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Decoding the Encoded Evidence: DNA in Forensic Science

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Abstract

Sherlock Holmes said "it has long been an axiom of mine that the little things are infinitely the most important", but never imagined that such a little thing, the DNA molecule, could become perhaps the most powerful single tool in the multifaceted fight against crime. 30 years after the development of DNA fingerprinting, forensic DNA analysis is to the conviction or exoneration of suspects and identification of victims of crime, accidents and mass disaster. As necessity is the mother of all invention, it drives us in the development of modern methods in molecular genetics, statistics, and the use of massive intelligence database.

Keywords: DNA; DNA fingerprinting; Forensic; Crime; Human genome; STR

DNA - Deoxyribonucleic Acid

Calling it as the encoded evidence because it's made up of nucleotide and around 3000 million nucleotide are passed on from parents to offspring and codes for the character of a person. DNA is present in nearly every cell of our bodies, and we leave cells behind everywhere we go without even realizing it. Flakes of skin drop of blood, hair and saline. In case of forensic we frequently rely upon the use of small bits of DNA to link criminal to the crimes they commit. So how does it work? Why DNA? Nothing else? An overwhelming majority of human genome is identical which is called as junk DNA across all individuals. But there are regions of variations and these variations occur anywhere in the genome and are random. These are called as short tandem repeats also called as STR. These are short DNA sequences repeat and are easily measured and compared between individuals. Example of STR is D75820 5-16 GATA repeats.

These repeats are random and hence not only one loci or region containing STR is compared but rather numbers of regions are compared like the FBI use 13 loci and in India 9 loci containing STR is compared. This is due to the fact that based on the principle of independent assortment.

DNA extraction is done from a sample and even the sliest of samples and even in monograms is enough for analysis. PCR amplification of each of the regions containing STR is done, which rEducces the cost of reagents and time of analysis. This is very useful as the partially degraded DNA sample which is often received from the crime scene to be successfully analyzed. STR containing regions are made up of 50-300 hence even the degraded DNA can be analysed. These variable regions are differentiated only by a single base and in the recent time of advancement, automated DNA sequences are analysed and these patterns are compared with a known ladder.

Matching of STR

STR and the bands are matched and if matched, the frequency with which this genotype is observed in the population is calculated. This type of calculations takes into account the frequency with each STR. A simple hardy Weinberg calculation is done. But when the DNA from crime scene is in small quantities, poorly preserved, highly degradation or when only partial DNA profile can be obtained. Other evidence should be used and the term should be fusion of forensic.

Problems

Though it is a very versatile tool but it also has its problem which is related to it. First, DNA fingerprinting is far more technically demanding than DNA diagnostics and second, the scientific community not agrees on, standards that ensure the reliability of the evidence. DNA diagnostic simply requires the identifying whether each parents has passed the rflp to their offspring's. DNA fingerprinting by contrast is more like analytically biochemistry, one must determine whether two completely unknown samples are Identical. DNA fingerprinting also depends on interferences about the frequency with which matching rflp patterns will be found by chance, which in turn rest on simplifying assumptions about population genetics.

Conclusion

This doesn't mean that DNA is not a powerful tool but rather the most powerful but yes with some exceptions. DNA evidence is easy to analyses because genetic material is found in all human cells and with modern technology, the amount of DNA required for analysis can be obtained for even a miniscule biological sample. As forensic science is a science which is largely rooted in probabilities, fusion of evidence and connecting the dots is very important. Lastly, it's a high time to understand that even the smallest of things brings the biggest of changes in the world.

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