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The Body Journal

Learning about our bodies in the best way

Issue
#2

Angélica Berroterán

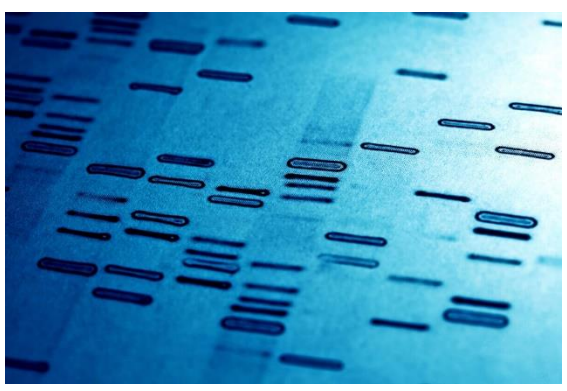
Welcome!

To our new issue

Welcome to the second issue of the magazine The Body Journal! Thank you for choosing us as your source of information about different aspects of the male and female human body in order to understand how it works and why.

In this 2nd issue, you will be introduced to DNA Profiling. We have chosen this theme as the one for this issue of our magazine because this is an interesting topic for everyone interested in it and helps people know about their genetic traits. But now, onto today's lesson!

Our Logo



DNA profiling chart

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DNA Profiling

Before we start with this topic, we have to define what DNA profiling means. DNA profiling, (also called DNA fingerprinting and genetic fingerprinting), is the analysis of DNA samples to determine whether they come from the same person or individual. "But what is the purpose of DNA profiling?," you may ask. Imagine this: A crime has just been committed and the murderer accidentally left body fluids (blood or semen) or small pieces of tissue at the scene or on the victim. How can you know who was the murderer? Through DNA profiling. This is why this process has transformed crime scene investigations, making them easier.

DNA profiling has been around for a long time. Here are some important events in the development of it:

1. Discovery of DNA Structure (1953): The foundation of DNA profiling starts with the discovery of the double-helix structure of DNA by James Watson and Francis Crick in 1953. This discovery provided the basis for understanding how DNA carries genetic information.
2. First DNA Profiling Case (1985): This was the first to include DNA profiling to help find the person who murdered and raped two teenage girls in England.
3. Advancements (Late 1980s and 1990s): DNA profiling evolved with the development of different databases and genetic markers, which made DNA profiling more accessible and precise.
4. The Human Genome Project (1990s and 2000s): The sequencing of the human genome, which began in the 1990s and continued into the 2000s, contributed to the expansion of genetic knowledge and the development of new DNA profiling techniques. We will talk about the expansion of this later.

Even though these are some main events, DNA profiling is always expanding and advancing.

Processes and Relationships

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Wondering how DNA profiling works and its relation to other genetic topics? Read our comparison on the following page.

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Experiments

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Looking for experiments that prove DNA profiling works and its advances? We're on it!

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Advantages & Risks

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Pros and cons of this topic can be found if you read further into our investigation!

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Processes

DNA profiling is a quick process which uses STRs (Short tandem repeats), which are regions of non-coding DNA that contain repeats of the same nucleotide sequence. To create a DNA profile using STR you need to do the following:

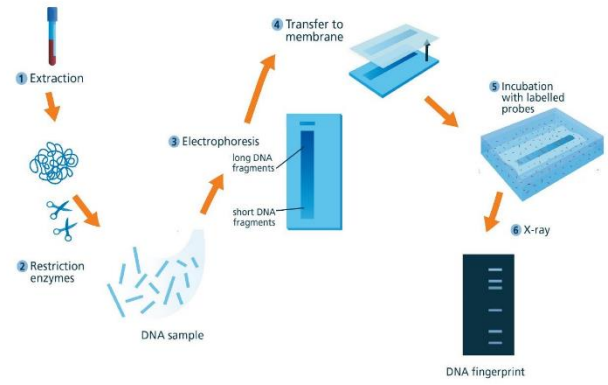
1. Get a sample of DNA: DNA is found in most cells of the body and can be detected in white blood cells, body tissue, body fluids, etc. DNA can also be collected directly from a person using a mouth swab.

2. Extract DNA: DNA is contained within the nucleus of cells. Chemicals are added to break open the cells, extract the DNA and isolate it from other cell components.

3. Copy the DNA: Normally, only small amounts of DNA are available for forensic analysis. The STRs at each genetic locus are copied many times using the polymerase chain reaction (PCR) to get enough DNA to make a profile. Specific primers are used during PCR that attach a fluorescent tag to the copied STRs.

4. Determine the size of the STRs: The size of the STRs at each genetic locus is determined using a genetic analyzer, which separates the copied DNA by gel electrophoresis and can detect the fluorescent dye on each STR.

