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# Collaboration of Forensic Science and Law

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**Abstract**

In present era, due to the progression in criminal justice system there has been a remarkable advancement of forensic sciences in the field of criminal justice system. Forensic science has its application in almost all of the criminal matters however investigations of homicides, arson and rape.[1] Forensic evidences fulfill several roles by establishing the key aspects of crime, identity of the people associated with the crime, proving the methods of committing the crime and by exculpating the innocent. In 1952, India's first State Forensic Science laboratory (SFSL) was established at Calcutta which became fully operational in 1953.[1-3] India's first Central Forensic Science Laboratory (CFSL) was established at Calcutta in 1957.[6,7] In the new modern technological era the emergence of DNA testing has become a major factor in upgrading the roles of forensic science from being just a viewer to main key player in the legal system.[11,13] Methods such as to raise the awareness and improved collaboration between forensic science and criminal sectors could be achieved by Cross Forensic Science Disciplinary Lerning and Teaching (CFSDLT). Current Indian scenario is highlighting the facts of section 45 and 46 of Indian Evidence Act 1872.[5]

**Keywords:** Criminal Justice System; Forensic evidences; State forensic science laboratory (SFSL); Central forensic science laboratory (CFSL); Cross forensic science disciplinary learning and Teaching (CFSDLT); DNA testing; Indian Evidence Act.

## Introduction

Forensic science is defined as an application of science to the matters of law.[1] It plays an integral role in the field of law. Forensic science has its application in almost all of the criminal matters however investigations of homicides, arson and rape are those that are benefited the most from forensic sciences.[1,2] In the nineteenth century the seeds of forensic science were sown in India. From that time the progress has been slow but steady. In 1952, India's first state Forensic Science laboratory was established at Calcutta which became fully operational in 1953.[1-3] The Medico legal section of Chemical Examiner's laboratory was also transferred to this laboratory. India's first Central Forensic Science Laboratory (CFSL) was established at Calcutta in 1957.[6,7]The CFSL consists of four basic disciplines – Forensic Physics, Forensic Chemistry, Forensic Biology, and Forensic Ballistics. Forensic scientists have expertise in analyzing the crime scenes and evidences to create a visualization of how a crime occurred.[6] This is carried out either individually or in teams. Forensic labs require advance technologies where the investigative conditions can be controlled and monitored with precision. Well trained forensic scientists serves as a determining factor for appropriately representing the fact of a case by linking the evidences that are thought to be related to one another. Linking evidences and crimes would help the law enforcement authorities to narrow the range of suspect and ensures that justice is served and innocent person remains free.

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*Role of Forensic Science in Criminal Justice System*

The collections of forensic evidences have become essential to criminal proceedings. It fulfills several roles that are as follows:[1,2,7]

- Establishes key aspects of crime.
- Establishes the identity of people associated with the crime.
- Proves the location of crime.
- Proves the method of committing the crime.
- Exculpate the innocent.

Every crime scene is exceptional in nature and each case presents its own challenges.

It provides scientifically based information by using the clues such as fingerprints, footprints, blood drops, hairs, weapons etc.[7] Detailed studies have shown that the use of these scientific evidences in the investigation process was largely funded by NIJ (National Institute of Justice) in the 1980s. At the level of criminal investigation, Peterson et al. have shown that the rates of solved cases using the scientific evidences are three times greater than the cases that do not use the scientific evidences. It is also shown that the forensic lab reports are the only evidence to have influence over the length of sentence. In 2008 Roman et al. stated that recent studies on DNA evidences became much more effective than fingerprinting in solving the cases. Due to the emergence of DNA technology, serves as a wonderful method of providing information to investigative officers that enables them to identify the criminal.

