Significance of forensic science in criminal Investigation

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Introduction

Forensic Science has been defined as the application of scientific methods and techniques to matters under investigation by a court of law.[2] It encompasses several disciplines of science such as Physics, chemistry, biology, criminology, psychology, anthropology, entomology, medicine, engineering, pathology, geology etc. which aid in solving a criminal matter pending before the court.

Forensic science helps in identifying the suspect of a crime. It explains the type of crime, the time when the time was committed, the location of the crime, the modus operandi and also the motive of the crime.Thus the forensic science plays a key role in criminal investigation

Historical background:

During the ancient times the knowledge about forensic science was not evolved. Criminal investigations were based only on evidence collected by the investigators and testimony of the witnesses. This helped the criminals to escape the punishment by destroying the evidences and manipulating the witnesses.

Forensic science developed as an important tool for criminal investigation over last 300 years. The first evidence of forensic methodology being used to detect crime is seen in 16th Century in Europe and France, when medical practitioners in Army started to gather information on cause and manner of death. During the same time two Italian Surgeons, Fotunato Fidelis and Pacchia studied the changes occurring in the body structure.

The research in forensic science continued in 18th Century as well. In 1776 Swedish Chemist Carl Wilhelm Scheele devised a method to detect arsenic from dead bodies if found in large quantities. This research was further expanded by German Chemist Valentin Ross in 1806 who invented a method to detect poison from wall of victim's stomach. In 1836 English

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[2]*Forensic Science,*English Oxford Dictionary.

Chemist James Marsh used chemical processes to prove that arsenic was cause of death in a case of murder.

Fingerprints were first used to authenticate documents and prevent forgery of signatures, by Sir William Herschel in 1858. In 1880 Dr. Henry Faulds published a paper on use of fingerprints in identification of criminals and also suggested a method of recording the fingerprints with printing ink. This study was carried further by Francis Galton who discovered a method of fingerprint analysis and put forth a theory of "false positive" i.e., chances of two different individual having same fingerprints was 1in 64 millions. After studying the research by Galton, Juan Vucetich, an Argentinean Chief Police Officer set up first fingerprint bureau in 1892 and created a method of recording fingerprint of individuals. In 1906 fingerprinting technique was introduced in United States by Deputy Commissioner of Police Joseph A. Faurot. The Henry classification system for classifying fingerprints was evolved by Indian Fingerprint experts Aziz Haque and Hem Chandra Bose and the first Fingerprint bureau was established in Calcutta in 1897.The first school of forensic science was started in 1909 by Rodolphe Archibald Reiss named 'Institute de police scientifique'at the University of Lausanne. During the 20th century several scientist evolved new methods of forensic science and forensic science emerged as a major tool in criminal investigation.[3]

Advantages of forensic science in criminal investigation:

In recent times Forensic science serves as an important method in finding solutions to difficult and unsolvable cases. It aids the investigators inall the stages of investigation.

Forensic techniques are used to determine the cause of death of a victim of crime. This is done by examining the injuries, bite marks, burn marks etc. on the body of victim of crime. The medical examiners also study the post mortem changes in the dead body.

Forensic science also determines the time of crime and the weapons used for commission of crime. The experts study the scene of offence to gather fingerprints and other material which will help in identifying the criminal.

In cases of accidents, forensic analysis is used to calculate the speed of the vehicle, tyre marks, condition of the vehicle etc.

[3] Dr. Ishita Chatterjee, Law of Forensic Science, 11-12 (Central Law Publications, Allahabad 1st ed 2015).

Forensic techniques are also used to detect cybercrimes. This is called computer forensics. This involves tracing IP addresses, or email addresses, decoding the data etc.

Forensic DNA analysis is another important part of forensic science which analyses the distinct DNA of human beings to solve issues of paternity or maternity or to match crime scene evidences with suspect.

In addition to this, forensic analysis helps in detecting presence of alcohol, drugs or poison in the body of the criminal or the victim.

It is also useful in investigation of sexual offences, and cases of domestic violence,dowry death and child abuse where accurate analysis of injuries cased is essential to identify and punish the offenders.

The fingerprinting methodis used to identify the criminals from their fingerprints on objects present at the scene of offence.

The other advantages of forensic analysis include tapping of voice signals, analysing authentication of tapes, analysis of gunshot injuries, foot print marks, or fire investigation, lie detection etc.

