

# Biotechnology and its Applications

## FACT/DEFINITION TYPE QUESTIONS

- Consumption of which one of the following foods can prevent the kind of blindness associated with vitamin 'A' deficiency?  
(a) 'Flavr Savr' tomato (b) Canolla  
(c) Golden rice (d) *Bt*-Brinjal
- Bacillus thuringiensis* (*Bt*) strains have been used for designing novel  
(a) bio-fertilizers  
(b) bio-metallurgical techniques  
(c) bio-mineralization processes  
(d) bio-insecticidal plants
- The genetically-modified (GM) brinjal in India has been developed for  
(a) insect-resistance  
(b) enhancing shelf life  
(c) enhancing mineral content  
(d) drought-resistance
- Bt* toxin kill the larvae of certain insects  
(a) by binding of activated toxin on mid gut epithelial cells, creating pores, leading to swelling and lysis.  
(b) by stopping transcription of larval cells.  
(c) by altering central dogma taking place in the cells of gut of larva.  
(d) by stopping protein synthesis.
- Cry* protein is obtained from  
(a) *Bacillus thuringiensis*  
(b) *Bacillus subtilis*  
(c) *Clostridium welchi*  
(d) *E. coli*
- Cry*-genes have been introduced in  
(a) cotton and corn (b) rice  
(c) potato and soyabean (d) all of the above
- Bt* toxin is harmful to insects like  
(a) lepidoterans (tobacco budworm, armyworms)  
(b) coleopterans (beetles)  
(c) dipterans (flies and mosquito)  
(d) all of the above
- RNA interference (RNAi) technique has been devised to protect the plants from nematode is silenced by \_\_\_\_\_ produced by the host plant.  
(a) dsDNA (b) ssDNA  
(c) dsRNA (d) target proteins
- Tobacco plants 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.
- C-peptide of human insulin is  
(a) a part of mature insulin molecule.  
(b) responsible for formation of disulphide bridges.  
(c) removed during maturation of pro-insulin to insulin.  
(d) responsible for its biological activity.
- The first human drug made using recombinant DNA technology was  
(a) glyphosatase (b) TPA  
(c) insulin (d) erythropoietin
- E. coli* are used in production of  
(a) rifampicin (b) LH  
(c) ecdysone (d) interferon
- The first clinical gene therapy was given in 1990 to a 4 years old girl with enzyme deficiency of  
(a) adenosine deaminase (ADA)  
(b) tyrosine oxidase  
(c) monamine oxidase  
(d) glutamate dehydrogenase

14. In some children, ADA deficiency can be cured by
  - (a) bone marrow transplantation
  - (b) enzyme replacement therapy
  - (c) both (a) and (b)
  - (d) none of the above
15. The site of production of ADA in the body is
  - (a) bone marrow
  - (b) lymphocytes
  - (c) blood plasma
  - (d) monocytes
16. Genes of interest can be selected from a genomic library by using
  - (a) restriction enzymes
  - (b) cloning vectors
  - (c) DNA probes
  - (d) gene targets
17. DNA or RNA segment tagged with a radioactive molecule is called \_\_\_\_\_.
  - (a) vector
  - (b) probe
  - (c) clone
  - (d) plasmid
18. The transgenic animals are those which have
  - (a) foreign DNA in some cells.
  - (b) foreign DNA in all of their cells.
  - (c) foreign RNA in all of their cells.
  - (d) both (a) and (c)
19. Today, transgenic models exist for many human diseases which includes
  - (i) Cancer
  - (ii) Cystic fibrosis
  - (iii) Rheumatoid arthritis
  - (iv) Alzheimer's disease
  - (a) (i) and (iii) only
  - (b) (ii) and (iii) only
  - (c) (i), (ii) and (iii) only
  - (d) all of these
20. The protein  $\alpha$ -1 antitrypsin is used to treat the
  - (a) cancer
  - (b) rheumatoid arthritis
  - (c) Alzheimer's disease
  - (d) emphysema
21. Maximum number of existing transgenic animals is of
  - (a) fish
  - (b) mice
  - (c) cow
  - (d) pig
22. GEAC stands for
  - (a) Genome Engineering Action Committee
  - (b) Ground Environment Action Committee
  - (c) Genetic Engineering Approval Committee
  - (d) Genetic and Environment Approval Committee
23. How many varieties of rice has been estimated to be present in India?
  - (a) 2,000
  - (b) 20,000
  - (c) 200,000
  - (d) 2,000,000
24. Which variety of rice was patented by a U.S. company even though the highest number of varieties of this rice is found in India ?
  - (a) Sharbati Sonara
  - (b) Co-667
  - (c) Basmati
  - (d) Lerma Roja
25. Biopiracy is related to
  - (a) bioresearches
  - (b) traditional knowledge
  - (c) biomolecules and genes discovered
  - (d) all of the above
26. The use of bioresources by multinational companies and other organizations without proper authorisation from the countries and people concerned without compensatory payment is called
  - (a) bioethics
  - (b) biopiracy
  - (c) bioterror
  - (d) bioweapon
27. Which step of Government of India has taken to cater requirement of patent terms and other emergency provisions in this regard ?
  - (a) Biopiracy act
  - (b) Indian patents bill
  - (c) RTI act
  - (d) Negotiable instruments act