*Common Evidences in Forensic/Crime Laboratories*

- *Body fluids:* It includes blood, saliva, semen, collected from the fabric of crime scene. These materials are collected on sterile swabs and are used for possible identification through serological techniques. In most of the cases other excretion fluids such as urine feces are also used for identification and is thoroughly examine in the laboratories.[6,7]
- *Fibers:* Any fiber which might be of victim's shirt found on knife blade is examined using techniques such as stereo microscope to find a link between the evidence and victim.[6,7]
- *Drugs:* Any drug found in victim's body taken up in the form of tablets, powder, capsules (that are found containing hallucinogen, lysergic acid diethylamide) or any other preparation whose excessive amount victim's body acts as a poison and become the cause of death.[6,7]
- *Finger, palm and foot prints:* Different prints casted from various surfaces for the purpose of identification and comparison. Impression of footwear and tires are also included in this category. These evidences form possibilities of reaching to an assumption which will act as a lead in solving the cases.[6,7]
- *Firearms, bullets and other explosives:* are include under this category. It includes distance determination, bullet test firing and operability of firearms.[6,7]
- *Glass:* A possibility arises that the glass traces, large sections, fragments obtained from the crime scene or obtained from the body of victim help in finding an association that will tell us either the place of crime or weapon of crime.[6,7]
- *Hair:* Obtained from crime scene is responsible for identifying to whom it is matched either to the victim or the suspect. The examination and interpretation of this evidence helps in determining whether the hair was forcefully removed or snatched, burned, cut or fallen naturally.[6,7]
- *Oil, grease and cosmetics products:* Oil and grease are the useful evidences which provides direction to the investigators to reach a conclusion. It helps in including or excluding a suspect.[6,7]
- *Paint and Paints products:* Such an evidence is useful in comparing the vehicular paint fragments from the clothing of hit and run victim and a suspect vehicle.[6,7]
- *Soils, woods and vegetation:* These are used to find out the location that is possibly associated with victim or suspect.[6,7]
- *Tool marks:* Impression of scars or cuts on victims body enables in identifying tool that produces them.[6,7]
- *Questioned document:* including handwritten or typed are examined.[6,7]

*Role of DNA Testing in Forensic Sciences*

In criminal justice procedure DNA testing has been established. It has been used to convict the guilty and exonerate the innocent.[11]

DNA has been always useful for testing because of the following reasons:

- It differs from individual to individual (except in identical twins).
- It is same throughout life.
- It is found in all cells (except mature red blood cells).

DNA testing requires more advancement in technologies and systems in order to collect evidences which would help in criminal proceedings.[11,12] Switching of Restriction Fragment Length Polymorphism (RFLP) to Polymerase Chain Reaction (PCR) is an effective way of testing as turn around time of RFLP has been reduced on the contrary PCR is more promising as it takes only days to perform.[12] Another important effective technique used in this is southern blotting developed by Edward Southern in 1975.[11,13] The utilization of DNA testing in forensics has been considered as an outgrowth of molecular biology. Its analysis involves those capabilities that are not found in most of the forensic disciplines. It has the power to potentially recognize the culprit.

According to the Current Indian Scenario,

As per section 45 of Indian Evidence Act 1872 stated the Opinion of expert: - "When the court has to form an opinion upon a point of foreign law or of science or art or as to identity of handwriting, the opinions upon that point of persons especially skilled in such foreign law, science or art are relevant facts. Such persons are called as experts.[5]

As per section 46 of Indian Evidence Act 1872 stated Facts upon opinion of experts- Facts are not otherwise relevant they are relevant if they support or are inconsistent with the opinion of experts when such opinions are relevant.[5]

Elements of section 45 and section 46 are highlighted below:

- When necessary the court will rely on skills of person who have technical knowledge of the facts concerned.
- Courts rely on genuine statements of proof given by forensic experts.
- In law the irrelevant evidences would be given relevance if they are consistent with the opinion of experts.[2,5,12]

## Methods

Due to the diversity in crime types, it is now essential to raise the awareness and improved collaboration between forensic science and criminal sectors. This could be achieved by a way in which we teach our forensic scientist. Cross Forensic Science Disciplinary Lerning and Teaching (CFSDLT) is now essential and are made compulsory in higher education so that the upcoming forensic scientists should have proper knowledge of investigating crimes using forensic skills.[3,4]

CFSDLT includes following methods that are as follows:

- *The General Intelligence Process:* It involves an iterative cycle of planning, collection, collation, dissemination, analysis and feedback. The main objective of this method is to convert the raw data timely and progressively into hypothesis and intelligence that allows the forensic experts to make a decision. It encircles a diversity of criminal investigation problems. It encounters a collaborative approach and development of explicit and alternative hypothesis.[3]
- *Designing an Informative Chart:* For the analysis of investigative problems and their relationships with time and space. It tells us the exact data of how many cases are filled every year w.r.t to various forensic sciences branches . The chart shown below completely depicting the facts in which highest filed cases are of Forensic chemistry.[3] (Fig. 1)
- *Visualization Methods:* acts as a catalyser for collaborative approach.

It relies upon methods that are significant in scope. It includes:

1. *Explore:* All the forensic records such as fingerprinting records, telephone records, transaction records are explored using visual concepts.

