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# Evolution of the Forensic Science and Law

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## ABSTRACT

*History, progress, advantages, and disadvantages. The discussion delves into the ancient roots of forensic science and how the subject has changed over time in response to shifting societal requirements and technological advances. It also looks at the significant innovations that have shaped forensic science, such as the use of DNA analysis, the founding of forensic laboratories, and the development of new evidence-analysis tools. The discussion focuses on the benefits of forensic science, such as its capacity to solve crimes, identify suspects, and exonerate the innocent, as well as its role in furthering scientific knowledge and improving public safety. It also analyses some of the possible disadvantages of forensic science, such as the risk of relying too much on forensic evidence, technology limits, human mistake, bias, and cost and time restrictions. Finally, the discussion considers the influence of forensic science evolution on the criminal justice system and society as a whole, as well as continuous attempts to enhance the discipline through research, training, and quality control methods.*

## I. INTRODUCTION

*Forensic science plays a role in criminal and civil law. Forensic scientists help determine cause of death, identify perpetrators of crimes, identify bodily remains, track the electronic transfer of money, investigate internet fraud and identity theft, and reconstruct vehicular accidents.<sup>2</sup>*

Forensic science is the examination of crimes and legal problems using scientific methods and ideas. It entails analyzing physical evidence discovered at a crime scene, including as DNA, fingerprints, fibers, and weapons, to identify what occurred, who was involved, and how the crime was done. Forensic science is an important part of the criminal justice system because it provides objective, scientific evidence that may be utilized to solve crimes, identify suspects, and exonerate innocent people. In response to changing social requirements and technical breakthroughs, the discipline of forensic science has changed and developed over time, with the use of DNA analysis and other new technology transforming the way evidence is processed and interpreted.

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<sup>2</sup> Lehman, D.C. (2012) *Introduction to forensic science*, American Society for Clinical Laboratory Science. American Society for Clinical Laboratory Science. Available at: <http://clsjournal.ascls.org/content/25/2/107> (Accessed: April 14, 2023).

Yet, there are also possible downsides to forensic science, such as the risk of relying too much on forensic evidence and the likelihood of human mistake and bias. Despite these obstacles, forensic science continues to play an important part in the criminal justice system, providing critical evidence that can assist establish the facts of a case and ensure justice is served.

## **II. WHY THE WORLD REQUIRES THE EVOLUTION OF FORENSIC SCIENCE?**

Before we proceed with the article's contents, let us first comprehend the main aspect, which is the evolution of forensic science and why it is vital.

Globally, forensic science has seen substantial changes as a result of numerous events, including:

- **Technological advancements:** Rapid technological advancements over the last few decades have enabled forensic experts to assess evidence more precisely and efficiently. For example, the advancement of DNA profiling has transformed how forensic evidence is utilized to identify suspects and solve crimes.
- **Criminal cases have become more complicated over time,** with the need to evaluate and understand an increasing variety of evidence kinds, such as digital evidence, chemical evidence, and biological evidence. To face these new obstacles, forensic science has had to adapt.
- **Standardization is required:** In forensic science, there is an increasing need for standardized processes and standards to guarantee that evidence is gathered, analyzed, and interpreted reliably and correctly. As a result, worldwide guidelines for forensic analysis, such as ISO 17025 and ISO 18385<sup>3</sup>, have been developed.
- **Concerns about reliability:** Some forensic methods, such as bite mark analysis and hair microscope, have been criticized for their dependability and precision. This has resulted in a drive for greater examination and confirmation of forensic methods, as well as the creation of new, more dependable and precise techniques.
- **Forensic science plays an essential role in the criminal justice system,** and there is an increasing recognition of the need for forensic evidence to be used fairly and impartially. This has resulted in a greater focus on forensic science training and education, as well as the need for greater openness and responsibility in the use of forensic evidence in criminal cases.

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<sup>3</sup> *ISO standards* (no date) *SceneSafe*. Available at: <https://scenesafe.co.uk/pages/iso-standards> (Accessed: April 14, 2023).

