BIOLOGY

NEET

CRASH COURSE

BIOTECHNOLOGY

SMART ACHIEVERS

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BIOTECHNOLOGY : PRINCIPLES & PROCESSES

1. Biotechnology deals with large scale production and marketing of products and processes using live organisms, cells or enzymes.
2. Modern biotechnology using genetically modified organisms was made possible only when man learnt to alter the chemistry of DNA and construct recombinant DNA.
3. This key process is called recombinant DNA technology or genetic engineering.
4. This process involves the use of restriction endonucleases, DNA ligase, appropriate plasmid or viral vectors to isolate and ferry the foreign DNA into host organisms, expression of the foreign gene, purification of the gene product, i.e., the functional protein and finally making a suitable formulation for marketing.
5. Large scale production involves use of bioreactors.

BIOTECHNOLOGY AND ITS APPLICATION

1. Biotechnology has given to humans several useful products by using microbes, plant, animals and their metabolic machinery.
2. Recombinant DNA technology has made it possible to engineer microbes, plants and animals such that they have novel capabilities.
3. Genetically Modified Organisms have been created by using methods other than natural methods to transfer one or more genes from one organism to another, generally using techniques such as recombinant DNA technology.
4. GM plants have been useful in increasing crop yields, reduce postharvest losses and make crops more tolerant of stresses.
5. There are several GM crop plants with improved nutritional value of foods and reduced the reliance on chemical pesticides (pest-resistant crops).
6. Recombinant DNA technological processes have made immense impact in the area of healthcare by enabling mass production of safe and more effective therapeutics.
7. Since the recombinant therapeutics are identical to human proteins, they do not induce unwanted immunological responses and are free from risk of infection as was observed in case of similar products isolated from non-human sources.
8. Human insulin is made in bacteria yet its structure is absolutely identical to that of the natural molecule.
9. Transgenic animals are also used to understand how genes contribute to the development of a disease by serving as models for human diseases, such as cancer, cystic fibrosis, rheumatoid arthritis and Alzheimer's diseases.
10. Gene therapy is the insertion of genes into an individual's cells and tissues to treat diseases especially hereditary diseases.
11. It does so by replacing a defective mutant allele with a functional one or gene targeting which involves gene amplification.
12. Viruses that attack their hosts and introduce their genetic material into the host cell as part of their replication cycle are used as vectors to transfer healthy genes or more recently portions of genes.
13. The current interest in the manipulation of microbes, plants, and animals has raised serious ethical questions.

EXERCISE

BIOTECHNOLOGY : PRINCIPLES & PROCESSES

Q.1 Genetic engineering is :-
(1) Study of extra nuclear gene
(2) Manipulation of genes by artificial method
(3) Manipulation of RNA
(4) Manipulation of enzymes

Q.2 Restriction endonucleases are used in genetic engineering bacause :-
(1) They can degrade harmful proteins
(2) They can join DNA fragments
(3) They can cut DNA at variable site
(4) They can cut DNA at specific base sequences

Q.3 When the genotype of an organism is improved by the addition of foreign gene, the process is called
(1) Tissue culture (2) Genetic diversity (3) Genetic engineering (4) Plastic surgery

Q.4 Chimeric DNA is :-
(1) DNA which contains uracil
(2) DNA synthesized from RNA
(3) Recombinant DNA
(4) DNA which contains single strand

Q.5 Taq - polymerase which is used for amplification of DNA related with :-
(1) Hybridoma technique
(2) PCR-technique
(3) Gene cloning
(4) r-DNA technology

Q.6 Which of the following cuts the DNA from specific places :
(1) Restriction endonuclease
(2) Ligase
(3) Exonuclease
(4) Alkaline phosphate

Q.7 Manipulation of DNA in genetic engineering became possible due to the discovery of :
(1) Restriction endonuclease
(2) DNA ligase
(3) Transcriptase
(4) Primase

Q.8 Restriction enzymes
(1) Are endonucleases which cleave DNA at specific sites
(2) Make DNA complementary to an existing DNA or RNA
(3) Cut or join DNA fragments
(4) Are required in vectorless direct gene transfer.

