Chapter 23

Short questions:

1. What is a probe? (LB-2014)

Probe: A probe is a single stranded DNA nucleotide sequence that will hybridize with certain pieces of DNA. Location of the probe is possible to locate because the probe is either radio active or fluorescent. These may be used to find out a particular gene in genomic library

2. What is gene pharming? (LB-2018)

The use of genetic engineering to insert genes that code for useful pharmaceuticals into host animals or plants that would otherwise not express those genes, thus creating a genetically modified organism (GMO)

3. What is aspartame?

Aspartame: It is a Dipeptide sweetener known as NutraSweet. It is made from Phenylalanine. This phenylalanine can be obtained from transgenic bacteria.

4. What is gene therapy?

Gene Therapy: It is the insertion of genetic material into human cells for the treatment of a disorder. e.g. against cystic fibrosis, cancer, hemophilia. It has two main methods.

- Ex-vivo.
- In-vivo.

5. What is cystic fibrosis?

Cystic Fibrosis:- It is a hereditary disease in which the patients lack a gene that codes for Trans-membrane carrier of the chloride ions. The patient dies due to infection in respiratory tract. It may be cured by in-vivo gene-therapy.

6. What is meant by cloning? (LB-2010)

Cloning is the process of producing genetically identical individuals of an organism either naturally or artificially. In nature, many organisms produce clones through asexual reproduction. Cloning in biotechnology refers to the process of creating clones of organisms or copies of cells or DNA fragments.

7. What are Palindromic sequences? (LB-2018, 2021)

Palindromic sequence: It is the sequence of four or six nucleotides in a DNA duplex arranged symmetrically in the reverse order. The bacterial restriction enzymes cut DNA at these specific sites or sequence. These sites are called palindromic sequences.

Example

G C T C A A T T G C T C
C G A G T T A A C G A G

8. What are the various methods of gene or DNA sequencing? (LB-2016)

Sanger sequencing is a method of DNA sequencing first commercialized by Applied Biosystems, based on the selective incorporation of chain-terminating dideoxynucleotides by DNA polymerase during in vitro DNA replication.

Maxam–Gilbert sequencing is a method of DNA sequencing developed by Allan Maxam and Walter Gilbert in 1977–1980. This method is based on nucleobase-specific partial chemical

modification of DNA and subsequent cleavage of the DNA backbone at sites adjacent to the modified nucleotides.

9. What are the two goals of Human Genome Project? (LB-2016, 2018)

One goal of the project was to accurately sequence the 3 billion nucleotide base pairs in the human genome. A second goal was to map and identify all of the human genes present in the DNA sequence.

10. What is the biodegradable plastic and its origin? (LB-2013)

Biodegradable plastic:It is chemically a polyhydroxy- butyrate. A weed called mouse eared cress has been engineered to produce this biodegradable plastic.

11. What is SCID?

It is abbreviation of Severe Combined Immunodeficiency Syndrome. In this disease the children lack an enzyme Adenosine deaminase that is involved in the maturation of T and B lymphocytes. These children are subjected to life threatening infections. This disease can be treated by ex-vivo gene therapy.

12. What is the role of suicide gene in transgenic bacteria? (LB-2013)

Suicide Gene: Some bacteria were made transgenic to clean up the levels of toxins that would have killed other strains. Further these bacteria were given suicide genes that caused them to self destruct when the job had been accomplished.

13. What is the advantage of genetic engineering of C4 plants?

Plants that perform C4 photosynthesis can keep their stomata closed more than their C3 equivalents because they are more efficient in incorporation CO2. This minimizes their water loss.

14. What are transgenic plants. (OR) Give two advantages of transgenic plants. (LB-2011, 2014, 2015)

Transgenic plants are plants that have been genetically engineered, a breeding approach that uses recombinant DNA techniques to create plants with new characteristics.They are identified as a class of genetically modified organism (GMO).

15. What is Ex-vivo gene therapy? (OR) Differentiate between Ex-vivo and In-vivo gene therapy. (LB- 2016, 2017)

In contrast, in vivo work is that which is conducted with living organisms in their normal, intact state, while ex vivo studies are conducted on functional organs that have been removed from the intact organism.