   It helps to discover correlations as well as errors and missing data. Its efficacy results in better analysis of crime.

2. *Evaluate:* After exploring the data it is then evaluated using specific links obtain through various charts, graphs that enables the experts to make decisions on their inquires.
3. *Communication:* Following evaluation, it allows the crime investigators to question the suspects on the basis of evaluated evidences. Before leading to mathematical formulas and computations identification team forces the suspects in order to identify the real culprit.
4. *Memory:* It plays an important role as investigators use them at the time of summarizing the evidences in the court.[3,4]

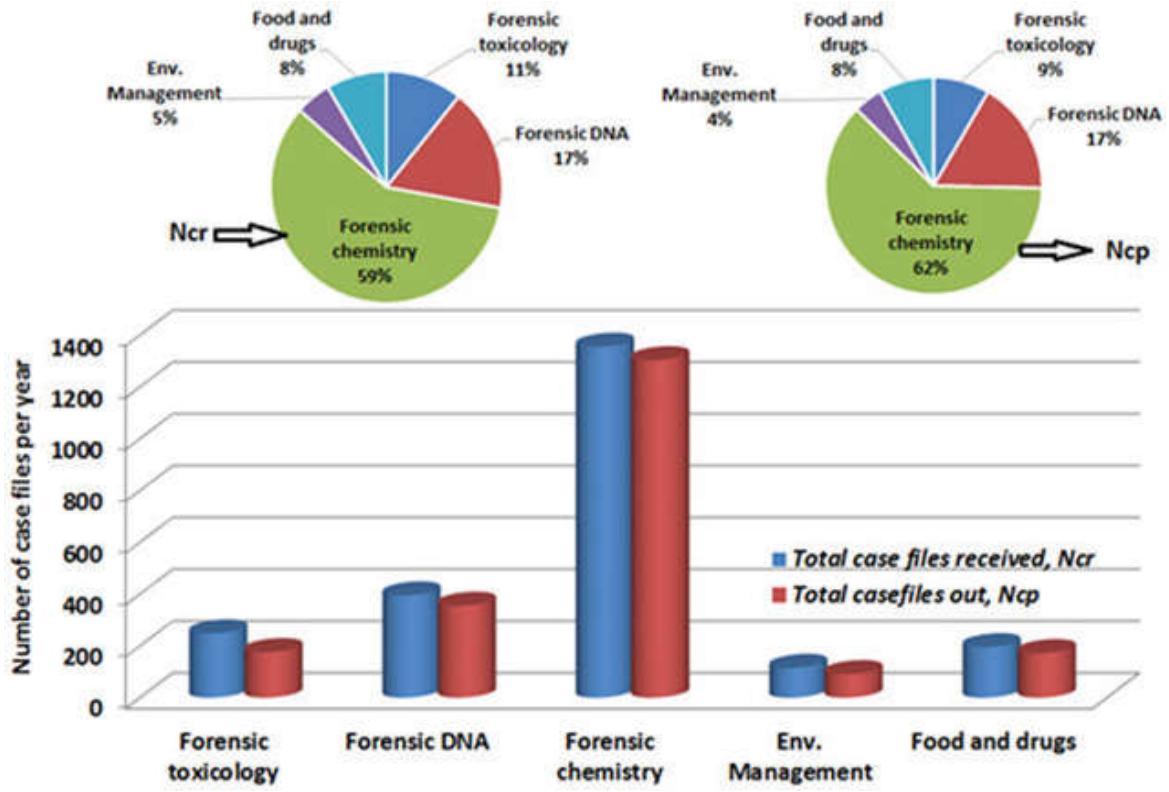


**Fig. 1:** Chart representing branches of forensics and the cases filed against them every year.

Additionally, there is 5W+H model ie. (Who, What, When, Where, Why and How) is considered an effective investigative approach to solve the legal cases.[8]

*Forensics and Criminal Justice Goes Hand in Hand*

Listing below are few crimes that involve the use of forensic evidences to reach to a conclusion:

- *Burglary:* These are the crimes which are mostly committed by young males that are mostly strangers and the ones who kept their eyes closely on the houses or apartments. In such cases police collects physical evidences of which high percentage of latent print is collected and is submitted to the forensic labs for reaching to any decision.[1,8,9]
- *Homicide:* In these cases, 85% suspects know their victims. Police collect the evidences such as bloody knife which is then submitted to forensic labs for ensuring the link of that murdered weapon with the suspect. In other cases where drugs are use for murder forensic toxicological experts are involved in solving the cases.[1,8,9]
- *Rape:* Cases that are quite sensitive and needs to solve at the utmost priority basis. In such cases submitted evidences include semen, vaginal, blood and latent print. These evidences are examined and their timely reports help the legal proceedings in identifying the criminal.[1,8,9]

