

12. Genetic Engineering and Genomics

DNA fingerprinting

- It is the technique to find variations in an individual at DNA level. It is based on the principle of DNA polymorphism.
- DNA fingerprinting was developed by Alec Jeffreys.
- **Polymorphism:** It is the variation at DNA level due to mutation. These variations accumulate and give rise to new species.
- **Application of DNA fingerprinting –**
 - Forensic science
 - Genetic biodiversity
 - Evolutionary biology
- **Applications of recombinant DNA technology in Medicine –**
 - Production of genetically engineered insulin
 - **Gene therapy:** It is the method of insertion of genes into an individual cell to cure genetic disorders.
 - Gene therapy was first used in 1990 to cure adenosine deaminase deficiency.
 - Early diagnosis and understanding of diseases: The techniques involved are –
 - **PCR (polymerase chain reaction):** It amplifies a specific gene into multiple copies. It is used for detecting mutation in a gene.
 - **ELISA (enzyme-linked-immunosorbent serologic assay):** It involves the use of antigen antibody to identify infectious diseases. It is widely used for detecting AIDS.
- **Transgenic animals:** They carry foreign genes that are purposely introduced into their genome; for example, mice, sheep, cows, fish, rabbit.
- **Transgenic animals are used for –**
 - Studying the regulation of genes
 - Understanding the development of diseases
 - Producing useful biological products
 - Testing the safety of vaccines
 - Testing the toxicity of drugs
- The manipulation of microbes/plants/animals has raised certain ethical issues.

- GEAC (Genetic Engineering Approval Committee) in India takes decisions regarding the validity of GM researches and the safety regarding genetically modified organisms.
- **Biopiracy:** It is the theft or robbery of biological resources without the knowledge of the concerned authority.
- **Patent:** It is an exclusive right which is granted for an invention, which could be a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem.
- Patents are awarded on the basis of novelty, non-obviousness, and utility.