Overall, changes in forensic science show an increasing awareness of the significance of using scientific evidence to solve crimes and ensure justice is served, as well as the need to adapt to new challenges and technological advances.

### III. MERITS OF HAVING FORENSIC SCIENCE

We may have discussed the importance of forensic science evolution, but the question of why forensic science is important in the first place for us to discuss or have as an important part of the criminal justice system remains unanswered, so let us now go over why forensic science is important and what its advantages are.

Forensic science offers several advantages, including:

- Solving crimes: Forensic science assists in the resolution of crimes by assessing evidence discovered at the crime site. It can provide important details about suspects, victims, and the circumstances surrounding a crime.
- Identifying suspects: With the study of DNA, fingerprints, and other physical evidence, forensic science may be utilized to identify suspects. This can lead to more efficient and successful investigations by narrowing the pool of prospective suspects.
- Forensic science may also be used to exonerate someone who have been wrongfully charged or convicted of a crime. DNA evidence, in particular, has proven critical in exonerating many wrongfully condemned persons.
- Forensic evidence can be used to support legal procedures, such as criminal trials, civil litigation, and administrative hearings. It provides objective, scientific data that can aid in the establishment of facts and the resolution of conflicts.
- Forensic science has contributed to the growth of scientific knowledge in a number of domains, including chemistry<sup>4</sup>, biology<sup>5</sup>, and physics<sup>6</sup>. New discoveries and applications in these sectors have resulted from the development of new techniques and technology.
- Increasing public safety: By identifying and prosecuting persons who constitute a threat to society, the use of forensic evidence in criminal investigations and prosecutions can

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<sup>4</sup> *Forensic chemistry: What it is and what it does* (2023) Perkins School for the Blind. Available at: <https://www.perkins.org/resource/forensic-chemistry-what-it-and-what-it-does/> (Accessed: April 14, 2023).

<sup>5</sup> *Forensic biology* (no date) *Forensic Biology | Chestnut Hill College*. Available at: <https://www.chc.edu/natural-behavioral-sciences/forensic-biology> (Accessed: April 14, 2023).

<sup>6</sup> *Home* (no date) *GOVERNMENT INSTITUTE OF FORENSIC SCIENCE*. Available at: <https://gifsa.ac.in/forensic-physics/> (Accessed: April 14, 2023).

serve to increase public safety.

Ultimately, forensic science is important in the criminal justice system and in society. It provides objective, scientific evidence that can aid in the resolution of crimes, the identification of suspects, and the exoneration of the innocent, all while increasing scientific knowledge and improving public safety.

#### **IV. DRAWBACKS OF THE EVOLUTION OF FORENSIC SCIENCE**

Well! When we debate any part of the components that worry society, we can never imagine that we can design that aspect without any loopholes or drawbacks; that aspect can be beneficial for most of the people but not for the full masses touched by it.

While the advancement of forensic science has resulted in several advantages, there are also negatives to consider:

- **Overreliance on forensic evidence:** There is a danger of overreliance on forensic evidence, which might lead to false convictions. In court, forensic evidence may be quite strong, but it must be used in concert with other evidence and accurately evaluated.
- **While technological developments have allowed forensic experts to evaluate evidence more accurately, there are still limitations to what can be studied and how credible the results are.** In certain circumstances, technology may be insufficient to assess specific forms of evidence or deliver reliable results.
- **Human error:** Human error can still occur in forensic analysis, leading to errors in evidence collection, processing, and interpretation. This can lead to inaccurate conclusions or mismanaged evidence, perhaps leading to unjust convictions or acquittals.
- **Bias:** Whether deliberate or inadvertent, prejudice exists in forensic analysis. Prejudice can result from a variety of sources, including prior cases, personal viewpoints, and cultural biases. It is critical to avoid prejudice at all phases of forensic investigation.
- **Cost and time:** Forensic analysis may be costly and time-consuming, limiting its availability and accessibility, particularly in underserved areas. As a result, certain instances may receive less attention or be explored insufficiently.

Thus, while the advancement of forensic science has resulted in several benefits, it is critical to be aware of these possible negatives and endeavour to overcome them by continuous research, training, and quality control procedures.

