

# Forensic Genetics: Scope and It's Application

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**Abstract:** The application of scientific knowledge to judicial or legal issues is known as forensic science. Deducing the identify of a piece of evidence or a suspect in a crime is one of the judicial system's main concerns, and forensic experts are crucial in this process. A developing area of dentistry called forensic odontology deals with the use of dentistry in the court of law. Based on Interpol DVI rules, one of the main elements of identification is dental characteristics. Therefore, one of the key areas of forensic odontology is the identification of unidentified human remains using dental traits. However, the use of DNA technologies takes precedence over its dependability and legal acceptability. Furthermore, there is disagreement on bite-mark analysis's acceptability and usefulness as evidence. To prove a connection between the offender and the victim, salivary DNA may also be found in the bite marks. Recent developments in DNA technologies, such as the ability to use saliva and teeth as sources of DNA, provide significant benefits for using DNA as a person identifier, particularly in cases of severely burned, decomposed, or disfigured bodies, and for connecting the criminal to the crime. In light of this, we offer an overview of forensic genetics applications from the perspective of forensic odontology.

**Key Word -Scope, Application, criminal Investigation, Identification, Justice System**

## INTRODUCTION

In the last 20 years the research and use of genetics has revolutionized forensic science. In 1984, a "DNA fingerprint" was created through the examination of polymorphic DNA regions. The following year, profiling using DNA was successfully applied in an actual case to settle an immigration dispute, at the urging of the United Kingdom Home Office. In 1986, DNA evidence was used in a criminal case for the first time, identifying Colin Pitchfork as the murderer of two schoolgirls in Leicestershire, UK. The conviction came about in January 1988. The forensic community swiftly adopted the use of genetics, and it is now widely used in criminal investigations. For the upcoming

years, forensic science's use of DNA analysis is going to expand in both length and scale.

Depending on the lab and region they operate in, forensic geneticists may do a wide range of tasks, such as paternity testing, identification of human remains, and examination of material seized from crime scenes. It can even occasionally be applied to the study of DNA from microbes, animals, and plants. Materials obtained from crime scenes, along with sample specimens obtained from suspects and victims, are sent to forensic laboratories. In the course of an investigation, forensic geneticists compares samples taken from crime sites with suspects in order to produce an investigation report information can be used in judgement or intelligence that could help with an inquiry.

In certain establishments, a single individual bears the responsibility of gathering proof, conducting biological and genetic examinations of specimens, and eventually presenting the findings in a legal setting. Nonetheless, a common practice in many larger organisations is for people to be simply one very particular duty within the procedure, such as extracting DNA from the evidence or examining and interpreting DNA profiles created by other scientists, is under their control.

## LITERATURE REVIEW

Wilhelm Johannsen coined the term "gene" in 1909. Gene is considered as the string of nucleotides present in DNA or as RNA which produce the ultimate gene product<sup>22</sup>. During the procedure for gene declaration, the DNA firstly gets replicated to RNA subsequently leads to production of proteins that is necessary to the activities in body. The numerous family qualities are passed down from the parents' genes through their descendants. Certain features are obvious to the naked eye, such as physical structure, eye colour, and hair shade, while others, including blood type and

hereditary illness causes, are invisible to the humans. Mutations in genes result in distinct variations in their sequence, referred to as "alleles." Humans have distinct features as a result of these little genetic differences.

DNA, also known as deoxyribonucleic acid, is a molecule made up of nucleic acid chains that are double-helices attached to another<sup>23</sup>. It contains all of the data and guidelines required for the human body to operate. Every organism, whether it is an insect or an animal, possesses DNA. Among the primary elements of life are nucleic acids. Friedrich Meyer extracted the first DNA in 1869, and James Watson explored its structure in 1953.

The term "genome" was first used upon by the professor Hans Winkler around 1920. The entire genome is the term used in biology to refer to the DNA of an organism. It is made up of DNA, including both the noncoding and coding DNA (the genes). The scientific study of genomes is known as genomics, and it is one within the most influential recently established sciences. It is the science of accurately monitoring every gene's activity simultaneously. Once gene activity is measured, it can be applied to food, energy, and health issues. Tom Roderick introduced the term "genomics" in 1986. Genomics has applications in medicine to understand the malfunction in the biological system that leads to disease as well as to detect diseases using genes as markers. Additionally, to investigate the issues in the genetic level through introducing the components that, when put together, result in illness. Many illness treatments are created applying these findings. Applying genomics, the energy sector is breeding plants with the potential to produce bioenergy. To apply genomics to boost production within plant, a genomic or plant expert is necessary. Similarly, a specialist in both neurology and genetics is needed if genomes is intended to be implemented for studying exactly how the human brain works. Several disciplines have been brought together by this fundamental science, creating an interdisciplinary approach.

