For BioResire students

NEET Biology Material

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BIOTECHNOLOGY AND ITS APPLICATION

ETHICAL ISSUES

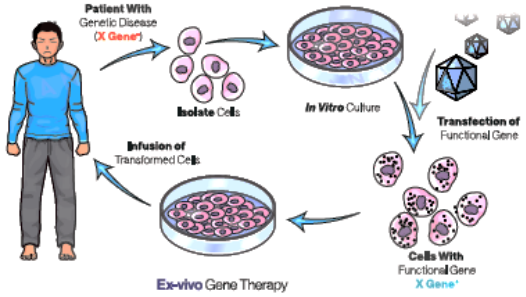
Genetic Engineering Approval Committee (GEAC)
Organisation established by Indian government to decid the validity of genetic engineering research and safety of GM organisms in public services

Indian Patents bills
Indian Parliament approved the amendment to the Indian Patents Bill,which concerns with Patent terms, emergency measures, etc.

BIOPiracy
- Patent granted for biological entities and products derived from them.
Eg. Basmati Rice

BIOPATENT
Use of bio – resources by multinational corporations and other organization without proper permission from the governments and people involved

GENE THERAPY
Set of techniques for correcting a defected gene



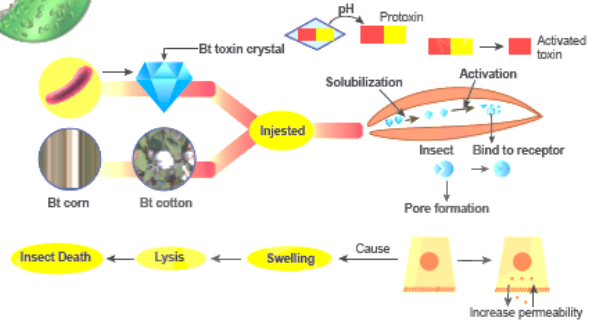
AGRICULTURE
- Agriculture based on agrochemicals
- Organic Agriculture
- Agriculture based on genetic engineered crops

GENETICALLY MODIFIED ORGANISMS (GMO)

Pest resistant Plants (Bio – Pesticides)

Nematode resistant in Tobacco Plants
- Meloidogyne incognita (Nematode) infact tobacco roots
- RNA interference (RNA:) used to prevent it.
- mRNA Silencing is done to inhibit translation of toxic crystal

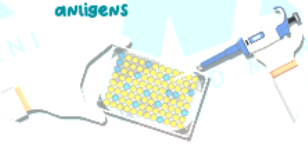
Bt Cotton



MOLECULAR DIAGNOEIS

Polymerase chain Reaction (PCR)
Amplification of desired sequence.
Use - HIV in AIDS identification
-Detection of mutation in cancer patients
-Detection of genetic disorders

Enzyme Linked Immuno Sorbent Assay (ELISA)
Antigen – antibody instruction principle.
Use - Detection of pathogenic antigens

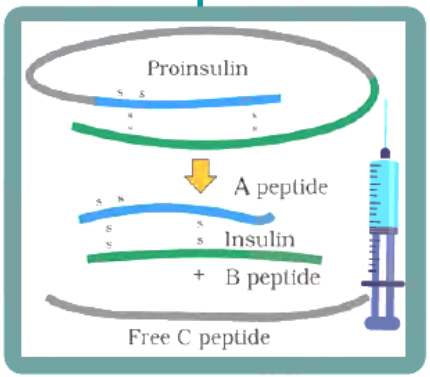


Transgenic Animals
- Animals having their DNA manifrulated
- Eg:- Transgenic rats, pigs sheeps, etc

Benefits of Transgenic animals
- Normal physiology & development & knowledge about gene regulation rate
- Study of diseases (eg. Transgenic models for cancer)
- Biological products (Eg. Human protein (- 1 – antitrypsin)
- Vavine safety (eg. Polio vaccine)

MEDICINE

INSULIN



BIOTECHNOLOGY AND ITS APPLICATIONS

Biotechnology:

The use of biology to develop technologies and products for the welfare of human beings is known as biotechnology.

It has various applications in different fields such as therapeutics, diagnostics, processed food, waste management, energy production, genetically modified crops, etc.

Biotechnological Application in Agriculture:

- Biotechnology has different applications in agriculture.
- It can be used in agrochemicals, organic agriculture, and genetically engineered crop-based agriculture.
- To produce genetically modified organisms it can be used. Genetically modified organisms (GMO) can be obtained by alteration in their genetic material.

A different application of genetically modified organisms is:

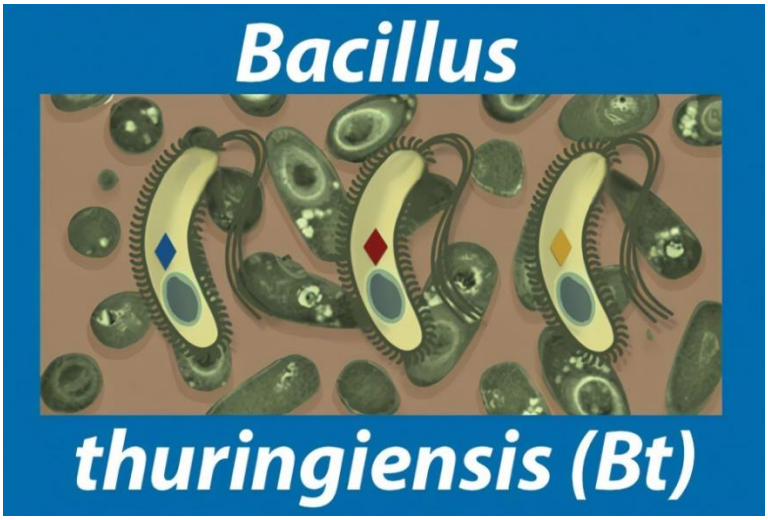
- Production of crops that are resistant to abiotic factors such as heat, cold, etc.
- Pest-resistant crops.
- Help to reduce post-harvest losses.
- Minerals can be used by the plants efficiently.
- Food with enhanced nutritional values.

