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DNA PROFILING

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DNA PROFILING

MATINA TSAILA

Abstract:

DNA, a complex molecule found in all living organisms, carries vital information for their construction. Inherited from one generation to the next, DNA is present in nearly every cell of multicellular organisms, resembling a double helix structure. DNA profiling, pioneered in 1984 by Dr. Alec Jefferys, is a forensic method used to identify individuals based on their unique DNA profiles. This technique, also known as DNA fingerprinting, analyzes specific sections of DNA to match samples in criminal investigations and paternity tests. Despite its utility, it faces challenges such as sample contamination, improper preparation procedures and misinterpretation of results, leading to discrepancies between biological evidence and its legal implications in court cases.

Key words: identification, genetic analysis, forensic science

1. Introduction:

The idea to do a project on DNA profiling was sparked by a discussion that was conducted in class regarding this topic which triggered my curiosity to understand the underlying mechanisms behind this powerful tool. It is fascinating to understand how scientists can use DNA to solve crimes and identify people. First, a thorough online research was conducted, and data were gathered from various sources such as articles, research papers by scientists and videos. All the results gathered are presented using a PowerPoint presentation and this report. The primary goal of this project is to understand the complexities of DNA profiling and learn more about its methodology, applications and significance in modern forensic investigations as well as to help the audience gain a deeper understanding of how DNA profiling manages to solve crimes and identify individuals.

2. Structure

- What is DNA profiling
- DNA profiling
- Timeline of DNA profiling
- Steps in DNA profiling
- Applications of DNA profiling
- Controversies regarding DNA profiling
- The case against DNA evidence

3. What is DNA profiling*?*

DNA profiling is a method used by forensic scientists to aid in identifying individuals or samples based on their unique DNA profiles. While most of the human genome is consistent across the population, approximately 0.9% exhibits variations between individuals. These variable DNA sequences, serve to distinguish and associate individuals with their respective DNA profiles.

4. DNA profiling

DNA fingerprinting is a lab method that identifies a person's identity by analyzing unique sections of their DNA based on the nucleotide sequences. It is mostly used in criminal investigations, forensics, and paternity tests to compare DNA samples from known and unknown individuals. The aim of this, is to find a match between two DNA fingerprints.

5. Timeline of DNA profiling

Forensic DNA analysis was first reported in 1984 by Dr. Alec Jefferys at the University of Leicester when he realized that DNA harbored repeating sequences unique to each individual. After this discovery Dr. Jefferys laid the groundwork for identity tests. Thereafter, in 1987 genetic fingerprinting became accessible when Imperial Chemical Industries, a chemical company in England, established a blood testing center.

6. Steps in DNA profiling:

- Step 1: sample collection

A wide variety of samples, including blood, saliva skin or tissue cells, fingernails, hairs can be collected from crime scenes and used for analysis.

- Step 2: DNA extraction

After the sample arrives at the laboratory, the next step involves extracting DNA from the cells. This process includes inactivation of nucleases and purification the DNA to isolate it from cellular debris.

- Step 3: DNA amplification

To ensure that there is sufficient DNA for downstream analysis, the sequences are amplified using specific methods.

- Step 4: DNA analysis

After amplification, the DNA sample undergoes analysis in a capillary filled with gel that allows smaller sequences to move faster through its pores. At the end of the capillary, a laser beam and a detector scrutinize each sequence.

- Step 5: data comparison and interpretation

7. Applications of DNA profiling

AN IMMIGRATION DISPUTE

A Ghanaian family migrated to the UK and became citizens, but one of their sons returned to Ghana and faced difficulties re-entering the UK due to a forged passport. The family's lawyer reached out to Professor Jeffreys to verify the son's identity as the mother's biological child rather than her nephew, considering the absence of the father and the mother's multiple sisters in Ghana. DNA samples were collected from the mother, the disputed son, and her three other children, confirming that all four children had the same father. This immigration scenario opened the door for using DNA fingerprinting for forensic as well as identity verification purposes.

IDENTIFYING A KILLER

Two young girls in UK were raped and murdered. Although there was a 3-year gap between the two attacks, the police believed that due to similarities, one person was responsible for both. It was a very complicated investigation so, Professor Jeffreys was asked to do DNA profiling on a blood specimen that was taken from the suspect and the two victims. The DNA profiling revealed that the semen from both victims matched, proving that one person had committed both crimes. Unexpectedly, the results also showed that the suspect in custody was not the murderer, leading to their release and marking the first instance of someone being cleared of a crime through DNA evidence. Months later, a woman reported overhearing a conversation where a man claimed to have provided blood for a colleague, Colin Pitchfork. Upon his apprehension and his blood test, DNA matching confirmed Pitchfork as the long-sought perpetrator, resulting in his conviction for both murders. This case underscored the significance of DNA profiling in criminal investigations.

8. Controversies regarding DNA profiling

DNA fingerprinting can encounter significant errors due to

- sample contamination
- improper preparation procedures and
- misinterpretation of results, leading to discrepancies between biological evidence and its legal implications in court cases

Privacy and racial considerations

The criticism regarding privacy rights evaluates multiple aspects, including:

- worries about individuals undergoing testing
- numerous family members inadvertently ensnared in broader criminal investigations
- a specific concern for innocent individuals whose lives could be negatively impacted by being under suspicion

Privacy concerns are crucial, leading to the implementation of measures to regulate the frequency of familial searches and allowing evaluation of the potential consequences before proceeding with a search. Privacy concerns also extend to those wrongly accused of crimes, as social media amplifies the risk of enduring severe reputational harm.

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