5. Check for a match: The number of times a nucleotide sequence is repeated in each STR can be calculated from the size of the STRs. This information can help determine if a body fluid sample comes from a particular person. If two DNA profiles from different samples are the same, the chance that the samples came from different people is low. This provides strong evidence that the samples have a common source.



DNA profiling process

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Experiments

DNA profiling has been made part of many experiments through the years, to help adjust and evaluate it correctly. Some of them are:

PCR Amplification of STRs: This experiment involves amplifying Short Tandem Repeats (STRs) from DNA samples using PCR. The PCR products are then separated by size using gel electrophoresis to create a DNA profile.

The Human Genome Project: This project led to the study and comprehension of all of the DNA (known as a genome) of a select set of organisms.

Forensic DNA Analysis: Consisted of simulating a crime scene investigation using DNA profiling.

Gel Electrophoresis for DNA Separation: This experiment demonstrated the separation of DNA fragments based on size using gel electrophoresis. DNA samples with known STR alleles can be run on a gel to visualize the unique banding pattern for each individual.

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Relationships

DNA profiling is related to inheritance through the results DNA profiling produces because the application of this technology and forensic genetics can help solve different problems such as paternity tests and finding what traits, diseases, or conditions an individual has inherited and from which parent it is.

The relationship between DNA replication and DNA profiling is that genetic information is copied and passed on during cell division and from one generation to the next. DNA profiling relies in specific regions of these replications to obtain the genetic variations between individuals. These variations, such as STRs, are inherited from one's parents and remain stable over time, making them valuable markers for identifying individuals.

DNA representation

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Advantages & Risks

Crime Scene Investigation

DNA profiling has various advantages when used. Firstly, DNA profiling provides a high level of accuracy in identifying individuals because each person's DNA is unique. By comparing DNA samples found at crime scenes with those of potential suspects, investigators can establish a strong connection between the individual and the crime, along with identifying who is innocent or guilty.

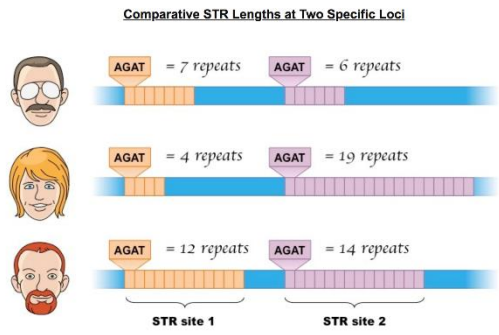
Also, this process is very accurate and law enforcement agencies rely constantly on it. It can help solve recent or ancient crimes thanks to the identification of people. Some crime examples could be. Murder, kidnapping, disappearances, etc.

It can also be used in a medical ambit because, due to its high accuracy, people can know more about their family tree and which traits have been inherited from each parent.