Green Revolution:

The Green Revolution succeeded in tripling the food supply but yet it was not enough to feed the growing human population. Increased yields have partly been due to the use of improved crop varieties, but mainly due to the use of better management practices and use of agrochemicals (fertilisers and pesticides). for farmers in the developing world, agrochemicals are often too expensive and further increases in yield with existing varieties are not possible using conventional breeding Use of genetically modified crops is a possible solution.

Bacillus thuringiensis (Bt):

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 created a bio-pesticide Examples are Bt cotton, Bt corn, rice, tomato, potato and soyabean etc.



Bt Cotton:

Some strains of Bacillus thuringiensis produce proteins that kill certain insects such as lepidopterans (tobacco budworm, armyworm) coleopterans (beetles) and dipterans (flies, mosquitoes). B. thuringiensis forms protein crystals during a particular phase of their growth These crystals contain a toxic insecticidal protein. Bt toxin protein exist as inactive protoxins once the insect ingest the inactive toxin it is converted into an active form of toxin due to alkaline pH of gut which solubilise crystals activated toxin binds to the surface of midgut epithelial cells create pores that cause cell swelling and lysis and eventually cause death of the insect.

Cry:

Specific Bt toxin genes were isolated from Bacillus thuringiensis and incorporated into the several crop plants such as cotton as most Bt toxins are insect-group specific. The toxin is coded by a gene named cry. for example, the proteins encoded by the genes cryIAc and cryIIAb control the cotton bollworms, that of cryIAb controls corn borer.

Pest Resistant Plants:

Various pests affect the plants which cause loss as well as a decrease in the yield of the plant.

A nematode Meloidogyne incognita infects the roots of tobacco plants and causes a decrease in the yield of the plant. To prevent this, RNA interference technology was used. This method involves silencing a specific mRNA due to a complementary dsRNA molecule. This inhibits the translation of the mRNA.

Biotechnological Applications In Medicine:

The rDNA technological processes have made immense impact in the area of healthcare by enabling mass production of safe and more effective therapeutic drugs. At present, about 30 recombinant therapeutics have been approved for human use the world over. In India, 12 of these are presently being marketed.

Genetically Engineered Insulin:

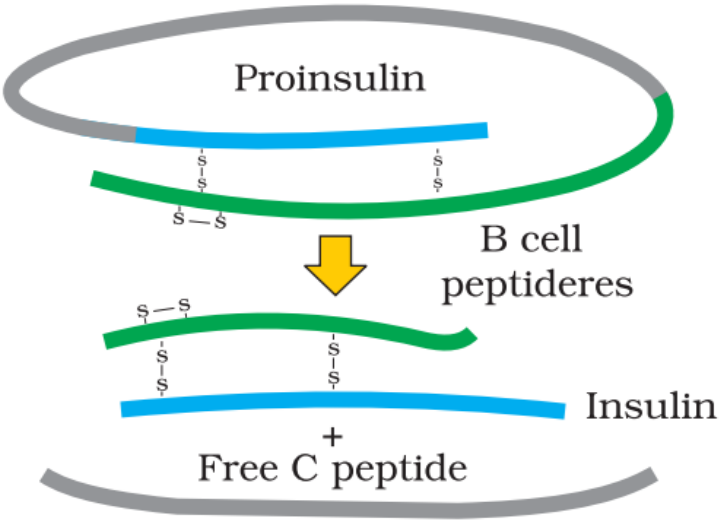
- Adult-onset diabetes can be controlled by taking insulin at regular intervals. The main source of this insulin was isolation of insulin from animals. Now a day's insulin can be obtained from bacterium using techniques of biotechnology.

- Insulin was earlier extracted from pancreas of slaughtered cattle and pigs but insulin from these sources develops allergy or other types of reactions to the foreign protein.

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

- In humans, insulin is synthesized as a prohormone, which contains an extra stretch called C peptide, which is absent in mature insulin. The main challenge for production of insulin using rDNA technique was getting insulin assembled into a mature form.

- An American company, Eli Lilly in 1983 prepared two DNA sequence corresponding to A and B chain of human insulin and introduced them in plasmids of E.coli to produce insulin chain. Chain A and Chain B were produced separately, extracted and combined by creating disulphide bonds to form human insulin.



Gene Therapy:

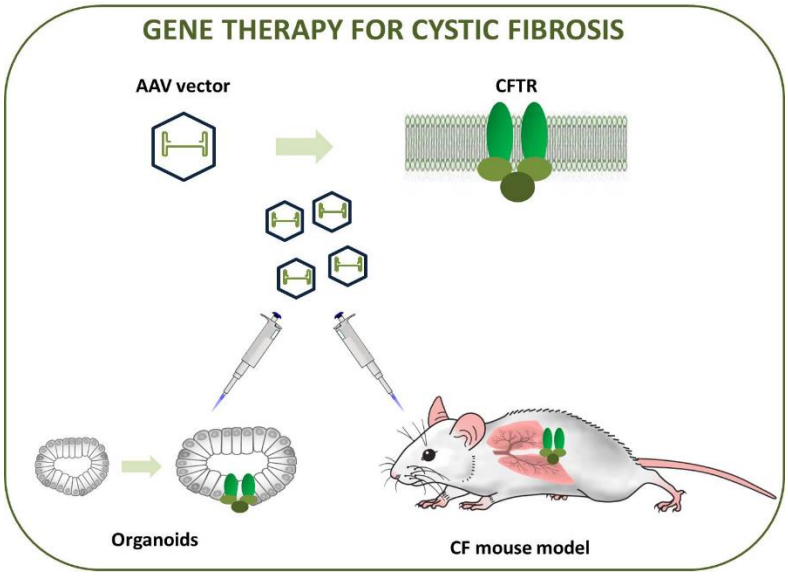
- It is a collection of methods that allows correction of a gene defect that has been diagnosed in a child or embryo. This method is applied in a person with a hereditary disease. In this method, genes are inserted into a person's cells and tissues to treat a disease.