## V. GLOBAL EVOLUTION OF THE FORENSIC SCIENCE

Internationally, forensic science has developed, with nations adopting their own methodologies and approaches to forensic inquiry. Fingerprinting was used to identify papers and clay sculptures in ancient China, making it one of the first known examples of forensic science.<sup>7</sup> The use of forensic medicine to solve crimes stretches back to the 18th century in Europe, with the work of Frenchman Mathieu Orfila<sup>8</sup> considered a watershed moment in the evolution of forensic science. In the United States, forensic science gained prominence in the early twentieth century, with the Los Angeles Police Department establishing the first forensic laboratory in 1923<sup>9</sup>.

Forensic science is now done all over the world, with developments in technology and communication allowing for more collaboration and exchange of best practices across foreign forensic groups. DNA analysis, for example, has become a widely acknowledged tool in forensic investigations across the world, resulting in the identification and apprehension of suspects in instances that would otherwise have gone unresolved.

International organizations such as INTERPOL and the International Association of Forensic Sciences (IAFS) have been formed to enhance international collaboration and information exchange among forensic scientists and law enforcement agencies. The IAFS, in particular, plays a significant role in establishing worldwide forensic science standards and best practices, as well as enabling forensic science education and training programs.

Despite progress in the worldwide evolution of forensic science, obstacles persist, such as disparities in resources and competence among nations, as well as the necessity for continual research and development to keep up with technological improvements. Yet, continuous collaboration and cooperation across worldwide forensic groups provides promise for additional improvement in the area, as well as the possibility for improved justice and public safety on a global scale.

Forensic science has changed greatly over time, with technological and scientific improvements allowing for better precision and dependability in criminal investigations. Following are some significant turning points in the history of forensic science:

- Sir William Herschel introduces the use of fingerprints as a form of identification in

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<sup>7</sup> <https://www.ojp.gov/pdffiles1/nij/225321.pdf> (the fingerprint sourcebook by Jeffrey G. Barnes)

<sup>8</sup> *Visible proofs: Forensic Views of the body: Galleries: Biographies: Mathieu Joseph Bonaventure Orfila (1787–1853)* (2014) U.S. National Library of Medicine. National Institutes of Health. Available at: <https://www.nlm.nih.gov/exhibition/visibleproofs/galleries/biographies/orfila.html> (Accessed: April 14, 2023).

<sup>9</sup> (no date) *America's First Crime Lab*. Available at: <https://www.laalmanac.com/crime/cr720.php> (Accessed: April 14, 2023).

India in the nineteenth century.<sup>10</sup>

- The emergence of forensic toxicology, the study of the effects of drugs and poisons on the body, as well as the use of blood type for identification purposes, occurred in the twentieth century.<sup>11</sup>
- The Los Angeles Police Department establishes the first crime laboratory, which includes a forensic science unit, in 1923.
- The FBI creates its own forensic laboratory in 1932, which becomes a valuable resource for law enforcement departments around the country.<sup>12</sup>
- James Watson and Francis Crick discover the structure of DNA in 1953, paving the way for DNA profiling as a forensic technique in the 1980s.<sup>13</sup>
- 1970s: With the creation of databases for fingerprint and DNA analysis, computer technology becomes a significant tool in forensic research.<sup>14</sup>
- 1990s: The use of DNA evidence in criminal investigations becomes prevalent, resulting to the exoneration of many falsely convicted persons.<sup>15</sup>
- The development of increasingly advanced DNA analysis techniques, as well as new tools for assessing digital evidence, continues to transform criminal investigations in the twenty-first century.<sup>16</sup>

Overall, the advancement of forensic science has allowed investigators to more correctly and consistently identify offenders and exonerate innocent people, so ensuring that justice is served.

## VI. INDIAN EVOLUTION

Forensic evidence has long been used in criminal investigations and prosecutions in India. These

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<sup>10</sup> (no date) *History of fingerprints*. Available at: <https://onin.com/fp/fphistory.html> (Accessed: April 14, 2023).