#### DISCUSSION

The subject of legal genetics has gone through an uproar in the last fifteen years. In nowadays, DNA analyses are commonly carried out to investigate sexual assault, murder, as well as other acts of violence. On such

investigations, the genetic information of defendants or people participating in the perpetrator's DNA database being contrasted to biological trails, like the sperm marks at the place of the crime.

Forensic genetic studies typically occur in investigating crime scenes to determine whether DNA analysis supports the hypothesis the fact that the specimen recovered from a trace originates from a specific person or whether a person with an integrating profile of DNA might be retrieved from a DNA database.

The majority of laboratories use PCR-based techniques to look at multiple STRs in maternity cases. STR regions of DNA pass down as traditional familial characteristics, and the results being subjected to traditional genetic screening. The importance of the proof supporting or refuting paternity is computed based on the relative abundance of the DNA markers under investigation. Various institutes use a restricted length polymorphism method for testing DNA of vary amount of terminal repeat (VNTR) regions. Some labs continue to type for traditional markers like the Rhesus or the ABO blood kinds. No matter whatever genetic tests carried out, extremely high percentages in supporting information could be bought if significant amounts of well-characterized genes are studied.

Determining whether the individuals under investigation are unconnected or connected parent-child is typically the first step in immigration cases. DNA techniques are fairly accurate at identifying across strangers, but they are less successful at separating close relatives.

As techniques for detecting ever tinier levels of DNA are developed, biological material found in cigarette buttes, stamps with postage, and hair strands can be DNA typed and used in criminal cases. Through the use of what is known low number of copies (LCN) DNA approach, a STR identification occurs through a significant PCR procedure to examine a small number of DNA molecules. However, because the technique is highly susceptible to interference with irrelevant DNA, inaccurate findings are frequently obtained. Throughout a while, studies continue to be conducted on the mitochondrial DNA found in hair roots and old, partially disintegrated bones. Since the volume of genetic material is typically very little and the methods frequently exhibit LCN DNA typing capabilities,

caution is needed made to safeguard against interference with unrelated DNA.

It can be challenging to generate a typical DNA composition with the information of the guy in instances if biological traces have been discovered or contain blended of like in the way of male genes and an equally big amount of female DNA. While female DNA doesn't hinder the male Y chromosomes STR DNA's typing, it may be useful to look at STR spots on the Y genome in certain situations.

At scenes of crime, tissue traces of a person who is unknown can provide details on physical characteristics like skin, hair, and shade of eyes. These comprise the crucial variations in genes which currently exist that could possibly present this info. The melanocortin n-1-

receptor gene's DNA contains SNP elements linked to reddish human hair, as well as light coloured locks as well as with freckles skin to a limited extend. SNP markers linked to brown eyes or black hair might be identified in a sequence of DNA coding within the Ago provide protein. With odds ratios ranging from 1 to 10, the relationships are modest, and the research have like significance.

The single most significant development in medical forensics in the latter half of the 20th century was the application of DNA investigation. The greatest achievements of forensic genetics to the battle against crime today are the development and efficient application of DNA databases. More insights from ongoing and upcoming human genome research initiatives will offer more ways to solve crimes.

#### CONCLUSION

The practical use of research findings in assistance is unable to separate from the profession of forensics, genes, since it's a field of expertise in all respects and has an important bearing on society as a whole by supplying trustworthy evidence that can be used to convict offenders as well as clear innocent persons. Thanks to the effective cooperation of the globally scientific group of people, a reliable method for genetic type is now being built, and novel typing.

#### REFERENCE

- [1] ARENAS, M. (2017). FORENSIC GENETICS AND GENOMICS: MUCH MORE THAN JUST A HUMAN AFFAIR. PLOS GENETICS.
- [2] BROWNE, T. N. (2024). NEXT GENERATION SEQUENCING: FORENSIC APPLICATIONS AND POLICY CONSIDERATIONS. WIRES.
- [3] Budowle, b. (2017). Increasing the reach of forensic genetics with massively parallel sequences. SPRINGER LINK.
- [4] Du a, S., Pillai, J. P., & Malik, U. (2022). Forensic genetics. Journal of Oral and Maxillofacial Pathology 26(4):p, 20-20.