- The correction of gene defect involves delivery of a normal gene into the individual or embryo to take over the function of and compensate for non-functional gene.

- The first clinical gene therapy was done in 1990 to a 4 year old girl with adenosine deaminase (ADA) deficiency. This disorder is caused due to the deletion of the gene for adenosine deaminase that is essential for immune system to function. This defect can be treated by enzyme replacement

therapy in which functional ADA is given to the patient by injection or bone marrow transplant.

- In gene therapy method lymphocytes from the blood of the patient are grown in culture medium outside the body. A functional ADA cDNA is then introduced into these lymphocytes and returned to the patient. In this method periodic infusion of such genetically engineered lymphocytes is needed. If gene isolated from bone marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.



Molecular Diagnosis:

Conventional method of diagnosis such as serum or urine analysis is not able to early detection of disease-causing pathogens or virus.

Following methods can be used to diagnosed earlier:

- Recombinant DNA technology.
- Polymerase Chain Reaction (PCR).
- Enzyme Linked Immuno-sorbent Assay (ELISA).

Symptoms of disease appear only when the concentration of pathogen get increased significantly. Low concentration of bacteria and virus can be detected by amplification of nucleic acid by PCR. It detects the mutation in the gene in cancer patient. PCR is routinely used to detect the HIV in suspected AIDS patients. Genetic disorder can be also detected by using PCR technique.

A single stranded DNA or RNA having radioactive molecule is allowed to hybridize to its complementary DNA in a clone of cells followed by detection using autoradiography. The clone having the mutated gene will not appear on the photographic film.

ELISA is based on the principle of antigen-antibody interaction. Infection by pathogen can be detected by the presence of antigens like proteins, glycoproteins etc. or by detecting the antibodies synthesised against the pathogen.

Transgenic Animals:

Transgenic animals can be defined as those animals in which a new or altered gene has been experimentally inserted into the genome by genetic engineering technique.

Few examples of transgenic animals are rats, rabbits, pigs, sheep, cows, fish, etc. Among all other transgenic animals, the mouse is the existing transgenic animal.

The main aim behind the creation of transgenic animals are:

- For the production of biological products.
- To study the different types of diseases.
- To study the contribution of genes in the development of the disease.
- For testing the safety of vaccines and toxicity of drugs before they are used on humans.
- To study how genes are regulated and how do they affect the normal functioning of the body and its development.

Applications in Aquaculture:

Biotechnology applications help in the improvement of quality and quantity of fish. The gonadotropin-releasing hormone is introduced into the fish to enhance breeding. This helps in enhancing growth and improving their genetic characteristics. It also prevents a number of diseases.

Production of Antibiotics:

Biotechnology helps in the production of vaccines, antibiotics and artificial hormones, using plants. Genes with desired characteristics are introduced into the plants to manufacture the encoded proteins. Edible vaccines are cost-effective, can be easily stored and administered in the body. These are used to cure diseases such as measles, hepatitis, cholera, etc.

Ethical Issues:

GEAC (Genetic Engineering Approval Committee): The Indian Government has set up organisations such as GEAC (Genetic Engineering Approval Committee) will make decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.

Biopiracy: The use of bio-resources found in any country by commercial and multinational companies and other organizations without taking appropriate authorization and permission from the countries and their people concerned and also without making the compensatory payment is biopiracy.

NCERT LINE BY LINE QUESTIONS

BASIS OF CLASSIFICATION

1. Biotechnology mainly deals with **[pg-207,E]**
   A) Industrial scale production of biopharmaceutical
   B) Biological use of genetically modified microbes, fungi, plants and animals
   C) Both A and B
   D) None of these
2. Which of the following is not included in the application of biotechnology **[pg-207,E]**
   A) Waste treatment
   B) Conventional hybridisation
   C) Energy production
   D) Genetically modified crops
3. Application like bioremediation, processed food, therapeutics and diagnostics are related to **[pg-207,E]**
   A) Biochemistry
   B) Microbiology
   C) Biotechnology
   D) Medical Science
4. ____ is/are the critical research area(s) of biotechnology. **[pg-207,E]**
   A) Creating optimals conditions for catalyst function
   B) Providing best catalyst
   C) Developing down streaming processing technique
   D) All of the above

PARAGRAPH- 12.1 BIOTECHNOLOGY APPLICATIONS IN AGRICULTURE

5. Which of the following is not for increasing food production? **[pg-208,E]**
   A) Agrochemical based agriculture
   B) Organic agriculture
   C) Genetic engineered crop-based agriculture
   D) None of these
6. Organic agriculture is a technique of raising crops for **[pg-208,M]**
   A) increased food production
   B) reduction in required labour
   C) increasing the use of agrochemicals
   D) Both A & C
7. Use of genetically modified crops in crop field may **[pg-208,M]**
   A) reduce the harmful effects of fertilizers
   B) maximize yield
   C) be environment friendly
   D) All of the above
8. Plants bacteria, fungi and animals whose genes have been altered by manipulation are called **[pg-208,M]**
   A) Pest resistant organism
   B) Hybrid organisms
   C) Genetically modified organism
   D) Insect resistant organism
9. Golden rice is genetically modified crop plant with incorporate gene meant for biosynthesis of **[pg-208,M]**
   A) Vitamin E B) Vitamin K C) Omega-3 D) Vitamin A
10. ____ produced by Bacillus thuringiensis **[pg-208,E]**
    A) t- toxin B) Bt toxin C) An acid D) All of these
11. The bacterium Bacillus thuringiensis produce ____ plants which reduces the amount of ____ used. **[pg-208,M]**
    A) disease resistant, insecticide
    B) insect resistant, fertilizers