*Impression of Forensic Evidences on Criminal Justice System by NIJ (National Institute of Justice)*

For investigating the role of forensic sciences in criminal justice system NIJ has established 4 major goals:

- Estimation of percentage of crime cases from which different types of forensic evidence is collected.
- Description of types of forensic evidence collected at crime areas.
- Analysis of use of forensic evidence in crime scenes by laboratory analysis.
- Identification of form of forensic evidence that is involved in solving most of the crime cases.[9,10]

To achieve these goals the potential analysis of recorded data that followed crime cases in five jurisdictions (Los Angeles County; Indianapolis,

IN; Evansville, IN; Fort Wayne, IN; and South Bend, IN) from the time of crime reported to criminal disposition. (Table 1)

**Table 1:** Reported Crime Incidents.

| | LA | Indianapolis | Evansville | Fort Wayne | South Bend |
|---|---|---|---|---|---|
| Assault | 12,855 | 3,454 | 1,450 | 281 | 350 |
| Burglary | 15,106 | 5,030 | 2,224 | 2,188 | 1,716 |
| Homicide | 342 | 76 | 20 | 41 | 26 |
| Rape | 631 | 262 | 139 | 214 | 78 |
| Robbery | 5,545 | 1,951 | 317 | 354 | 324 |

Los Angeles and Indianapolis, 2003

*Evansville:* Assault, Burglary and Robbery (2003-2004); Homicide (2003-2006); Rape (2003-2005).

*Fort Wayne and South Bend:* Assault, Burglary, Rape, Robbery (2003); Homicide (2003-2004).

Cases with incomplete data were eliminated for analysis in all sites. These data were collected from sources such as investigator reports, crime lab reports and prosecutor case files. Linking elements such as unique identifier number, suspects name, race, birth date were used to connect the case with prosecutor data. For descriptive analysis; crime scene evidence, laboratory examined evidence (latent print, firearms, genetic objects, drugs) are used.

Thus we can conclude that the facts given by forensic experts on the basis of scientific study and experience help the court to ensure justice.

Forensic science and law exhibits a kind of employee- employer relationship in such a way that forensic science is employed to investigate the cases that are of interest to the legal system and to help in solving the legal disputes.[8,9,10]

*Need of KPMG in India*

KPMG stands for Klynveld Peat Marwick Goerdeler. In India, there is need of KPMG as it works with law firms to help their victims to avail the highest level of integrity. The forensic professionals with the help of transparency in world insights and enhanced technology seek to transform how companies identify, mitigate and respond to risk, saving time and money. It helps in designing, assessing and implementing programmes to mitigate the misconduct and help in preventing, detecting and responding to other forms of misconduct. The global network of the firms ensures help to deep forensic capabilities around the world. In forensic zones they have over 3,600 multidisciplinary professionals who worked out of 42 forensic approved practices. They play a major role in solving the commercial disputes.[14]

*Potentialities of KPMG:*

- Completed around 5000 investigations, including the high profile cases.
- About 900 committed forensic professionals from varied background including former CBI officials, chartered accountants etc.
- Enhanced and developed forensic labs aimed at investigations.
- Verification channels to conduct large scale checks.
- Customized strategies to form a bridge between forensic professionals and the criminal justice.[14]

Using an extensive range of experienced technological tools, KPMG Forensic allows firms to address the risks relating to the evidences and discovery management.

## Conclusion

From the past decade criminal activities became a major factor in affecting the welfare and development of the society. The physical and scientific evidence plays an important role in crime detection and have been recognized since antiquity. Forensic science acts as a scientific discipline that functions within the specified parameters of legal system that not only provides guidance in criminal and civil investigation but also provides accurate information to the courts. In the new modern technological era the emergence of DNA testing has become a major factor in upgrading the roles of forensic science from being just a viewer to main key player in the legal system. The discovery of modern genetic science mainly the DNA technologies are used for the identification of criminals by analyzing various clues or objects obtained from crime spot like any body fluid, hair root, saliva etc. Thus from the current scenario we can clearly state that the collaboration of forensic science and law have become the need of hour.

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