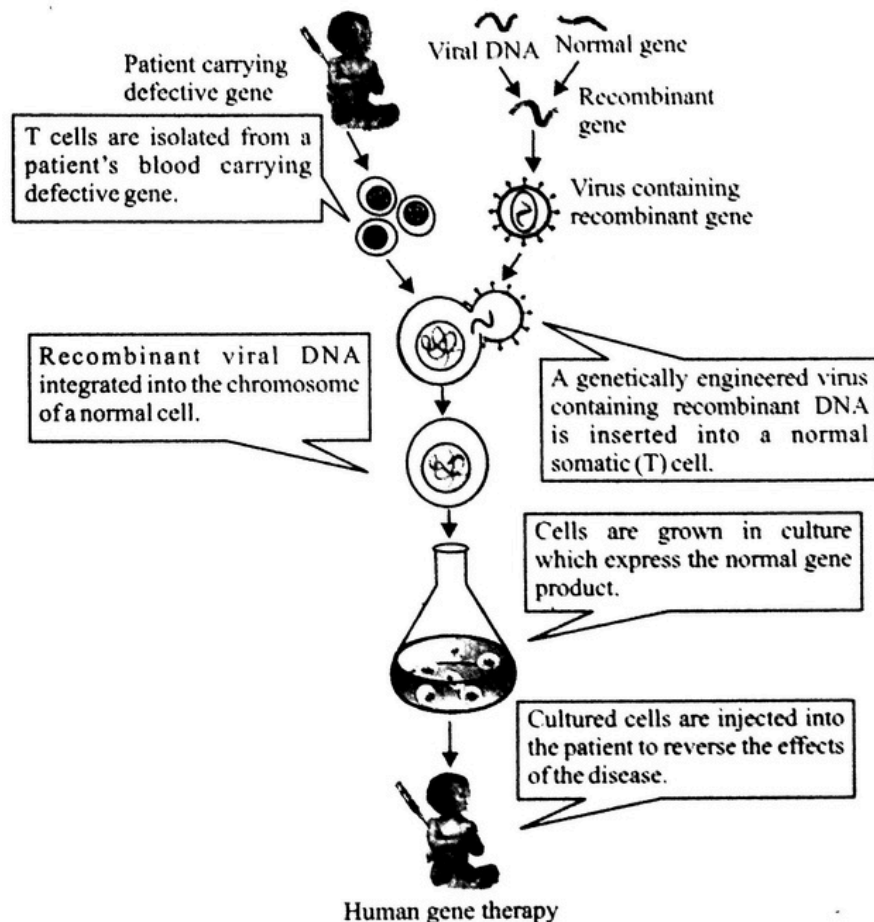
(D) Both statements 1 and 2 are incorrect.

26. Give figure represents the maturation of pro-insulin into insulin. Identify the product A.



- (A) Polypeptide chain A
(B) Polypeptide chain B
(C) Polypeptide chain C
(D) Both B and C
27. Which of the following statements is not correct?
- (A) Insulin used for diabetic patients was earlier extracted from pancreas of slaughtered cattle and pigs which was more efficient than the genetically engineered insulin.
(B) PCR technique is applied to detect HIV in suspected AIDS patients and to detect mutations in genes in suspected cancer patients.
(C) Bone marrow transplantation requires periodic infusion of genetically engineered lymphocytes in ADA deficient patients.
(D) Bioremediation is the one of the applications of biotechnology.

28. 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

29. Some of the steps involved in the production of humulin are given below. Arrange them in the correct sequence and select the correct option.

(i) Synthesis of gene (DNA) for human insulin artificially. (ii) Culturing recombinant *E.coli* in bioreactors. (iii) Purification of humulin. (iv) Insertion of human insulin gene into plasmid. (v) Introduction of recombinant plasmid into *E.coli*. (vi) Extraction of recombinant gene production from *E.coli*. (vii) Extraction of recombinant gene product from *E.coli*. (A) (ii), (i), (iv), (iii), (v), (vi) (B) (i), (iii), (v), (vi), (ii), (iv) (C) (i), (iv), (v), (ii), (vi), (iii) (D) (iii), (v), (ii), (i), (vi), (iv)

30. Study the following steps which are followed during the process of gene therapy while treating a patient of SCID.

- (i) Retrovirus infects lymphocytes extracted from bone marrow of the patient and cultured.
- (ii) Engineered cells are injected into patient's bone marrow.
- (iii) Normal allele is inserted into a retrovirus.
- (iv) Retrovirus makes a DNA copy of its RNA. This DNA carrying the normal allele gets inserted into the chromosome of the host cell.