C) disease resistant, industrial enzyme
D) insect resistant, insecticide

12. Which of the following crops are modified using Bacillus thuringiensis? **[pg-208,E]**
A) Corn and cotton
B) Tomato and rice
C) Potato and soyabean
D) All of the above

13. Which of the following is being grown in India by farmers as Bt crop? **[pg-208,E]**
A) Maize B) Brinzal C) Cotton D) Soyabean

14. By inserting a piece of DNA from ____insect resistant transgenic cotton has been produced. **[pg-208,H]**
A) a wild relative of cotton B) bacterium C) an insect D) virus

15. Some strains of Bacillus thuringiensis produce proteins that will insect like **[pg-208,H]**
A) Lepidopterans B) Coleopterans
C) Dipterans D) All of these

16. Coleopterans examples are/is- **[pg-208,E]**
A) Flies B) Mosquitoes C) Beetles D) All of the above

17. Bacillus thuringiensis forms protein crystals which contain a- **[pg-208,H]**
A) Simple protein
B) Non-toxic insecticidal protein
C) Toxic insecticidal protein
D) Simple lipids

18. Why does Bt toxin protein crystal not kill the Bacillus? Because- **[pg-208,M]**
A) Bacteria encloses toxins in special sac
B) Bacteria are resistant to toxin
C) Toxin occurs as inactive protoxins in bacteria
D) All of the above

19. Bt toxin kills insect by- **[pg-209,M]**
A) Inhibiting protein synthesis
B) Generating excessive heat
C) Creating pores leading to cell swelling and lysis in the mid gut epithelial cells
D) None of these

20. The choices of genes of Bacillus thuringiensis, incorporated in to crop depends upon **[pg-209,M]**
A) Crop B) Targeted pest C) Both A and B D) Toxin

21. The crops having cry genes need **[pg-209,M]**
A) Small amount of fungicide B) Large amount of pesticide
C) Small amount of insecticide D) None of the above

22. The Bt toxin protein **[pg-209,E]**
A) Obstruct a biosynthetic pathway
B) Causes death of the insect
C) Stops egg laying of adult
D) Generating excessive heat

23. Cotton bollworm controlled by- **[pg-209,M]**
A) Cry I Ac, Cry II Ab
B) Cry I Ac, Cry II Ac, Cry I Ab
C) Cry II Ac, Cry I Ab
D) Cry I Ab

24. Bt corn has been made resistant to corn borer by the introduction of gene **[pg-209,H]**
A) Cry I Ac B) Cry II Ab C) Cry I Ab D) Cry II Ac

25. Cry II Ab and Cry I Ab produces toxins that control **[pg-209,M]**
A) Cotton bollworms and corn borer resp.
B) Cotton bollworm and budworms of tobacco resp.
C) Corn borer and cotton bollworms resp.
D) Nematodes and tobacco budworms resp.

26. Which of the following nematodes infects the root of the tobacco plants which reduces the production of tobacco? **[Pg-209,H]**
A) *Melodiogyne incognitia* B) *Ascaris* C) *Wuckereria* D) *Interobious*

27. A Novel strategy was adopted to present *Meloidiogyne incognita* infection in tobacco plants that was based on the process of **[Pg-209,M]**
A) DNA interference B) RNA interference
C) RNA initiation D) DNA initiation

28. Resistance against a Nematode was introduce by implying RNA in ____plants. **[pg-209,E]**
A) Tomato B) Bt corn C) Bt cotton D) Tobacco

29. RNAi stand for **[pg-209,E]**
A) RNA inteteron B) RNA interference
C) RNA inactivation D) RNA initiation

30. RNAi take place in all ____ organisms as method of ____. **[pg-209,M]**
A) prokaryotes, insect resistant B) eukaryotes, insect resistant
C) eukaryotes, cellular defence D) prokaryotes, cellular defence

31. ____ is used for silencing of an unwanted gene **[Pg-209,M]**
A) RNA B) DNA polymerase
C) Restriction enzyme D) All of these

32. Silencing of mRNA molecule in order to control the production of a harmful protein has been used in the protection of plants from **[Pg-209,H]**
A) Beetles B) Armyworm C) Budworm D) Nematodes

33. Transposons are also known as **[Pg-209,E]**
A) Silenced gene B) Plesotropic genes
C) Mobile genetic elements D) Both A and C

34. Tobacco plant resistant to a nematode have been developed by the introduction of DNA and it is produced in the lost cells as **[Pg-209,M]**
A) A particular hormone
B) Toxic protein
C) Both sense and antisense RNA
D) An antifeedant

PARAGRAPH-12.2 BIOTECHNOLOGY APPLICATIONS IN MEDICINE

35. The first human hormone produced by recombinant technology is **[Pg-210,E]**
A) Oestrogen B) Progesterone C) Thyroxine D) Insulin

36. The demerits of using bovine insulin (from cow) and porcine insulin (from pig) in diabetic patients is- **[Pg-211,M]**
A) It leads to hypercalcemic B) It may cause allergic reaction
C) It is expensive D) All of the above

37. The two polypeptides of human insulin are linked together by **[Pg-211,M]**
A) Phosphodiester bonds
B) Disulphide bridge
C) Hydrogen bonds
D) None of the above

38. ____ is removed during the maturation of proinsulin to insulin. **[Pg-211,H]**
A) A-chain B) B-chain C) C-chain D) Both A and B

39. The main challenge for production of insulin using rDNA techniques was **[Pg-211,M]**
A) Splitting A and B- peptide chains
B) Addition of C- peptide to proinsulin
C) Getting insulin assembled to mature form
D) Removal of C- peptide from active insulin

40. Which of the following companies prepared human insulin in 1983? **[Pg-211,E]**
A) Monsanto B) Eli Lily C) Genetech D) GEAC