16. What is a genome and genomic library? (OR) Differentiate between genome and genomic library. (OR)

Define genomic library. (LB-2016, 2018)

Genomic Library: A genomic library is a collection of bacterial or bacteriophage clones, each clone containing a particular segment of DNA from the source cell. A probe is used to locate the gene from the collection.

Making Genomic Library: For making genomic library an organism's DNA is sliced up into pieces and pieces are put into vectors (plasmid or virus), which are taken up by host bacteria. The entire collection of bacterial or bacteriophage clones contain all the genes of that organism.

17. What is PCR and write applications of PCR amplification. (OR) What are the uses of PCR amplification and analysis? (LB-2013)

PCR: A process by which DNA polymerase enzyme is used to copy a DNA sequence of interest repeatedly, making millions of copies of the same DNA in a test tube. In this process primers are also added. DNA-polymerase used in PCR is extracted from Thermus aquaticus bacterium which lives in hot springs.

18. What is totipotency? (OR) What is totipotent cell? (OR) Define the term totipotent. (OR) Why plant cells are said to be totipotent? (LB-2014, 2017)

Totipotent:- It means that each plant cell has the full genetic potential of the organism and therefore a single cell could become a complete organism.

19. Define biotechnology. Give its application. (LB-2016)

Biotechnology: is the use of a natural biological system to produce a product or to achieve an end product desired by human.

Uses of Biotechnology:

- To obtain drugs as insulin, vaccines, antibodies, interferons etc.
- To clean up environmental pollutants.
- To kill insect pests.
- To increase soil fertility.
- Gene therapy in humans etc.

20. Define Molecular scissors. (OR) What are restriction enzymes? Give example. (OR) Differentiate between molecular scissors and molecular vectors? (LB-2009, 2018)

Restriction Enzymes: These are natural enzymes of bacteria, which they use for their own protection against viruses. They cut down viral DNA. These enzymes can be isolated and used in biotechnology to cut the gene of interest. e. g EcoR1

21. What is the role of molecular carrier-the vector? (OR (LB-2012, 2013, 2014, 2017)

A plasmid is a small DNA molecule within a cell that is physically separated from chromosomal DNA and can replicate independently. They are most commonly found as small circular, double-stranded DNA molecules in bacteria

22. Explain the importance of gene sequencing. (LB-2010)

DNA sequencing is important to apply to the human genome. It allows scientists to sequence genes and genomes. Since there is a limit to how many bases can be sequenced in one experiment, larger DNA molecules - as mentioned - have to be 'broken' into smaller fragments before they can be sequenced and reassembled

23. Give the process of coronary artery 'angioplasty' briefly, using biotechnology. (LB-2021)

Coronary Artery Angioplasty:

During coronary artery angioplasty, a balloon catheter is sometimes used to open up a closed artery:

Unfortunately the artery has a tendency to close up once again, so investigators have come up With a new procedure.

Coronary Artery Gene-Therapy:

In this method the balloon is coated with a plasmid that contains a gene for vascular endothelial growth factor.

The expression of the gene promotes the proliferation of the blood vessels bypassing the obstructed area. It has been observed in at least on patient.

24. Give any two requirements to produce recombinant DNA. (LB- 2019)

In order to produce recombinant DNA, followings materials are required:

1. **Gene of interest**: which is to be cloned. e.g. Gene of insulin
2. **Molecular scissors**: to cutout the gene of interest, e.g, restriction endonuclease enzymes
3. **Molecular carrier or vector**: on which gene of interest could be placed, e.g, plasmid bacteriophage etc.
4. **Expression system**: the gene of interest along with the vector is then introduced into an expression system, as a result of which a specific product is made, e.g, bacterial cell.

25. What are protoplasts? Give scientific name of biodegradable plastic. (LB-2021)

Protoplasts:

Plant cells whose cell wall has been removed is called protoplast. Protoplasts can be used to introduce genes into the cells.

Bio-degradable plastic: Its scientific name is *polyhydroxybutyrate*.