<sup>11</sup> *Forensic toxicology and its relevance with criminal justice delivery system in India* (2017) *Forensic Research & Criminology International Journal*. MedCrave Publishing. Available at: <https://medcraveonline.com/FRCIJ/forensic-toxicology-and-its-relevance-with-criminal-justice-delivery-system-in-india.html> (Accessed: April 14, 2023).

<sup>12</sup> *The birth of the FBI's technical laboratory-1924 to 1935* (2016) *FBI*. FBI. Available at: <https://www.fbi.gov/history/history-publications-reports/the-birth-of-the-fbis-technical-laboratory1924-to-1935> (Accessed: April 14, 2023).

<sup>13</sup> *The discovery of The double helix, 1951-1953 | Francis Crick - profiles in Science* (no date) *U.S. National Library of Medicine*. National Institutes of Health. Available at: <https://profiles.nlm.nih.gov/spotlight/sc/feature/doublehelix> (Accessed: April 14, 2023).

<sup>14</sup> *Supra* Note 10.

<sup>15</sup> LaPorte, G.M. (no date) *Wrongful convictions and DNA exonerations: Understanding the role of forensic science*, *National Institute of Justice*. Available at: <https://nij.ojp.gov/topics/articles/wrongful-convictions-and-dna-exonerations-understanding-role-forensic-science> (Accessed: April 14, 2023).

<sup>16</sup> <https://www.ojp.gov/pdffiles1/nij/grants/248770.pdf> (digital evidence and the US criminal system)

are some significant turning points in the growth of forensic science and law in India:

- India in the past: The Indian court system, which dates back to ancient times, has a long history of employing scientific approaches in the investigation and adjudication of criminal cases. For example, in the *Arthashastra* and *Manusmriti*, ancient Indian literature discuss the use of fingerprints, footprints, and handwriting analysis to solve crimes.<sup>17</sup>
- During the British colonial period, contemporary forensic procedures including as fingerprinting and ballistics analysis were introduced to India. In 1878, the first forensic laboratory in India was founded in Kolkata.<sup>18</sup>
- The Forensic Science Laboratory in Calcutta was founded in 1952 and has since become a vital resource for law enforcement organizations around the country.<sup>19</sup>
- The Indian Evidence Act was revised in 1984 to incorporate rules for the admission of scientific evidence, including forensic evidence, in court.
- In the 2000s, India made major expenditures in forensic science, establishing many new forensic facilities around the country and introducing novel methods like as DNA profiling.
- The Criminal Law (Amendment) Act of 2013 was enacted in reaction to a high-profile gang rape and murder of a young lady in Delhi. The new legislation incorporated various forensic evidence measures, including obligatory DNA profiling of convicted perpetrators.

Overall, both traditional traditions and modern scientific approaches have affected the growth of forensic science and law in India. In recent years, the government has made tremendous progress in expanding its forensic infrastructure and in utilising scientific evidence to assist guarantee that justice is delivered.

## VII. CONCLUSION

To summarize, the advancement of forensic science has had a profound influence on the criminal justice system and society at large. From its early beginnings through present methods, forensic science has evolved in response to shifting societal requirements and technological

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<sup>17</sup> *Judiciary in ancient India " IILS blog* (2015) *IILS Blog*. Available at: <https://www.iilsindia.com/blogs/judiciary-in-ancient-india/> (Accessed: April 14, 2023).

<sup>18</sup> *Information retrieval in medicine: Overview and applications*. <https://www.jpgmonline.com/article.asp?issn=0022-3859;year=2000;volume=46;issue=2;spage=116;epage=22;aulast=Nadkarni> (Accessed: April 14, 2023).

<sup>19</sup> *Ibid*.

advances. The application of scientific methods and technology has allowed forensic scientists to evaluate evidence more precisely and rapidly, resulting in better outcomes in criminal investigations and judicial trials. While there have been certain problems connected with the growth of forensic science, they have been addressed via continual research, training, and quality control methods. As technology advances, it is believed that the area of forensic science will continue to evolve, strengthening its capabilities and contributing to the expansion of scientific knowledge in a variety of sectors.

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