PARAGRAPH-12.2.2 GENE THERAPY

41. Treatment of genetic disorder by manipulating gene is called- **[Pg-211,M]**
A) Gene therapy

B) rDNA technology
C) Bone marrow transplantation
D) Enzyme replacement therapy

42. For the first time, therapy was tried on a 4 year old girl in 1990 to treat ____. **[Pg-211,E]**
A) Cytosine Deaminase (CDA)
B) Adenosine Deaminase (ADA)
C) Tyrosine oxidase
D) Glutamate tryhydrogenase

43. Which kind of therapy was given in 1990 to 4 year old girl with enzyme deficiency? **[Pg-211,E]**
A) Gene therapy
B) Chemotherapy
C) Immunotherapy
D) Radiation therapy

44. Adenosine deaminase (ADA) deficiency can be treated by ____ and ____ but it is not fully curative. Here A and B can be **[Pg-211,M]**
A) A- gene therapy, B- radiation therapy
B) A- bone marrow transplantation, B-enzyme replacement therapy
C) A- organ transplantation, B- hormone replacement
D) A- radiation therapy, B- enzyme replacement therapy

45. The advantage of beginning gene therapy prior to birth is- **[Pg-211,H]**
A) The body would not reject it as it has not yet recognised 'self'.
B) This would give the body plenty of time.
C) The cell being extremely young are more receptive to gene therapy.
D) None of these

PARAGRAPH-12.2.3 MOLECULAR DIAGNOSIS

46. Why using conventional method for diagnosis is not very relevant? **[Pg-212,M]**
A) Early detection is not possible
B) Not reliable
C) Results are incorrect
D) All of these

47. Which of the following molecular diagnostic technique is used to detect the presence of a pathogen in its early stage of infection- **[Pg-212,E]**
A) Angiography
B) Radiography
C) Enzyme replacement technique
D) Polymerase chain reaction

48. Why PCR is used? **[Pg-212,E]**
A) to detect HIV in suspected AIDS patients
B) to detect Mutation in the genes of suspected cancer patients
C) Diagnose many genetic disorders
D) All of the above

49. A single stranded Nucleic acid tagged with a radioactive molecule is called **[Pg-212,E]**
A) Plasmid
B) Probe
C) Vector
D) Selectable market

50. In which of the following method, a probe is allowed hybridise to its complementary DNA in the clone of cells? **[Pg-212,M]**
A) Enzyme linked Immono sorbent Assay (ELISA)
B) PCR
C) Autoradiography
D) Gene therapy

51. Technique used to detect mutation in genes is known as- **[Pg-212,E]**
A) Gel electrophoresis

B) PCR
C) Gene therapy
D) Autoradiography

52. Which of the following technique is based on the principle of antigen – antibody interaction? **[Pg-212,H]**
A) PCR
B) ELISA
C) Recombinant DNA technology
D) Gene therapy

PARAGRAPH-12.3 TRANSGENIC ANIMALS

53. Animals whose DNA is manipulated to possess and express an extra (foreign) gene are known as **[Pg-212,E]**
A) Transgenic animals B) Hybrid animals
C) Transferrin animals D) All of the above

54. Transgenic animals are those which have foreign? **[Pg-212,M]**
A) DNA in all of their cells B) Proteins in all of their cells
C) RNA in all their cells D) RNA in some of their cells

55. 95% of all the existing transgenic animals are **[Pg-212,E]**
A) Pigs B) Cows C) Mice D) All of these

56. Transgenic animals can be used to **[Pg-212,213,E]**
A) Study normal physiology
B) Study the biological effects
C) Study the vaccine safety
D) All of the above

57. Transgenic animals made to serve as models for human diseases. The disease are- **[Pg-213,M]**
A) Alzheimer's disease
B) Cancer
C) Cystic fibrosis
D) All of these

58. Which of the following transgenic human protein products development are used to treat emphysema? **[Pg-213,H]**
A) α-1 antitrypsin B) α-1 trypsin C) α-1 albumin D) α-1 globulin

59. When was the first transgenic cow, Rosie produced? **[Pg-213,E]**
A) 1979 B) 1997 C) 1996 D) 1999

60. ____ was introduced in the first trans genetic cow- **[Pg-213,M]**
A) α-1 antirypsin
B) Human β-Lactalbumin
C) β-1 antitrypsin
D) None of these

61. The first transgenic cow, Rosie produced **[Pg-213,H]**
A) Human calcium enriched milk (2.4 g/l)
B) Human protein enriched milk (2.4 g/l)
C) Human calcium enriched milk (2.6 g/l)
D) Human protein enriched milk (2.8 g/l)

62. ____ are used in testing safety of polio vaccine before they are used on human. **[Pg-213,E]**
A) Transgenic pig
B) Transgenic monkey
C) Transgenic rabbits
D) Transgenic mice

63. ____ animals are made that carry genes which makes them more sensitive to toxic substances than non-transgenic animals. **[Pg-213,M]**
A) Transgenic B) Mutaled C) Transverred D) Transformed

PARAGRAPH-12.4 ETHICAL ISSUE

64. Which committee takes decision regarding the validity of GM research and the safety of introducing GM-organisms for public services? **[Pg-213,E]**
A) Indian Council of Medical Research (ICMR)
B) Genetic Engineering Approval committee (GEAC)
C) Indian Institute of Science Education and Research (IISER)
D) Genetic Engineering Appraisal Committee (GEAC)

65. A ____ granted to a person who has either invented a new and useful product, made improvement existing product or invented a new process of making a product is called- **[Pg-214,M]**
A) bioethics B) patent C) bio piracy D) genetic recombination

66. Bio patent means **[Pg-214,E]**
A) Right to use an invention B) Right to use application are processes
C) Both A and B D) None of these

67. ____ have been present in India from long time yet foreign country got patent through the US patent and Trademark office. **[Pg-214,M]**
A) Brown rice B) Basmati rice C) Co-667 D) All of these

