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Perspective on DNA-Profiling

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Perspective

The process of obtaining a specific DNA pattern, known as a profile, from a person or a sample of body tissue is known as DNA profiling. Even though we are all unique, the majority of our DNA is identical to that of other people. Specific locations, on the other hand, differ greatly from person to person. The DNA testing process is comprised of four main steps, including extraction, quantitation, amplification, and capillary electrophoresis.

The History of DNA Profiling

Forensic scientists have spent years developing the very accurate testing processes that allow examples like the ones above to be possible. The aforementioned STRs, or short tandem repeats, are used in today's processes. In today's forensics, a single STR can be anywhere from three to five DNA bases long. In the past, substantially longer repetitive portions of bases, ranging from hundreds to tens of thousands, were necessary. When DNA was isolated and fragmented in the past, it was also labelled with radioactive phosphorous and studied with X-ray-sensitive film. It took anything from six to eight weeks to complete the operation.

Because of the conversion to STRs, the procedure is now more streamlined. The switch from gel electrophoresis to capillary electrophoresis to separate DNA is another advancement that has made DNA profiling more effective. Gel electrophoresis cannot sustain electric fields greater than 40 volts, whereas capillary electrophoresis can apply voltages of up to 30,000 volts, cutting separation time in half.

Furthermore, the discovery of a technology known as polymerase chain reaction, or PCR, has dramatically advanced DNA analysis. This method includes repeatedly heating and cooling DNA samples, which “amplifies” the DNA and makes fragments easier to detect. Forensic scientists may now work with less amounts of biological evidence thanks to this breakthrough (which was later honoured with a Nobel Prize, marking a watershed moment in DNA profiling history).

DNA profiling is a technique by which individuals can be identified and compared via their respective DNA profiles

- Satellite DNA — large stretches of DNA made up of repeating components termed short tandem repeats – appears in the non-coding portions of an individual's genome (STRs)
- Individuals will have varying numbers of repeats at distinct satellite DNA loci, resulting in unique DNA profiles.

In criminal investigations (forensics) and to resolve paternity disputes, DNA profiling is routinely utilised.

For both, the technique is the same:

- Satellite DNA (containing STR sequences) is cut using appropriate restriction enzymes to create fragments • A DNA sample is taken (e.g., from blood, semen, saliva, etc.) and then amplified using PCR.
- The fragments are separated using gel electrophoresis and the resulting profiles are compared. • Fragment length will vary between individuals due to the varied length of their short tandem repeats.

Forensic Investigations

If a conviction is to be obtained, suspects must match the DNA sample acquired from the crime site exactly. The number of loci required to create a unique profile is determined by the size of the population under consideration. For example, in comparison to America (population: 320 million), Australia (population: 25 million) utilises only 9 loci.

Paternity testing

Because children inherit half of their chromosomes from both parents, they should have a mix of parental pieces. In other words, either the mother or the father should produce all fragments formed in the infant.

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