### STATEMENT TYPE QUESTIONS

28. Which of the following statement is correct about *Bt* toxin ?
  - (a) *Bt* protein exists as active toxin in the *Bacillus*.
  - (b) The activated toxin enters the ovaries of the pest to sterilize 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.
29. Find out the incorrect statement.
  - (a) Human protein used to treat emphysema is  $\alpha$ -1 antitrypsin.
  - (b) Human insulin is being commercially produced from a transgenic species of *Agrobacterium tumefaciens*.
  - (c) Rosie, the first transgenic cow, produced human protein enriched milk.
  - (d) *Cry I Ab* endotoxins obtained from *Bacillus thuringiensis* is effective against corn borers.
30. Which one of the following statement(s) is/are correct about Genetic Engineering Approval committee (GEAC) ?
  - (a) It will make decision regarding the validity of GM research.
  - (b) It will make the safety of introducing GM - organism for public services.
  - (c) Its genetic modification of organism can have unpredictable results when such organisms are introduced into the ecosystem. Therefore, the Indian government has set up organisation such as GEAC.
  - (d) All of the above

31. Which one of the following statement is correct?
- The proteins encoded by the genes *cry I Ac* and *cry II Ab* control cotton bollworms.
  - Protein encoded by *cry I Ab* controls corn borer.
  - Both (a) and (b)
  - Proteins encoded by *cry I Ac* and *cry I Ab* control flies.
32. Which of the following is a correct statement?
- "*Bt*" in *Bt*-cotton indicates that it is genetically modified organism produced through biotechnology.
  - Somatic hybridization involves fusion of two complete plant cells carrying desired genes.
  - The anticoagulant hirudin is being produced from transgenic *Brassica napus* seeds.
  - "*Flavr Savr*" variety of tomato has enriched the production of ethylene which improves its taste.
33. Which of the following statement(s) is/are correct?
- The procedure for chemical safety testing / toxicity is the same as that used for testing toxicity of drugs.
  - Transgenic animals are more sensitive to the toxic substances than non-transgenic animals.
  - Golden rice, a genetically engineered rice has high vitamin A (retinol) content.
  - All of the above
34. Which of the following statements is correct?
- The current interest in the manipulation of microbes, plants and animal has raised serious ethical issues.
  - One possible risk of genetic engineering is the accidental production of dangerously resistant microorganisms.
  - Although risks are possible, genetic engineering appears to offer more of contribution to human welfare than threats.
  - All of the above
35. Select the correct statement.
- Genetic engineering works only on animals and has not yet been successfully used on plants.
  - There are no risks associated with DNA technology.
  - The first step in PCR is heat which is used to separate both the strands of target DNA.
  - DNA from one organism will not bond to DNA from another animal.
36. Which of the following statements (i - v) is/are incorrect ?
- Recombinant DNA technology is used to improve crop plants by increasing their productivity, by making them more nutritious and by developing disease resistant.
  - Bt* cotton is resistant to bollworm infestation.
  - Bacillus thuringiensis* can form cry protein during any phase of their growth.
  - Bacillus thuringiensis* is not harmed by self cry protein because of its occurrence as protoxin (inactive).
  - Protoxin cry protein is changed into active cry protein in the stomach of insects due to alkaline pH in stomach.
- Only (iii)
  - (i) and (iv)
  - All of these
  - None of these