68. Bioethics is- **[Pg-214,E]**
A) Process of discovery and commercialisation of new products.
B) Use of bio resources with proper authorisation.
C) Standards used to regulate human activities in relation to the biological world.
D) All of these

69. Exploitation of bio resources of a nation by multinational companies without authorisation from the concerned country is referred to- **[Pg-214,E]**
A) Bioethics B) Bioweapon C) Bio piracy D) Bio-exploitation

70. Bio piracy is related with the- **[Pg-214,E]**
A) Stealing of bio resources
B) Traditional knowledge and utilization
C) Biomolecules and regarding bio resources exploitation
D) Both A and C

71. ____ was taken by Indian parliament to meet and fulfill the requirements of patent terms and other emergency provisions in this regard? **[pg-214,E]**
A) Indian patents bill B) Bioethics act
C) Bio piracy act D) All of these

72. Basmati is unique for its aroma and flavour, whose __A__ documented verities cultivated in __B__. **[pg-214,E]**
A) A-37, B-India B) A-27, B-India C) A-27, B-USA D) A-30, B-USA

NEET PREVIOUS YEARS QUESTIONS

1. In India, the organisation responsible for assessing the safety of introducing genetically modified organisms for public use is **[2018]**
(a) Indian Council of Medical Research (ICMR).
(b) Council for Scientific and Industrial Research (CSIR).
(c) Genetic Engineering Appraisal Committee (GEAC).
(d) Research Committee on Genetic Manipulation (RCGM).

2. Use of bioresources by multinational companies and organisations without authorisation from the concerned country and its people is called : **[2018]**
(a) Bio-infringement (b) Biopiracy
(c) Bioexploitation (d) Biodegradation

3. Golden rice is a genetically modified crop plant where the incorporated gene is meant for biosynthesis of **[2015]**

(a) Vitamin C (b) Omega 3 (c) Vitamin A (d) Vitamin B

4. The crops engineered for glyphosate are resistant/ tolerant to : **[2015]**

(a) Bacteria (b) Insects (c) Herbicides (d) Fungi

5. In *Bt* cotton, the *Bt* toxin present in plant tissue as pro-toxin is converted into active toxin due to **[2015]**

(a) acidic pH of the insect gut.

(b) action of gut micro-organisms.

(c) presence of conversion factors in insect gut.

(d) alkaline pH of the insect gut.

6. Which body of the Government of India regulates GM research and safety of introducing GM organisms for public services? **[2015]**

(a) Indian Council of Agricultural Research

(b) Genetic Engineering Approval Committee

(c) Research Committee on Genetic Manipulation

(d) Bio-safety committee

7. Pollen tablets are available in the market for: **[2014]**

(a) *In vitro* fertilisation (b) Breeding programmes

(c) Supplementing food (d) *Ex situ* conservation

8. The first human hormone produced by recombinant DNA technology is : **[2014]**

(a) Insulin (b) Estrogen (c) Thyroxin (d) Progesterone

9. Which of the following is true for Golden rice ? **(NEET-2019)**

(1) It is Vitamin A enriched, with a gene from daffodil

(2) It is pest resistant, with a gene from Bacillus thuringiensis

(3) It is drought tolerant, developed using Agrobacterium vector

(4) It has yellow grains, because of a gene introduced from a primitive variety of rice

10. What triggers activation of protoxin to active Bt toxin of Bacillus thuringiensis in boll worm? **(NEET-2019)**

(1) Body temperature (2) Moist surface of midgut

(3) Alkaline pH of gut (4) Acidic pH of stomach

11. Which of the following bacteria reduce nitrate in soil into nitrogen ? **(NEET-2019 ODISSA)**

(1) Nitrobacter (2) Nitrococcus (3) Thiobacillus (4) Nitrosomonas

12. In RNAi, the genes are silenced using: **(NEET-2019 ODISSA)**

(1) ds-RNA (2) ss-DNA (3) ss-RNA (4) ds-DNA

13. Match the following techniques or instruments with their usage : **(NEET-2020 COVID)**

(a) Bioreactor (i) Separation of DNA fragments

(b) Electrophoresis (ii) Production of large quantities of products

(c) PCR (iii) Detection of pathogen, based on antigen – antibody reaction

(d) ELISA (iv) Amplification of nucleic acids

Select the correct option from following:

(1) (a)-(iii), (b)-(ii), (c)-(iv), (d)-(i)

(2) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

(3) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

(4) (a)-(ii), (b)-(i), (c)-(iii), (d)-(iv)

14. Match the following columns and select the correct option **(NEET-2020)**

Column – I	**Column – II**
(a) Bt cotton	(i) Gene therapy
(b) Adenosine deaminase Deficiency	(ii) Cellular defence

(c) RNAi (iii) Detection of HIV infection

(d) PCR (iv) Bacillus thuringiensis

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
1)	(i)	(ii)	(iii)	(iv)	2)	(iv)	(i)	(ii)	(iii)
3)	(iii)	(ii)	(i)	(iv)	4)	(ii)	(iii)	(iv)	(i)

15. Match the organism with its use in biotechnology **(NEET-2020)**

(a)	Bacillus thuringienesis	(i)	Cloning vector
(b)	Thermus aquaticus	(ii)	Construction of first rDNA molecule
(c)	Agrobacterium tumefaciens	(iii)	DNA polymerase
(d)	Salmonella typhimurium	(iv)	Cry proteins

Select the correct option from the following :

	(a)	(b)	(c)	(d)		(a)	(b)	(c)	(d)
1)	(iii)	(iv)	(i)	(ii)	2)	(ii)	(iv)	(iii)	(i)
3)	(iv)	(iii)	(i)	(ii)	4)	(iii)	(ii)	(iv)	(i)

16. Bt cotton variety that was developed by the introduction toxin gene of Bacillus thuringensis (Bt) is resistant to **(NEET-2020)**

