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# ***How DNA Technology Is Transforming Forensic Science***

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*Advancing Knowledge in Life Science Research & Innovation*

Forensic science has undergone a profound transformation over the past few decades, driven largely by advances in DNA technology. Once limited to basic identification, DNA analysis now plays a central role in solving crimes, exonerating the innocent, and uncovering long-forgotten truths. Today, cutting-edge innovations are pushing the boundaries even further, bringing speed, precision, and new investigative possibilities to the forefront of justice.

## **From Fingerprints to Genetic Fingerprints**

Traditional forensic methods relied heavily on fingerprints, eyewitness accounts, and physical evidence. While still valuable, these approaches can be limited in scope and reliability. DNA technology, by contrast, provides a unique genetic fingerprint for every individual (except identical twins), allowing investigators to link suspects to crime scenes with remarkable accuracy.

Modern forensic DNA analysis can work with incredibly small or degraded samples, such as a single hair shaft, trace skin cells, or aged biological material, expanding the range of usable evidence.

## **Key Advances Driving Change**

Recent developments in DNA technology are revolutionizing forensic workflows:

- **Next-Generation Sequencing (NGS):** Enables comprehensive analysis of genetic material, including mixed or degraded samples that were previously difficult to interpret.
- **Rapid DNA Testing:** Portable systems can generate DNA profiles within 90 min, allowing for faster suspect identification in time-sensitive cases.
- **Forensic Genetic Genealogy (FGG):** Combines DNA analysis with public genealogy databases to identify unknown individuals by tracing familial relationships.
- **Touch DNA Analysis:** Detects DNA left behind from skin cells after minimal contact, increasing the ability to place individuals at crime scenes.

## **Real-World Impact: Case Examples**

### **1. Solving Cold Cases**

One of the most notable applications of DNA technology is in revisiting unsolved cases. For decades-old investigations, preserved evidence can now be reanalyzed using modern techniques. In several high-profile cases, forensic genetic genealogy has helped identify suspects years after crimes were committed, providing closure to families and communities.

### **2. Exonerating the Innocent**

DNA evidence has been instrumental in overturning wrongful convictions. Organizations like the Innocence Project have used DNA testing to exonerate individuals who were imprisoned based on flawed or incomplete evidence. These cases highlight the critical role of DNA in ensuring justice and accountability.

### **3. Disaster Victim Identification**

In mass disasters, such as plane crashes or natural catastrophes, DNA analysis helps identify victims when traditional methods are not possible. By comparing DNA from remains with that of relatives, forensic teams can provide answers to grieving families.

#### **4. Wildlife and Environmental Forensics**

DNA technology is also being used beyond human crime investigation. Forensic scientists can identify illegally traded wildlife products, trace poaching activities, and monitor biodiversity through environmental DNA (eDNA) sampling.

#### **The Role of Data and Interpretation**

While DNA technology provides powerful tools, accurate interpretation remains essential. Complex samples, such as mixtures from multiple individuals, require advanced analytical methods and expert oversight. Bioinformatics and statistical modeling are increasingly important in ensuring that DNA evidence is interpreted correctly and presented reliably in court.

#### **Looking Ahead**

The future of forensic science is being shaped by continuous innovation in DNA technology. As tools become faster, more sensitive, and more accessible, their impact will extend even further, enhancing public safety, strengthening justice systems, and deepening our understanding of genetic evidence. DNA is no longer just a tool for identification. It is now a powerful lens through which we can uncover truth and bring closure to cases.

#### **ITSI Biosciences: Supporting DNA-Driven Discovery**

With over 21 years of experience in bioanalytical services, ITSI Biosciences is committed to supporting advancements in DNA-based technologies.

Through innovative workflows, robust sample preparation, and expert data analysis, ITSI helps researchers and institutions generate high-quality genetic data for a wide range of applications, including forensic science.

From experimental design to result interpretation, ITSI Biosciences ensures that every dataset delivers meaningful insights, empowering scientists and investigators to make informed decisions.

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**Next Issue:** *Available Methods and Advantages of Preserving DNA at Room Temperature*

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