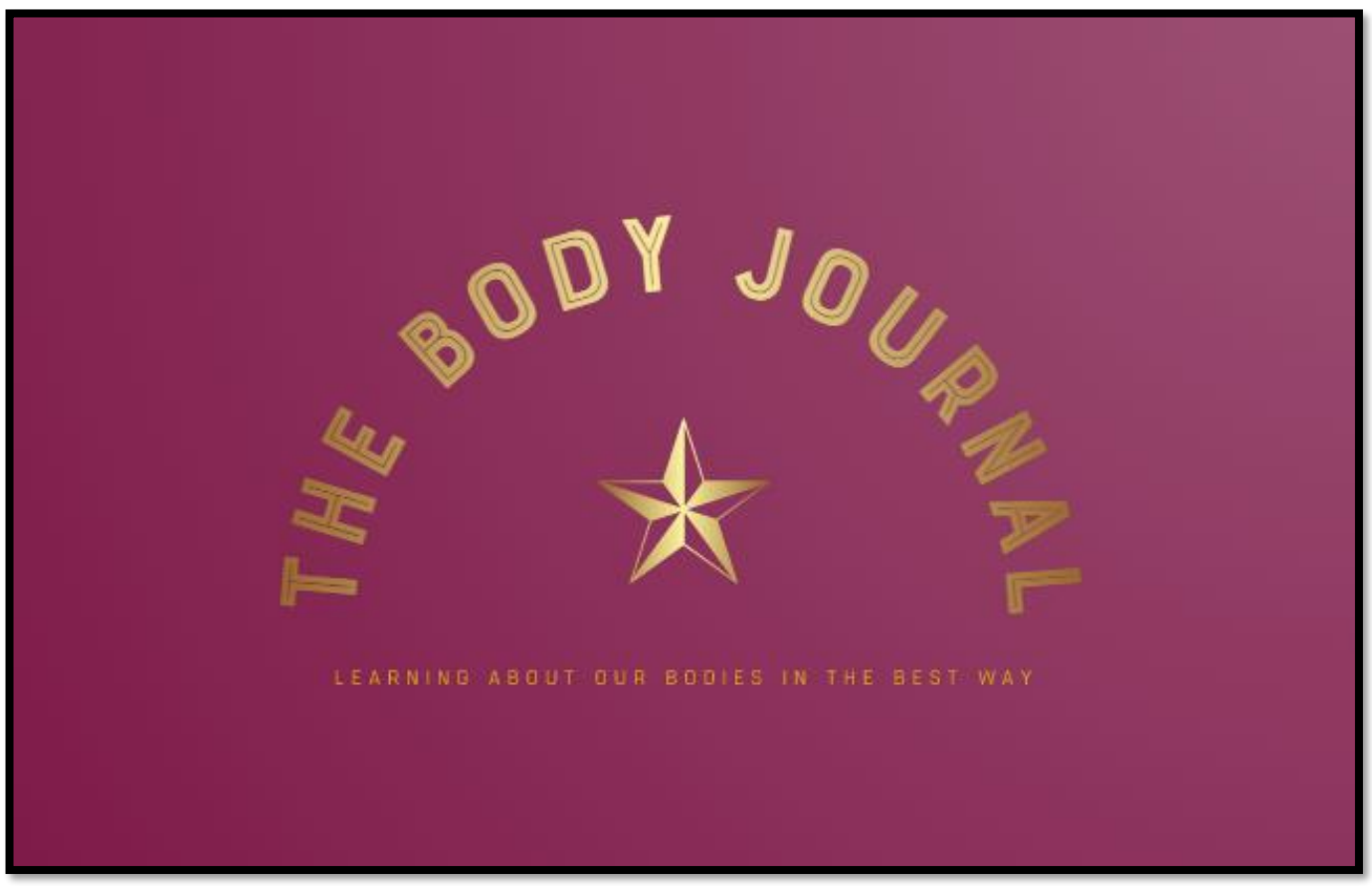
But, even with all its advantages and technology, DNA profiling can still fail. It involves the collection and analysis of an individual's genetic material, which contains highly personal and sensitive information, which can be misused and abused by other people. One of the main concerns is the potential for misuse or abuse of this information.

In addition, there's a risk of false positives and misidentification, which can have significant consequences for innocent individuals.

These are some reasons why some ethical rules about DNA profiling have been established, which include an individuals' rights to privacy (collecting and analyzing an individual's genetic information) because critics argue that DNA profiling can lead to the collection and storage of genetic data without a person's consent.



DNA Comparative profiling chart



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Conclusion and Goodbye

Thanks to this issue of The Body Journal, we can conclude that DNA profiling has been around for an exceptionally long time, helping in crime scenes and medical aspects. Also, even though it has some negative aspects, DNA profiling is an especially useful method to identify the corresponding DNA of a person. All these genetic investigations can be appealing to people because it helps them discover more about their genetic traits and how they pass from one generation onto another.

Well, this was all for today's edition of The Body Journal. We hope to see you soon to learn more about how our body works and its different topics. See you in the next issue!

Bibliography

Our sources which helped with this Issue

Jeffreys, A. J., Wilson, V., & Thein, S. L. (1985). *Hypervariable 'minisatellite' regions in human DNA*. Nature, 314(6006), 67-73.

Butler, J. M. (2005). *Forensic DNA Typing: Biology, Technology, and Genetics of STR Markers*. Academic Press.

National Institute of Justice. (2001). *The FBI's Combined DNA Index System.* Retrieved from https://nij.ojp.gov/.

Jeffreys, A. J. (2013). The man behind the DNA fingerprints: an interview with Professor Sir Alec Jeffreys. *Investigative Genetics*, *4*(1), 21. https://doi.org/10.1186/2041-2223-4-21

DNA profiling. (n.d.). Science Learning Hub. https://www.sciencelearn.org.nz/resources/1980-dna-profiling

The Human Genome Project. (n.d.). Genome.gov. https://www.genome.gov/human-genome-project

DNA-Profiles. (n.d.). Experiment: Forensic Investigation. Retrieved from http://www.dna-profiles.net/experiment.html.

The Editors of Encyclopaedia Britannica. (2023, October 7). *DNA fingerprinting | Definition, Examples, & Facts*. Encyclopedia Britannica. https://www.britannica.com/science/DNA-fingerprinting

Layne, J. (2023, October 4). Pros and Cons of DNA Profiling 2023 | Ablison. *Ablison*. https://www.ablison.com/pros-and-cons-of-dna-profiling/

Letts, B. (2023). Mitochondrial DNA and its use in the forensic analysis of skeletal material. In *Elsevier eBooks* (pp. 213–230). https://doi.org/10.1016/b978-0-12-815766-4.00010-8