

DNA Fingerprinting or DNA Profiling or DNA Typing:

- * Alec Jeffreys (1984) invented DNA fingerprinting technique. He is known as father of DNA fingerprinting.
 - * Dr Lalji Singh - father of Indian fingerprinting
 - * DNA fingerprinting is a technique of determining nucleotide sequences of certain areas of DNA which are unique to each individual. Each person has a unique DNA fingerprint.
- Fingerprints occur only on fingertips and can be altered by surgery, a DNA fingerprint is same for every cell, tissue and organ of a person. It can not be changed by any known treatment.
- * By their differences, about 0.1% or 3×10^6 bp provide individuality to each human being.
 - * Human genome possesses numerous small non-coding but inheritable sequences of bases which are repeated many times. These sequences occur near telomere, centromere, Y-chromosome and heterochromatic area.
- DNA fingerprinting involves identifying differences in some specific regions in DNA sequences called as Repetitive DNA, because in these sequences, a small stretch of DNA is repeated many times.
- * These repetitive DNA are separated from bulk genomic DNA as different peaks during density gradient centrifugation.
 - * The bulk DNA forms major peak and other small peaks are referred to as Satellite DNA.
 - * Depending on base composition (A:T rich or G:C rich), length of segment, and number of repetitive units, the satellite DNA is classified into many categories, such as micro-satellites, mini-satellites etc.
- Mini-satellite sequences → They are 11-60 bp long hypervariable repeat sequences. They are VNTRs used in DNA-fingerprinting.
- Micro-satellite or simple sequence repeats → They have 5-8 bp. These sequences are clustered around centromere and near the ends of chromosome. These repetitive sequences are called Junked DNA.
- * These sequences do not code for any proteins, but they form a large portion of human genome.
 - * These sequences show high degree of polymorphism and form the basis of DNA fingerprinting.
 - * Since DNA from every tissue (such as blood, hair follicle, skin, bone, saliva, sperm etc), from an individual show the same degree of polymorphism, they become very useful identification tool in forensic application.
 - * As the polymorphisms are inheritable from parents to children, DNA fingerprinting is the basis of paternity testing, in case of dispute.
- DNA Polymorphism is the basis of genetic mapping of human genome as well as DNA fingerprinting
- * The term polymorphism is used if more than one variant (allele) at a locus occurs in human population with a frequency greater than 0.01.
 - * The probability of such variation to be observed in non-coding sequence would be higher as mutation in these sequences may not have any immediate effect/impact in an individual's reproductive ability. These mutations keep on accumulating generation after generation and form one of the basis of variability / Polymorphism.
 - * If an inheritable mutation is observed in a population at high frequency, it is referred as DNA Polymorphism.
 - * There is a variety of different type of polymorphism ranging from single nucleotide to very large scale changes.
 - * Such polymorphism play very important role in evolution and speciation.
- Technique for DNA fingerprinting :-
- * It was developed by Alec Jeffreys (1984). It includes
 - (1) Isolation of DNA from nuclei of WBC or spermatozoa or hair follicle cells etc.
 - (2) Cut DNA obtained or digestion of DNA by restriction endonuclease (chemical knife)
 - (3) The DNA fragments are separated according to size by electrophoresis
 - (4) They are treated with alkaline chemicals to split them into ss DNAs.
 - (5) Transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon.
 - (6) Hybridisation using labelled VNTR probe. VNTR (Variable number of Tandem Repeats). The method of hybridisation of DNA with probes is called southern blotting
 - (7) An x-ray film is exposed to the nylon membrane to mark the places where the radioactive DNA probes have bound to the DNA fragments. These places are marked as dark bands when x-ray film is developed. This is known as Autoradiography
 - (8) The dark bands on x-ray film represent the DNA fingerprints (= DNA profiles)
- The VNTRs belong to a class of satellite DNA referred to as mini-satellite. The small DNA sequence is arranged tandemly in many copy numbers. The copy number varies from chromosome to chromosome in an individual. As a result the size of VNTR varies from 0.1 to 20 kb.
- * Consequently, after hybridization with VNTR probe, the autoradiogram gives many bands of differing sizes. These bands give a characteristic pattern for an individual DNA. It differs from individual to individual in a population except in case of monozygotic (identical) twins.
 - * The sensitivity of the technique has been increased by use of polymerase chain reaction (PCR) ∴ DNA from single cell is enough to perform DNA fingerprinting analysis.
 - * DNA fingerprinting is used in determining population and genetic diversities.
 - * Currently, many different probes are used to generate DNA fingerprints. Now a day STRs are used short tandem repeats.