

SELF ASSESSMENT TEST – ANSWERS

(Chapter 4 : Molecular basis of inheritance)

SECTION – A

Q. 1. Multiple Choice Questions (MCQ) : **(1 mark each)**

- (i) (b) RNA polymerase
- (ii) (d) sigma factor
- (iii) (d) degeneracy
- (iv) (c) point mutation

Q. 2. Very Short Answer Questions (VSA) : **(1 mark each)**

- (i) Two molecules each of histone protein, viz. H₂A, H₂B, H₃ and H₄ are the nucleosomal core histones.
- (ii) Okazaki fragments are formed only on lagging template as only short stretch of lagging template becomes available for replication at one time.

SECTION – B

Q. 3. Short Answer Questions (SA - I) : **(2 marks each)**

- (i) (1) Frederick Griffith – (b) *Streptococcus Pneumoniae*
(2) Avery, McCarty and MacLeod – (a) Test tube assay
(3) Alfred Hershey and Martha Chase – (d) Bacteriophages
(4) Meselson and Stahl – (c) *E. coli*
- (ii) (1) In a typical mammalian cell, length of DNA double helix is approximately 2.2 metres.
(2) The size of typical nucleus is approximately 10⁻⁶ m.
(3) Such a long DNA molecule has to be fitted in small nuclear space.
(4) Therefore, DNA is highly condensed, coiled and supercoiled so that it can be accommodated in the nucleus.

SECTION – C

Q. 4. Short Answer Questions (SA - II) : **(3 marks each)**

- (i) (1) To sequence 3 billion base pairs of DNA in human genome and to map an estimated 33000 genes.
(2) To store the information collected from the project in databases.
(3) To develop tools and techniques for analysis of the data.
(4) Transfer of the related technologies to the private sectors, such as industries.
(5) Taking care of the legal, ethical and social issues which may arise from project.
(6) To sequence the genomes of several other organisms such as bacteria e.g. *E.coli*, *Caenorhabditis elegans*, *Saccharomyces cerevisiae*, *Drosophila*, rice, *Arabidopsis*, *Mus musculus*, etc.

- (ii) (1) An operon is a unit of gene expression and regulation.
- (2) It includes the structural genes and their control elements. Control elements are promoters and operators.
- (3) The structural genes code for proteins, r-RNA and t- RNA that are necessary for all the cells.
- (4) Promoters are signal sequences in DNA. They start the RNA synthesis. They also act as sites where the RNA polymerases are bound during transcription.
- (5) Operators are present between the promoters and structural genes.
- (6) There is repressor protein that binds to the operator region of the operon.
- (7) There are regulatory genes which are responsible for the formation of repressors which interact with operators.

SECTION – D

Q. 5. Long Answer Questions (LA) :

(4 marks)

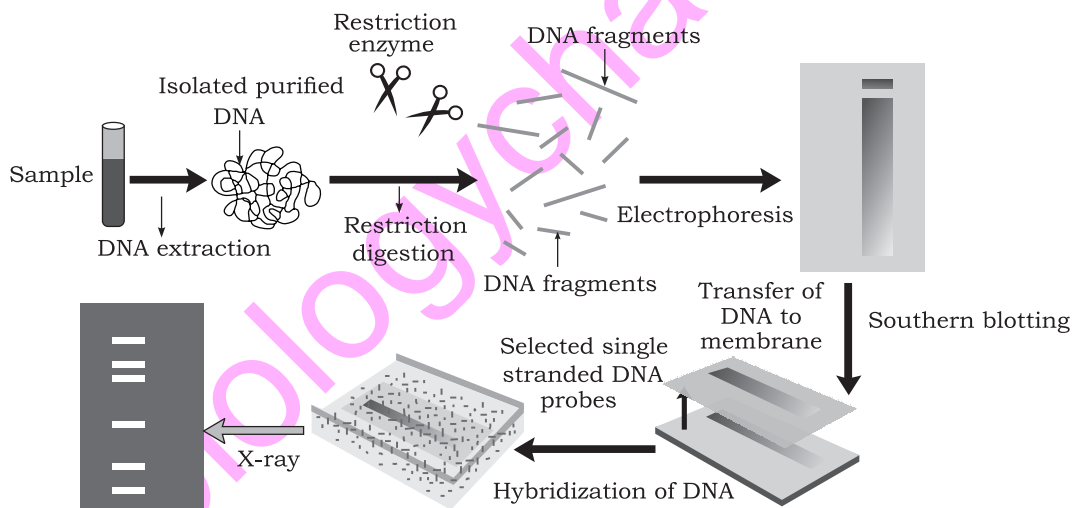


Fig : DNA Fingerprinting

Steps involved in DNA fingerprinting are as follows :

1. **Isolation of DNA :** The DNA can be isolated even from the small amount of tissue like blood, hair roots, skin, etc.
2. **Restriction digestion :**
 - (1) The isolated DNA is treated with restriction enzymes which cut the DNA at specific sites to form small fragments of variable lengths.
 - (2) Variations in the lengths of restriction fragments are known as restriction fragment length Polymorphism (RFLP).

3. Gel electrophoresis :

- (1) The DNA samples are loaded on agarose gel and electrophoresis is carried out.
- (2) Negatively charged DNA fragments move to the positive pole.
- (3) Separation of fragments depends on their length and it results in formation of bands.
- (4) dsDNA is then denatured into ssDNA by alkali treatment.

4. Southern blotting : The separated DNA fragments are transferred to a nylon membrane or a nitrocellulose membrane.

5. Selection of DNA probe :

- (1) DNA Probe is a known sequence of single stranded DNA.
- (2) It is obtained from organisms or prepared by cDNA preparation method.
- (3) The DNA probe is labelled with radioactive isotopes.

6. Hybridization :

- (1) In this process, probe is added to the nitrocellulose membrane containing DNA fragments.
- (2) The single-stranded DNA probe pairs with the complementary base sequence of the DNA strand.
- (3) As a result DNA-DNA hybrids are formed on the nitrocellulose membrane. Unbound single-stranded DNA probe fragments are washed off.

7. Photography : The nitrocellulose membrane is then kept in contact with X-ray film. DNA bands, due to radioactive probe, give photographic image on X-ray film. This is autoradiography.