1) Insect predators 2) Insect pests 3) Fungal diseases 4) Plant nematodes

17. Now a days it is possible to detect the mutated gene causing cancer by allowing radioactive probe to hybridise its complimentary DNA in a clone of autoradiography because **(NEET-2021)**
1) mutated gene completely and clearly appears on a photographic film
2) mutated gene does not appear on a photographic film as the probe has no complimentarity with it
3) mutated gene does not appear on photographic film as the probe has complimentarity with it
4) mutated gene partially appears on a photographic film

18. Transposons can be used during which one of the following? **(NEET-2022)**
1) Polymerase Chain Reaction
2) Gene silencing
3) Autoradiography
4) Gene sequencing

19. The capacity to generate a whole plant from any cell of the plant is called:
(a) Totipotency
(b) Micropropagation
(c) Differentiation
(d) Somatic hybridization

[NEET 2024]

20. Given below are two statements:

Statement I: Bt toxins are insect group specific and coded by a gene cry IAc.

Statement II : Bt toxin exists as inactive protoxin in *B*. thuringiensis. However, after ingestion by the insect the inactive protoxin gets converted into active form due to acidic pH of the insect gut.

In the light of the above statements, choose the correct answer from the options given below:
(a) Both Statement I and Statement II are true
(b) Both Statement I and Statement II are false
(c) Statement I is true but Statement II is false
(d) Statement I is false but Statement II is true

[NEET 2024]

21. Match List I with List II :

List I

A. $\alpha - 1$ antitrypsin

B. Cry IAb

C. Cry IAc

D Enzyme replacement therapy

List II
I. Cotton bollworm
II. ADA deficiency
III. Emphysema
IV Corn borer
Choose the correct answer form the options given below:
(a) A-II, B-I, C-IV, D-III
(b) A-III, B-I, C-II, D-IV
(c) A-III, B-IV, C-I, D-II
(d) A-II, B-IV, C-I, D-III

[NEET 2024]

22. The "Ti plasmid" of Agrobacterium tumefaciens stands for
(a) Tumour inhibiting plasmid
(b) Tumor independent plasmid
(c) Tumor inducing plasmid
(d) Temperature independent plasmid

[NEET 2023]

23. Which of the following can act as molecular scissors?
(a) Restriction enzymes
(b) DNA ligase
(c) RNA polymerase
(d) DNA polymerase

[NEET 2023 Manipur]

24. Match List-I with List-II.

	List - I		List - II

(A)	Gene therapy	(I)	Separation of DNA fragments
(B)	RNA interference	(II)	Diagnostic test for AIDS
(C)	ELISA	(III)	Cellular defence
(D)	Gel Electrophoresis	(IV)	Allows correction of a gene

Choose the correct answer from the options given below :
(a) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
(b) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(c) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(d) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

[NEET 2023 Manipur]

25. During the purification process for recombinant DNA technology, addition of chilled ethanol precipitates out

(a) DNA (b) Histones
(c) Polysaccharides (d) RNA

[NEET 2023]

26. In gene gun method used to introduce alien DNA into host cells, microparticles of metal are u
(a) Zinc
(b) Tungsten or gold
(c) Silver
(d) Copper

[NEET 2023]

27. Main steps in the formation of Recombinant DNA are given below. Arrange these steps in a correct sequence.
A. Insertion of recombinant DNA into the host cell
B. Cutting of DNA at specific location by restriction enzyme
C. Isolation of desired DNA fragment
D. Amplification of gene of interest using PCR
Choose the correct answer from the options given below :
(a) C, A, B, D (b) C, B, D, A
(c) B, D, A, C (d) B, C, D, A

[NEET 2023]

28. Given below are two statements:
Statement I: Transfer RNAs and ribosomal RNA do not interact with mRNA.
Statement II: RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defence.
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both statement I and statement II are correct
(b) Both statement I and statement II are incorrect

(c) Statement I is correct but statement II is incorrect
(d) Statement I is incorrect but statement II is correct

[NEET 2025]

29. Which of the following genetically engineered organisms was used by Eli Lilly to prepare human insulin?
(a) Bacterium
(b) Yeast
(c) Virus
(d) Phage

[NEET 2025]

NCERT LINE BY LINE QUESTIONS – ANSWERS

1) C	2) B	3) C	4) D	5) D	6) A	7) D	8) C	9) D	10) B
11) D	12) D	13) C	14) B	15) D	16) C	17) C	18) C	19) C	20) C
21) D	22) B	23) A	24) C	25) A	26) A	27) B	28) D	29) B	30) C
31) A	32) D	33) C	34) C	35) D	36) B	37) B	38) C	39) C	40) B
41) A	42) B	43) A	44) B	45) C	46) A	47) D	48) D	49) B	50) C
51) B	52) B	53) A	54) A	55) C	56) D	57) D	58) A	59) B	60) D
61) B	62) D	63) A	64) B	65) B	66) C	67) B	68) A	69) C	70) D
71) A	72) B								

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

1 (c) 2 (b) 3 (c) 4 (c) 5 (d) 6 (b) 7 (c) 8 (a) 9 (1) 10 (3)
11 (3) 12 (1) 13 (2) 14 (2) 15 (3) 16 (2) 17 (2) 18 (2) 19(a) 20(c) 21(c) 22(c) 23(a) 24(c) 25(a) 26(b) 27(d) 28(d) 29(a)

NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. (c) Indian Government has setup organisation such as GEAC (Genetic Engineering Appraisal Committee) which will make decisions regarding the validity of GM research and safety of introducing GM-organism for public services.

2. (b) Biopiracy refers to the use of bioresources by multinational companies and other organisation without proper authorisation from the countries and people concerned with compensatory payment.

3. (c) Golden rice (*Oryza sativa*) is a genetically modified crop. It biosynthesises b-carotene, which is the precursor of vitamin A.