Arrange the above given steps in correct sequence and select the correct answer.

- (A) (iii), (i), (ii), (iv) (C) (B) (iii), (i), (iv), (ii) (D)
 (iv), (ii), (iii), (i) (iv), (iii), (i), (ii)

31. A doctor while operating on an HIV (+) ve patient accidentally cuts himself with scalpel. Suspecting himself to have contracted the virus which test will he take to rule out/confirm his suspicion?

- (A) PCR (B) Routine urine examination
(C) TLC (D) DLC

32. Animals that have had their DNA manipulated to possess and express a foreign gene are called

- (A) transgenic animals (B) somatic hybrids
(C) somaclones (D) super animals.

33. 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

34. Match Column-I with Column-II and select the correct answer from the codes given below:

Column I		Column II	
A.	α -1-antitrypsin	(i)	AIDS
B.	Transposon	(ii)	Gene therapy
C.	ELISA	(iii)	Emphysema
D.	Retroviral vector	(iv)	Mobile genetic element

- (A) A-(i), B-(iii), C-(ii), D-(iv)
 (B) A-(iii), B-(iv), C-(i), D-(ii)
 (C) A-(i), B-(ii), C-(iii), D-(iv)
 (D) A-(iii), B-(i), C-(ii), D-(iv)

35. Match Column-I containing transgenic organisms with their specific characteristics in Column-II and select the correct answer from codes given below.

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)

36. Read the given statements and select the correct option.

Statement 1: Transgenic mouse is termed as 'super mouse' because it is twice big in size than the normal mouse.

Statement 2: In 'super mouse', the gene for human growth factor has been introduced and expressed.

- (A) Both statements 1 and 2 are correct and statement 2 is the correct explanation of statement 1.
- (B) Both statements 1 and 2 are correct but statement 2 is not the correct explanation of statement 1.
- (C) Statement 1 is correct and statement 2 is incorrect.
- (D) Both statements 1 and 2 are incorrect.

37. Match Column-I with Column-II and select the correct answer from the codes given below.

Column I	Column II
----------	-----------

A. Biopiracy (i)		Effort to fix the non-functional
B. Biopatent (ii)	Gene silencing	
C. Gene therapy	(iii)	Illegal removal of biological materials
D. RNAi	(iv)	Right granted for biological entities

- (A) A-(iv), B-(ii), C-(i), D-(iii)
 (B) A-(ii), B-(iv), C-(i), D-(iii)
 (C) A-(iii), B-(iv), C-(i), D-(ii)
 (D) A-(iii), B-(iv), C-(ii), D-(i)

38. Rules of conduct that may be used to regulate our activities in relation to the biological world is called

- (A) bioethics (B) biowar
 (C) biopatent (D) biopiracy

39. Biopatents are

- (i) right to use invention.
 (ii) right to use biological entities.
 (iii) right to use products.
 (iv) right to use process.
 (A) (i) and (ii) (B) (ii) only
 (C) (i), (ii) and (iv) (D) (i), (ii), (iii) and (iv)

40. X is the right granted by a government to an inventor to prevent others from commercial use of his invention. When 'X' are granted for biological entities and for products derived from them, these are called Y. Read the above paragraph and identify X and Y. (A) X – patent, Y – biopatent (B) X – piracy, Y – biopiracy (C) X – patent, Y – biopiracy (D) X – piracy, Y – biopatent
41. Which of the following has been covered under the board patent category?
(A) *Triticum* (B) *Oryza*
(C) *Pisum sativum* (D) *Brassica*
42. Which of the following statements is correct?
(A) The current interest in the manipulation of microbes, plants and animals has raised serious ethical issues.
(B) One possible risk of genetic engineering is the accidental production of antibiotic resistant microorganisms.
(C) Although risks are possible, genetic engineering offers more of a contribution to human welfare than threats.
(D) All of these