Branches of forensic science used in criminal investigation:

Forensic science has several branches which assist investigators in solving a criminal case. Some of these branches are as follows:

Forensic Odontology:

It is also called as forensic dentistry. It involves examination and evaluation of dental evidencesto assist the investigators to solve a criminal case. The evidences collected from teeth can reveal age of a person in circumstances where the victim or the criminal does not have valid proof of their age. The examination of teeth can identify the person to whom the teeth belong to. This is helpful in cases when the body is in decomposed or deteriorated condition and beyond the stage of recognition.Forensic odontology also aids in determining sex of a person by analysing the teeth. This plays a major role in identifying unknown persons in times of mass calamities or natural disasters. This technique is also used in studying the bite marks left on either victim or the criminal especially in cases of sexual

assault or child abuse. Bite marks can also be collected from the objects found on the scene of crime[4].Thus this technique provides an important and indispensable service to criminal justice administration.

Forensic Entomology:

It involves applying study of insects to criminal investigation. It is mainly associated with investigation of death. It works on principle that insects found on or near the dead body may reveal important information about death including time of death[5].This technique is also used to detect time of infliction of wounds, place of crime, presence of drugs and poisons etc.

Forensic Pathology:

This branch is primarily concerned with determining the cause of death through the examination of a dead body.[6] Autopsy is conducted on the dead body by expert medical practitioner to determine the cause of death, time of death etc. This technique is crucial in determining modus operandi of causing death of a person which in turn helps the judiciary to punish the offender.

Forensic Toxicology:

It is a multidisciplinary field which involves the detection and interpretation of the presence of drugs, poison, alcohol and other potentially toxic compounds in bodily tissues and fluids. [7] The forensic toxicologist examines the samples of urine, blood, hair, saliva, and other bodily fluids to collect the evidences which may be useful in medical and legal investigation. It takes help of analytical chemistry, Pharmacology and clinical chemistry to analyse the samples.

Forensic Psychology:

It involves the application of psychology to criminal matters. Forensic psychologists study the criminals and give detail description about their personality, behaviour etc.[8] They also study the psychology of victims who are facing post-traumatic stress disorder and counsel them.

[4]Divakar KP, Forensic Odontology, The New Dimension in Dental Analysis, Int. J Biomed Sci. 2017;13(1):1-5.
[5]*Supra* note 3.
[6] Incognito Forensic Foundation, All that you need to know about the Branches of Forensic Science, https://ifflab.org/branches-of-forensic-science/ (November 13,201810.30pm).
[7] Peter R. Stout, Information Resources in Toxicology (4th ed. 2009).
[8]*Supra* note 6.

Forensic DNA profiling:

This is most commonly used technique in criminal investigation. This involves evaluating unique DNA profile of a person for identifying a unknown person or also to identify a criminal.[9] The Experts use hair, skin urine, blood, saliva or the remains of deteriorated body for the purpose of DNA analysis.

Forensic Anthropology:

This technique is used where the dead body is in mutilated or decomposed state and is beyond recognition[10]. The Forensic anthropologists can examine the bones, skeletons and remains of such body and help the investigators to identify the person. They can also determine the age, sex, race, and physique of the person and establish the reasons behind death.

Forensic Ballistics:

This technique is used in investigation of cases involving firearms. The experts analyse the bullets, gunpowder residue, bullet marks etc. to infer the weapon used in the crime.[11] They can also determine the distance from which the shot was fired, the angle of firing etc. which can be crucial in apprehending the shooter.

Computer forensics:

This branch is mainly involved in detection and investigation of cybercrimes. The experts extract and analyse the evidences in digital form found in computer or storage devices.They also track IP addresses, decode emails etc. for the purpose of identifying the cyber criminals.

Finger print analysis:

[9] *Supra* note 6.
[10] Stanojevich V, (2012) *The Role of a Forensic Anthropologist in a Death Investigation*, J Forensic Res, 3:154. doi: 10.4172/2157-7145.1000154. (November 13,2018 10.30pm)
[11] Jeremy R. Dack, *Using Forensic Ballistics in The Courtroom*, Law School Student Scholarship, 2014.