37. Read the following four statements (i-iv) and answer the question ?
- The first transgenic buffalo, Rosie produced milk which was human alpha-lactal albumin enriched.
  - Restriction enzymes are used in isolation of DNA from other macro-molecules.
  - Downstream processing is one of the steps of R-DNA technology.
  - Disarmed pathogen vectors are also used in transfer of R-DNA into the host.
- Which are the two statements having mistakes?
- (ii) and (iii)
  - (iii) and (iv)
  - (i) and (iii)
  - (i) and (ii)
38. Read the following statements and choose the correct statements.
- Gene therapy has been tested on a large number of patients with a wider variety of inherited genetic disorders, and in numerous cases it has produced a complete cure.
  - Genetic engineering has been used to produce insulin for curing the diabetes.
  - DNA hybridization is the base pairing of DNA from two different sources.
  - Genetic engineering is a technique of plant breeding.
- (i) and (ii)
  - (ii) and (iii)
  - (i), (ii) and (iii)
  - All of these
39. Which of the following statement(s) is/are incorrect?
- Insulin was originally extracted from pancreas of slaughtered pigs and cattle.
  - Animal insulin is difficult to obtain.
  - Animal insulin is identical to human insulin.
  - Non-human insulin caused some patients to develop allergy.
  - Recombinant insulin is actually obtained from *E. coli* in bacterial cell.
- Only (i) and (ii)
  - Only (iii) and (iv)
  - Only (iii)
  - Only (v)

40. Transgenic animals are produced
- to study how genes are regulated and how they affect the normal functions of body and its development.
  - to study diseases.
  - to obtain useful biological products .
  - to test vaccine safety and chemical safety.
- (a) (i), (ii), (iii) and (iv)      (b) (i) and (iv)  
(c) (ii) and (iv)                      (d) Only (i)
41. When a patient with defective ADA was treated, which of the following steps was performed for gene therapy?
- Lymphocytes were obtained from the patients.
  - Lymphocytes are transferred to culture dishes.
  - Lymphocytes were transfected with normal ADA genes.
  - The transfected cells are returned to the patients.
- (a) All of these                      (b) (iii) and (iv)  
(c) Only (iv)                        (d) SCID cannot be treated
42. The given statements are the steps in one type of gene therapy.
- Inject engineered cells into patients bone marrow.
  - Viral DNA carrying the normal allele inserts into chromosome.
  - Let retrovirus infect bone marrow cells that have removed from patient and cultured.
  - Insert RNA version of normal allele into retrovirus.
- The correct sequence is
- (a) (i), (ii), (iii) and (iv)      (b) (iv), (iii), (ii) and (i)  
(c) (i), (ii), (iv) and (iii)      (d) (iv), (iii), (i) and (ii)

### ASSERTION/REASON TYPE QUESTIONS

In the following questions, a statement of Assertion is followed by a statement of Reason.

- (a) If both Assertion and Reason are true and the Reason is the correct explanation of the Assertion.  
(b) If both Assertion and Reason are true but the Reason is not the correct explanation of the Assertion.  
(c) If Assertion is true but Reason is false.  
(d) If both Assertion and Reason are false.
43. **Assertion** : Blood clotting is prevented by Hirudin protein.  
**Reason** : The gene encoding for the Hirudin protein is transferred into *Brassica napus*, where accumulation of hirudin occurs in the seeds.
44. **Assertion** : An application of tissue culture is the production of transgenic plants.  
**Reason** : A transgenic organism is one that contains and expresses a transgene.
45. **Assertion** : *Flavr Savr* tomato is transgenic tomato that is capable of remaining fresh and retaining the flavour for a longer time.