Q.9 Thermal cycle takes place in which technique :
(1) Gel electrophoresis (2) PCR-technique (3) Centrifugation (4) Southern blotting

Q.10 PCR–technique is used in :
(1) Production of transgenic microbes
(2) Production of genetically modified food
(3) Forensic investigation
(4) r–DNA technique

Q.11 BACs and YACs are :
(1) Natural DNA obtained from bacteria and yeast
(2) Useful vectors for eucaryotic gene transfer
(3) Artificial DNA obtained from bacteria and yeast
(4) (2) & (3) both

Q.12 Electroporation procedure involves :
(1) Fast passage of food through sieve pores in phloem elements with the help of electric stimulation.
(2) Opening of stomatal pores during night by artificial light
(3) Making transient pores in the cell membrane to introduce gene constructs
(4) Purification of saline water with the help of a membrane system.

Q.13 Polyethylene glycol method is used for :
(1) Energy production from sewage (2) Gene transfer without a vector
(3) Biodiesel production (4) Seedless fruit production

Q.14 Transgenic plants are the ones :
(1) Grown in artificial medium after hybridization in the field
(2) Produced by a somatic embryo in artificial medium
(3) Generated by introducing foreign DNA in to a cell and regenerating a plant from that cell
(4) Produced after protoplast fusion in artificial medium

Q.15 Which is not correctly matched :
(1) Agrobacterium — Ti-plasmid (2) Cosmid — Vector DNA
(3) Rhizobium — Asymbiotic N_2 -fixer (4) Albinism — Autosomal recessive gene

Q.16 In transgenics, expression of transgene in target tissue is determined by :
(1) Reporter (2) Enhancer (3) Transgene (4) Promotor

Q.17 Restriction endonucleases are enzymes which :
(1) restrict the action of the enzyme DNA polymerase
(2) remove nucleotides from the ends of the DNA molecule
(3) make cuts at specific positions within the DNA molecule
(4) recognize a specific nucleotide sequence for binding of DNA ligase

Q.18 *Agrobacterium tumefaciens* contains a large plasmid, which induces tumour in the plants it is termed as-
(1) Ti plasmid (2) Ri plasmid
(3) Recombinant plasmid (4) Shine Delgrano sequence

Q.19 Which of the follwing is used as a best genetic vector in plants :
(1) Bacillus thuriengenesis (2) Agrobacterium tumifaciens
(3) Pseudomonas putida (4) All of these

Q.20 A kind of Biotechnology involving manipulation of DNA is
(1) DNA replication (2) Genetic engineering (3) Denaturation (4) Renaturation

Q.21 PCR proceeds in three distinct steps governed by temperature they are in order of :
(1) Denaturation, Annealing, Synthesis (2) Synthesis, Annealing, Denaturation
(3) Annealing, Synthesis, Denaturation (4) Denaturation, Synthesis, Annealing

Q.22 The thermostable enzymes, 'Taq' and 'Pfu', isolated from thermophilic bacteria are :
(1) RNA polymerases (2) DNA polymerases
(3) Restriction endonucleases (4) DNA ligases

Q.23 If a recombinant DNA bearing gene for ampicillin resistance if transferred into E.Coli cells and the host cells are spread on agar plates containing ampicillin, then :
(1) both transformed and untransformed recipient cells will die
(2) both transformed and untrasformed recipient cell will be grow
(3) tranformed recipient cells will grow and untransformed recipient cells will die
(4) transformed recipient cells will die and untransformed recipient cells will grow

Q.24 If hemoglobin (Hb) of a normal individual and a sickle-cell patient are run in electrophoretic field, they will show :
(1) same mobilities (2) different mobilities
(3) Hb of patient will not move at all (4) Hbs are immobile

Q.25 'Transgenic' plants are produced by :-
(1) Inducing gene mutation (2) Arresting spindle fibre formation
(3) Deleting sex chromosomes (4) Introducing foreign genes

Q.26 For a DNA to function as a cloning vector the most essential requirement is :
(1) multiple restriction sites (2) several selectable markers
(3) circular nature (4) 'ori' sequence