43. Which variety of rice was patented by a U.S. company even though the highest number of varieties of this rice are found in India?
- (A) Sharbati Sonara (B) Co-667
 (C) Basmati (D) Lerma Rojo
44. The site of production of ADA in the body is
- (A) erythrocytes (B) lymphocytes
 (C) blood plasma (D) osteocytes
45. Pathophysiology is the
- (A) study of physiology of pathogen
 (B) study of normal physiology of host
 (C) study of altered physiology of host
 (D) none of the above

ANSWERS

1. D 2. B 3. A 4. A 11. A 5. A 6. C 7. A 8. D 9. D 10. A
 12. B 13. B 14. A 21. D 22. A 15. A 16. C 17. C 18. A 19. D 20. C
 C 23. D 24. A 31. A 32. A 25. A 26. C 27. A 28. A 29. C 30. B
 33. B 34. B 41. B 42. D 43. A 35. A 36. A 37. C 38. A 39. D 40. A
 C 44. B 45. C

SOLUTIONS

1. Transgenic golden rice produced through genetic engineering biosynthesize beta-carotene, a precursor of

- vitamin A, in the edible parts of rice. Hence, golden rice is rich in vitamin A content. Bt in Bt cotton stands for *Bacillus thuringiensis*. In genetic engineering, the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline or kanamycin, etc., are considered useful selectable markers for *E. coli*.
- 3.
 - 5.
 6. Two cry genes, cry IAc and cry IIAb have been incorporated in cotton. The genetically modified crop is called Bt cotton as it contains Bt toxin genes. The genes cry I Ac and cry II Ab control cotton bollworms.
 7. Rearing of honey bees for obtaining honey and bee wax is called apiculture. It is not biotechnological application.
 8. Agro-chemical based agriculture, in which chemical products are used such as fertilizers and pesticides, is used to increase the food production.
 10. The *Cry* proteins are toxic proteins secreted by *Bacillus thuringiensis* in crystal form during a particular phase of their growth.
 11. Cry I Ab has been introduced in Bt corn to protect it from corn borer.
 16. Hirudin is a protein that stops blood clotting. The gene encoding hirudin was chemically synthesized. This gene was then transferred into *Brassica napus*, where hirudin

accumulates in seeds. The hirudin is purified and used as medicine.

19. The Government has agreed to allow cultivation of genetically modified Bt Cotton. Bt cotton farming has shown good results in Malwa region in Punjab.
20. In organic farming, farmers use manures, biofertilizers, biopesticides and biocontrol agents to increase crop production instead of using artificial fertilizers and pesticides. It does not utilise genetic engineering.
21. Conversion of pro Bt toxin to Bt toxin takes place in highly alkaline conditions which are not present in human stomach. Human stomach is acidic in nature.
25. The technique of polymerase chain reaction (PCR) has been applied to detect HIV in suspected AIDS patients and to detect mutations in genes in suspected cancer patients.
26. A represents polypeptide chain C which is removed prior to insulin formation.
31. Very low count of bacteria or viruses (when the symptoms of the disease are not yet visible) can be detected by multiplication of their nucleic acid by PCR, (PCR can detect very low amounts of DNA). PCR is usually used to detect HIV in suspected AIDS patients.
32. The animals which carry foreign genes are called transgenic animals. The foreign genes inserted into the genome of the animal using recombinant DNA technology are called transgenes.

33. Early diagnosis of disease cannot be done by transgenic animals but through techniques such as PCR and ELISA.
38. Bioethics may be viewed as the set of standards that may be used to regulate various activities based on their effects on the biological world. This is because biotechnology has aroused social as well as political concerns, which have ranged from biotechnology being unnatural to detrimental to biodiversity.
44. Lymphocytes are a kind of white blood cells present in bone marrow. ADA (adenosine deaminase) is an enzyme that is present in lymphocytes and is very important for the immune system to function.
45. Pathophysiology means the functional changes associated with or resulting from a disease or injury or the functional changes associated with a disease or syndrome.