**Reason** : In this, production of pectin degrading Polygalactouronase is blocked.

46. **Assertion** : ELISA is based on the principle of antigen antibody interaction.  
**Reason** : Pathogen infection is usually detected by presence of antigens or detection of antibodies synthesized against the pathogen.
47. **Assertion** : The GEAC (Genetic Engineering Approval Committee) has been set up by the Indian Government.  
**Reason** : Introduction of GMO could have unpredictable result in the ecosystem.

### MATCHING TYPE QUESTIONS

48. Match the following and choose the correct combination from the options given below :

#### Column - I

- A. *Escherichia coli*  
B. *Bacillus thuringiensis*  
C. *Rhizobium meliloti*  
D. *Agrobacterium tumefaciens*  
(a) A – II; B – I; C – (IV); D – III  
(b) A – II; B – I; C – (III); D – IV  
(c) A – II; B – III; C – I; D – IV  
(d) A – IV; B – I; C – II; D – III

#### Column - II

- I. *nif* gene  
II. Interferon  
III. *Bt* toxin  
IV. Vector

49. Match the items given in column - I with those in column - II and choose the correct option.

#### Column - I

- A. GMO  
B. Flavr - Savr tomato  
C. Biopiracy  
D. *E.coli*  
(a) A – III; B – I; C – II; D – IV  
(b) A – II; B – I; C – III; D – IV  
(c) A – II; B – III; C – I; D – IV  
(d) A – IV; B – I; C – II; D – III

#### Column - II

- I. Increased shelf life  
II. Bioresources  
III. rDNA  
IV. Insulin

50. Match column-I with column-II and identify the correct option.

#### Column - I

- A. Gene therapy  
B. Biofertilizer  
C. *Bt* cotton  
D. Humulin  
(a) A – II; B – I; C – IV; D – III  
(b) A – III; B – I; C – II; D – IV  
(c) A – II; B – III; C – I; D – IV  
(d) A – IV; B – I; C – II; D – III

#### Column - II

- I. *Rhizobium*  
II. *Cry* gene  
III. SCID  
IV. Diabetes

51. Match column-I with column-II and choose the correct option.

#### Column - I

- A. Golden Rice  
B. *Bt* toxin  
C. RNAi  
D. Rosie

#### Column - II

- I. *Cry* protein  
II. Rich in vitamin A  
III. First transgenic cow  
IV. Gene silencing

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- (a) A – II; B – I; C – IV; D – III  
 (b) A – II; B – I; C – III; D – IV  
 (c) A – II; B – III; C – I; D – IV  
 (d) A – IV; B – I; C – II; D – III

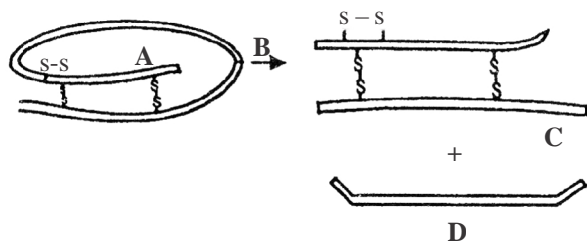
52. Match column-I with column-II and choose the correct option.

Column - I	Column - II
A. Forensic science	I. AIDS
B. ELISA	II. Radioactive DNA/RNA
C. Probe	III. Emphysema
D. $\alpha$ -1-antitrypsin	IV. DNA fingerprinting

(a) A – II; B – I; C – IV; D – III  
 (b) A – II; B – I; C – III; D – IV  
 (c) A – II; B – III; C – I; D – IV  
 (d) A – IV; B – I; C – II; D – III

## DIAGRAM TYPE QUESTIONS

53. Which of the following is the correct set of the labels A, B, C and D in the given figure of maturation of pro-insulin into insulin ?