4. (c) Today plants having broad leaves are made resistant to a powerful bio-degradable herbicide glyphosate. It is an active ingredient of round up ready plant. It disturbs the working of EPSP synthetase enzyme. If it is taken up by crop plants they will die. So, the bioengineers have transferred gene for synthesis of EPSP synthetase enzyme to crop plant.

5. (d) *Bt* toxin are solubilised in alkaline pH of the insect gut causing death.

6. (b) Genetic Engineering Approval Committee is the body of Government of India. It regulates GM research and safety of introducing GM organisms for public service in the country.

7. (c) Pollen grains are rich in nutrients therefore used as food supplements. Athletes and race horses use these as tablets to enhance performance.

8. (a) Mammalian hormones were among the first products prepared in bacteria by r-DNA technology. Human

insulin and human growth hormone are earliest examples.

14. (a) Cry genes isolated from Bacillus thuringiensis are used in development of insect pest resistance Bt cotton variety
(b) Adenosine deaminase leads to SCID it is treated by gene therapy
(c) RNAi's is a cellular defence mechanism in many eukaryotes
(d) PCR is useful for early detection of HIV infection

15. (a) Cry proteins are isolated from bacteria Bacillus thuringienesis
(b) Thermus aquaticus is a heat resistant DNA polymerase

(c) Ti plasmid of Agrobacterium tumefaciens is most commonly using vector to develop transgenic plants
(d) Anti biotic resistant genes of Salmonella typhimurium are used in construction of first rDNA molecule

16 Bt cotton is a Insect pests resistant verity, produced by using cry genes from Bacillus thuringensis

17 Autoradiography allows the detection/localisation of radioactive isotope within a biological sample. Probe is a radiolabelled ss DNA or ss RNA depending on the technique. To identify the mutated gene probe is allowed to hybridise to its complementary DNA in a clone of cells followed by detection using autoradiography. The mutated gene will not appear on the photographic film, because the probe does not have complementarity with the mutated gene

18. Gene silencing

19.Ans. (a)
Explanation
Totipotency is defined as the capacity to generate a whole plant from any cell of the plant.

20.Ans. (c)
Explanation
The correct answer is option (c) as specific Bt toxin genes were isolated from Bacillus thuringiensis and incorporated into the several crop plants such as cotton. The choice of genes depends upon the crop and the targeted pest as most Bt toxins are insect-group specific. The toxin is coded by a gene named cry. There are a number of them, for example, the proteins encoded by the genes cry IAc and cry IIAb control the cotton bollworms, that of cry IAb controls corn borer

21.Ans.(c)
Explanation
The correct answer is option (c) as

$\alpha - I$ antitrypsin → Is used for treatment of Emphysema

Cry I Ab gene → Controls corn borer

Cry I Ac gene → Controls cotton bollworms

Enzyme replacement therapy → Can be used as treatment option in ADA deficiency.

22.Ans. (c)
Explanation
The correct answer is option (c) as Ti plasmid of Agrobacterium tumefaciens is tumor inducing plasmid, containing T-DNA which causes tumor in several dicot plants.

Options (a), (b) and (d) are not correct.

23.Ans. (a)
Explanation
Option a : Restriction enzymes
Restriction enzymes, also known as restriction endonucleases, act as molecular scissors in molecular biology. They recognize specific DNA sequences in a molecule and then cut the DNA at these recognition sites. Different restriction enzymes recognize and cut at different DNA sequences.

24.Ans. (c)
Explanation

The correct answer is Option c.
The correct matching between List - I and List - II is as follows :
(A) Gene therapy - (IV) Allows correction of a gene defect.
Gene therapy is a technique that uses genes to treat or prevent disease by either replacing damaged genes with healthy ones, turning off harmful genes or introducing new genes to fight disease.
(B) RNA interference - (III) Cellular defence
RNA interference (RNAi) is a biological process in which RNA molecules inhibit gene expression or translation, by neutralizing targeted mRNA molecules. This is a form of cellular defense.
(C) ELISA - (II) Diagnostic test for AIDS
ELISA, or enzyme-linked immunosorbent assay, is a commonly used laboratory test that measures the amounts of antibodies in the blood and can be used as a diagnostic test for AIDS.
(D) Gel Electrophoresis - (I) Separation of DNA fragments
Gel electrophoresis is a laboratory method used to separate mixtures of DNA, RNA, or proteins according to molecular size and charge.

25.Ans.(a)
Explanation
Option (a) is the correct answer as, during isolation of the genetic material, purified DNA ultimately precipitates out after the addition of chilled ethanol.
Option (b) is not the answer as, proteins can be removed by treatment with proteases.
Option (d) is not the answer as RNA can be removed by treatment with ribonuclease.

26.Ans.(b)
Explanation
Option (b) is the correct answer because in gene gun method, microparticles of tungsten or gold are used. Gold or tungsten are inert in nature so they do not alter the chemical composition of cells.

27.Ans. (d)
Explanation
The correct answer is option (d) because recombinant DNA technology involves several steps in specific sequence such as isolation of DNA, fragmentation of DNA by restriction endonucleases, isolation of desired DNA fragment, ligation of the DNA fragment into a vector, transferring the recombinant DNA into the host, culturing the host cells in a medium at large scale and extraction of the desired product.

28.Ans. (d)
Explanation
tRNA interacts with mRNA during translation by matching its anticodon to the mRNA codon. rRNA is part of the ribosome and helps in aligning mRNA and tRNA, facilitating protein synthesis.
RNA interference (RNAi) takes place in all eukaryotic organisms as a method of cellular defence.

29.Ans. (a)
Explanation
Eli Lilly, a pharmaceutical company, was the first to commercialise genetically engineered human insulin under the brand name Humulin.
Scientists inserted the human insulin gene into plasmids, which were then introduced into genetically engineered Escherichia coli bacteria (a type of bacterium).

About us

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