BIOTECHNOLOGY AND ITS APPLICATION

Q.27 The name of drug used in cancer treatment produced by biotechnology is
(1) Interferon (2) [HGH] Human growth hormone
(3) TSH (4) Insulin

Q.28 Modern biotechnology consist :
(1) Genetic enginearing (2) tissue culture (3) Microbiology (4) All the above

Q.29 Main objective of production/use of herbicide resistant GM crops is to :
(1) Eliminate weeds from the field without the use of herbicides
(2) Encourage eco-friendly herbicides
(3) Reduce herbicide accumulation in food articles for health safety
(4) Eliminate weeds from the field without the use of manual labour

Q.30 Find the odd one out :
(1) vaccines — immunology (2) eco degradation — pesticides
(3) solar energy converter — pest control (4) recombinant DNA — biotechnology

Q.31 Humulin is :
(1) Antibiotic (2) Insulin (3) Haemoglobin (4) Pepsin

Q.32 Bacillus thuringiensis forms protein crystals which contain insecticidal protein. This protein :
(1) does not kill the carrier bacterium which is itself resistant to this toxin
(2) binds with epithelial cells of midgut of the insect pest ultimately killing it
(3) is coded by several genes including the gene cry
(4) is activated by acid pH of the foregut of the insect pest

Q.33 A transgenic rice (Golden rice) has been developed for increased content of :
(1) Vitamin A (2) Viamin B1 (3) Vitamin C (4) Vitamin D

Q.34 Which scientist obtained interferon through recombinant DNA technology :
(1) Kohler and Milstein (2) Charles Weismann
(3) Nathans & Smith (4) An American firm

Q.35 First transgenic plant :
(1) Potato (2) Tomato (3) Tobacco (4) Maize

Q.36 Introduction of food plants developed by genetic engineering is not desirable because
(1) Economy of developing countries may suffer.
(2) These products are less tasty as compared to the already existing products.
(3) This method is costly.
(4) There is danger of coming viruses and toxins with introduced crop.

Q.37 Cultivation of Bt cotton has been much in the news. The prefix "Bt" means :
(1) "Barium – treated" cotton seeds.
(2) "Bigger thread" variety of cotton with batter tensile strength.
(3) Produced by "biotechnology" using restriction enzymes and ligases.
(4) Carrying an endotoxin gene from Bacillus thuringiensis.

Q.38 The bacteria Pseudomonas is useful because of its ability to :
(1) Transfer genes from one plant to another (2) Decompose a variety of organic compounds
(3) Fix atmospheric nitrogen in the soil (4) Produce a wide variety of antibiotics

Q.39 Which of the following combination of risk are associated with genetically modified food :
(1) Toxicity
(2) Allergic reaction
(3) Antibiotic resistance in microorganism present in alimentary canal
(4) All the above

Q.40 DNA probe is used for :
(1) DNA finger printing
(2) Detection of pathogenic bacteria
(3) Medical genetics to find whether a person carries a particular gene or not
(4) All the above

Q.41 *Bacillus thuringiensis* (Bt) strains have been used for designing novel –
(1) Bioinsecticidal plants (2) Bio–mineralization processes
(3) Biofertilizers (4) Bio–metallurgical techniques

Q.42 What is true about Bt toxin ?
(1) The concerned Bacillus has antitoxins
(2) The inactive protoxin gets converted into active form in the insect gut
(3) Bt protein exists as active toxin in the Bacillus
(4) The activated toxin enters the ovaries of the pest to sterilise it and thus prevent its multiplication

Q.43 Golden rice is a promising transgenic crop. When released for cultivation, it will help in
(1) Alleviation of vitamin A deficiency (2) Pest resistance
(3) Herbicide tolerance (4) Producing a petrol-like fuel from rice

Q.44 An improved variety of transgenic basmati rice :
(1) is completely resistant to all insect pests and diseases of paddy
(2) gives high yield but has no charactristic aroma
(3) does not require chemical fertilizers and growth hormones
(4) give high yield and is rich in vitamin A

Q.45 Genetic engineering has been successfuly used for producing :
(1) transgenic Cow-Roise which produces high fat milk for making ghee
(2) animals like bulls for farm work as they have super power
(3) transgenic mice for testing safety of polio vaccine before use in humans
(4) transgenic models for studying new treatments for certain cardiac diseases

