DNA FINGERPRINTING

Sometimes also called DNA typing, DNA profiling, DNA testing are the techniques used to distinguish between individuals of species on the basis of differences in their DNA content.

DNA fingerprinting is a form of identification based on sequencing specific non-coding portions of DNA that are known to have a high degree of variability from person to person. These sections are known as Tandem repeats.

Basis of DNA fingerprinting

Most of our DNA is identical to each other, however, there are inherited regions of our DNA that can vary from person to person (such variations are termed as polymorphisms). One such class of polymorphisms is known as *tandem repeats*, which vary within the individual of the species. This forms the basis of genetic fingerprinting.

Tandem repeats

- In a Eukaryotic genome, Tandem repeats are an array of consecutive repeats, known as satellites.

They are of three types based on migration when centrifuged in CsCl density gradient.

1. Satellites.
2. Minisatellites.
3. Microsatellites.

DNA fingerprinting process used today is based on two methods.

- Using VNTR analysis.
- Using STR analysis.

DNA fingerprinting done using restriction enzymes analyses VNTRs

1. DNA is extracted from a sample.
2. DNA is cut into fragments using restriction enzymes.
3. DNA band pattern is transferred into nylon membrane.
4. A radioactive DNA probe is introduced. The DNA probe binds to specific DNA sequences on the nylon membrane.
5. The excess probe material is washed away leaving the unique DNA band pattern.
6. The radioactive DNA pattern is transferred to X- ray film by direct exposure. When developed, the resultant visible pattern is the **DNA FINGERPRINT.**

DNA fingerprinting using STR analysis

- A class of satellite DNA called Short Tandem Repeats (STR) are stretches of DNA containing tandemly repeated nucleotide sequences in which the repeat unit is at least two bases but no more than seven in length. A specific STR is characterized by the sequence of its repeat unit and the number of times that unit is repeated.
- The STRs in use today are all tetra- or penta-nucleotide repeats (4 or 5 repeat units), as these give a high degree of error-free data while being robust enough to survive degradation in non-ideal conditions, longer repeat DNAs are more prone to degradation then shorter repeats. Hence STRs require lesser sample amount than VNTRs
- DNA is extracted from cells found in teeth, bone, tissue, blood, semen, or commonly from buccal cells that are naturally shed and found in saliva.
- Once DNA is isolated, the amplification of the target DNA fragments is done using PCR.
- Capillary electrophoresis with a series of capillaries that separate on sample at a time through an acrylamide polymer that acts as a sieve.
- DNA fragments move through the capillary according to size, the smallest moving the fastest.
- Some of the PCR primers carry a fluorescent dye. This results in fluorescently labeled DNA fragments that can be detected and sized on an Genetic Analyzer.
- The results are in the form of electropherograms. Each peak on the electropherogram represents a fluorescently labeled DNA fragment having a particular size as represented by the number of base pairs, and a particular quantity based on the amount of fluorescent signal.

Applications

- Diagnosis of inherited disorders such as haemophilia, cystic fibrosis etc.
- Developing cures for inherited disorders.
- Forensic or criminal use and determination of paternity cases.
- Personal identification.