A	B	C	D
(a) Proinsulin	cell peptidases	Insulin	Free C-Peptide
(b) Insulin	cell peptidases	Free C-Peptide	Proinsulin
(c) Insulin	Free C-Peptide	cell peptidases	Proinsulin
(d) Insulin	Proinsulin	Free C-Peptide	cell peptidases

## CRITICAL THINKING TYPE QUESTIONS

54. Transgenic plants are the ones  
 (a) generated by introducing foreign DNA into a cell and regenerating a plant from that cell.  
 (b) produced after protoplast fusion in artificial medium.  
 (c) grown in artificial medium after hybridization in the field.  
 (d) produced by a somatic embryo in artificial medium.
55. Transgenic animals has been successfully used for producing  
 (a) transgenic mice for testing safety of polio vaccine before use in humans.  
 (b) transgenic models for studying new treatments for certain cardiac diseases.

- (c) transgenic cow – rosie which produces high fat milk for making ghee.  
 (d) animals like bulls for farm work as they have super power.

56. Silencing of mRNA has been used in producing transgenic plants resistant to  
 (a) bollworms (b) nematodes  
 (c) white rusts (d) bacterial blights
57. Which one of the following techniques made it possible to genetically engineer living organism ?  
 (a) Recombinant DNA techniques  
 (b) X-ray diffraction  
 (c) Heavier isotope labelling  
 (d) Hybridization
58. Which of the following Bt crops is being grown in India by the farmers?  
 (a) Cotton (b) Brinjal  
 (c) Soyabean (d) Maize
59. A transgenic food crop which may help in solving the problem of night blindness in developing countries is  
 (a) golden rice (b) *Bt* soyabean  
 (c) *flavr - savr* tomato (d) starlink maize
60. Which of these is used as vector in gene therapy for SCID?  
 (a) Arbovirus (b) Rotavirus  
 (c) Retrovirus (d) Parvovirus
61. The genetic defect, adenosine deaminase (ADA) deficiency may be cured permanently by  
 (a) administering adenosine deaminase through injection  
 (b) bone marrow transplantation  
 (c) enzyme replacement therapy  
 (d) introducing isolated gene from marrow cells producing ADA into the cells at early embryonic stages
62. Genetically engineered bacteria have been successfully used in the commercial production of  
 (a) human insulin (b) testosterone  
 (c) thyroxine (d) melatonin
63. Main objective of production/use of herbicide resistant GM crops is to  
 (a) eliminate weeds from the field without the use of manual labour.  
 (b) eliminate weeds from the field without the use of herbicides.  
 (c) encourage eco-friendly herbicides.  
 (d) reduce herbicide accumulation in food articles for health safety.

64. Biotechnology deals with industrial scale production of biopharmaceuticals and biological products using genetically modified
- microbes only
  - fungi only
  - plants and animals only
  - all of the above
65. *Cry II Ab* and *cry I AC* produce toxins that control
- cotton bollworms and corn borer respectively.
  - cotton borer and cotton bollworms respectively.
  - tobacco budworms and nematodes respectively.
  - nematodes and tobacco budworms respectively.
66. *Bt* toxin is
- intracellular lipids.
  - intracellular crystalline protein.
  - extracellular crystalline protein.
  - intracellular polysaccharide.
67. RNA interference involves
- synthesis of mRNA from DNA.
  - synthesis of cDNA from RNA using reverse transcriptase.
  - silencing of specific mRNA due to complementary RNA.
  - interference of RNA in synthesis of DNA.
68. The RNAi stands for
- RNA inactivation
  - RNA initiation
  - RNA interference
  - RNA interferon
69. What is the disadvantage of using porcine insulin (from pig) in diabetic patients?
- It leads hypercalcemia.
  - It is expensive.
  - It may cause allergic reactions.
  - It can lead to mutation in human genome.
70. Which technique would to be completely curative in SCID ?
- Gene therapy in adult stage.
  - Gene therapy in embryonic stage.
  - Bone marrow transplantation.
  - Enzyme replacement therapy.
71. In order for gene therapy to be most effective, genes should be inserted in
- WBC
  - RBC
  - stem cells
  - all of these
72. Which of the following is based upon the principle of antigen-antibody interaction?
- PCR
  - ELISA
  - r-DNA technology
  - RNA
73. Deliberate alteration of genome for treatment of disease is called
- transformation rescue
  - imprinting
  - exon shuffle
  - gene therapy