Q.46 The genetically-modified (GM) brinjal in India has been developed for :
(1) Enhancing mineral content (2) Drought-resistance
(3) Insect-resistance (4) Enhancing shelf life

Q.47 Genetically engineered human insulin is called :
(1) Humulin (2) Haematin (3) Hybridoma (4) Hybrid

AIIMS Special

Instructions for following questions (Q.48 to Q.00).
(1) If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then mark (1).
(2) If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2).
(3) If Assertion is true statement but Reason is false, then mark (3).
(4) If both Assertion and Reason are false statements, then mark (4).

BIOTECHNOLOGY : PRINCIPLES & PROCESSES

Q.48 **Assertion :** DNA ligase play important role in recombinant DNA technology.
Reason : The linking of antibiotic resistance gene with plasmid vector became possible by enzyme DNA ligase.

Q.49 **Assertion :** Restriction enzymes belong to a larger class of enzymes called nucleases.
Reason : Each restriction enzyme recognises a specific palindromic nucleotide sequence in the DNA.

Q.50 **Assertion :** During gel electrophoresis, the DNA fragments move towards the anode.
Reason : DNA fragments are negatively charged molecules.

Q.51 **Assertion :** Selection of recombinants due to inactivation of antibiotics is cumbersome procedure.
Reason : It requires simultaneous plating on two plates having different antibiotics.

Q.52 **Assertion :** Taq Polymerase is involved in PCR technique.
Reason : This enzyme remain active during the high temperature including denaturation of double stranded DNA.

Q.53 **Assertion :** Small DNA fragments will arrange towards positive end after the gel electrophoresis in DNA test.
Reason : DNA is negatively charged.

Q.54 **Assertion :** PCR-technique is used in amplification of specific gene.
Reason : In PCR-technique Taq-polymerase enzyme is used and this enzyme is thermosensitive.

BIOTECHNOLOGY AND ITS APPLICATION

Q.55 **Assertion :** RNAi takes place in all eukaryotic organisms as a method of cellular defense.
Reason : Complementary dsRNA molecule binds to specific mRNA and prevents its translation (silencing).

Q.56 **Assertion :** Bt toxin are protein crystals containing insecticidal protein
Reason : B. thuringiensis forms these protein crystals throughout continuously during their growth period.

Q.57 **Assertion :** Recombinant DNA technologies process has been less effective in therapeutic drug production.
Reason : Recombinant therapeutics induce unwanted immunological responses.

Q.58 **Assertion :** Transgenic mice are being used to test the safety of the polio vaccine.
Reason : It could replace the use of monkeys to test the safety of batches of the vaccine.

Q.59 **Assertion :** Indian Government has set up organisation such as GEAC (Genetic Engineering Approval Committee), which will make decisions regarding the validity of GM research and safety of introducing GM organisms for public services.
Reason : Genetic modification of organisms can have unpredictable results when such organism are introduced into the ecosystem.

ANSWER KEY

Q.1	2	Q.2	4	Q.3	3	Q.4	3	Q.5	2	Q.6	1	Q.7	1
Q.8	1	Q.9	2	Q.10	3	Q.11	4	Q.12	3	Q.13	2	Q.14	3
Q.15	3	Q.16	4	Q.17	3	Q.18	1	Q.19	2	Q.20	2	Q.21	1
Q.22	2	Q.23	3	Q.24	2	Q.25	4	Q.26	4	Q.27	1	Q.28	4
Q.29	4	Q.30	3	Q.31	2	Q.32	2	Q.33	1	Q.34	2	Q.35	3
Q.36	4	Q.37	4	Q.38	2	Q.39	4	Q.40	4	Q.41	1	Q.42	2
Q.43	1	Q.44	4	Q.45	3	Q.46	3	Q.47	1	Q.48	1	Q.49	2
Q.50	1	Q.51	1	Q.52	1	Q.53	1	Q.54	3	Q.55	2	Q.56	3
Q.57	4	Q.58	2	Q.59	1								