Fingerprint collected from the crime scene provide a valuable piece of evidence in criminal investigation.These fingerprints are collected by experts by using chemical or physical methods. Finger prints being unique to every person help in identification of person to whom the fingerprints belong to. Thus it aids in connecting suspect to crime.

All these branches play a very important role in effective investigation of crime and in turn help court to deliver justice.

Laws relating to forensics in India:

The main task of forensic scientists is to collect evidences from crime scene, analyse them and submit the forensic report to the court of law. Indian law considers forensic scientists as experts and gives due weightage to it in administration of justice.Although there is no specific law on forensic science in India,there are provisions giving importance to forensic evidence in certain criminal laws.

Indian Evidence Act 1872 provides that when the court has to form an opinion about a point of science or as to identity of handwriting or finger impression, the opinions upon that point of persons especially skilled in such science, or as to identity of handwriting or finger impressions are relevant facts. Such persons are called experts.[12]

It further provides that facts which are not otherwise relevant are considered relevant if they support or are consistent with the relevant opinions of experts.[13] Similarly, the Code of Criminal Procedure gives powers to the forensic scientist to collect samples and analyse them. Section 53 of the Code deals with examination of the accused by medical practitioner at the request of police, if there are reasonable grounds for believing that an examinationof a person will afford evidence as to the commission of crime.Similar powers are given to the medical practitioner in case of rape cases.[14]

The examinationby the medical practitioner include the examination of blood, blood stains, semen, swabs in case of sexual offences, sputum and sweat, hair samples and finger nail

[12] Sec 45, The Indian Evidence Act 1872,No. 1, Acts of Parliament, 1872. (India)
[13] Sec46, The Indian Evidence Act 1872,No. 1, Acts of Parliament, 1872. (India)
[14] Sec 53-A, The Code of Criminal Procedure 1973, No. 2, Acts of Parliament, 1973. (India)

clippings by the use of modern and scientific techniques including DNA profiling and such other tests which the registered medical practitioner thinks necessary in a particular case.[15]

Another Act which makes a mention about forensic examination of samples obtained from suspect is the Prevention of Terrorism Act, 2002. It provides that, when an investigation officer requests the Court of Chief Judicial Magistrate or Chief Metropolitan Magistrate in writing for obtaining sample of handwriting, finger prints, foot prints, photographs, blood, saliva,semen,hair,voice of any accused person, reasonable suspect to be involved in the commission of an offence under this Act, it shall be lawful for the Court to direct that such samples shall be given by the accused person to the police officer either through a medical practitioner or otherwise as the case may be.[16]

Thus these provisions help the forensic experts to collect and analyse the samples belonging to crime suspect and give its opinion as to the important aspects of crime.

Judicial decisions based on forensic evidences:

1. **Tandoor Murder case: (1995)**

   This was the first criminal case to be solved with the help of forensic science. In this case Mr. Sushil Sharma murdered his wife Ms. Naina Sahni by firing bullets, on suspicion of extra marital affair. Then he tried to burn her body in a tandoor in a restaurant.The DNA Analyses was carried out and blood samples of the deceased was matched with that of her parents and it was proved that charred body belongs to Ms. Naina Sahni.Also, with the help of forensic evidences Mr. Sharma was held guilty of the offence of murder.

2. **Sister Abhaya murder Case (1995)**:

   Sister Abhaya, a Roman Catholic Nun was found dead in well in her hostel compound in kottayam. In this case the methods such as polygraph tests, brain mapping,narco-

[15] Sec 53, The Code of Criminal Procedure 1973, No. 2, Acts of Parliament, 1973. (India)
[16] Sec.27(1),Prevention of Terrorism Act, 2002, No. 15, Acts of Parliament, 2002. (India)

analysis were used to solve the case. On the basis of this two fathers of the Church were arrested.

3. Aarushi Talwar murder case (2008)

Aarushi Talwar, a 14-year girl from Noida was found dead in her house. The domestic help in her house Mr. Hemraj was also found dead on the terrace of the house. Forensic experts collected blood samples and fingerprints from crime scene. Narco tests was also conducted on suspects including her father to test the angle of honour killing.After several probes into the matter the trial court convicted the parent of Aarushi. But Allahabad High Court acquitted them in 2017.

4. **Neeraj Grover Murder case: (2008)**

The body of Mumbai-based television executive Neeraj Grover was chopped into pieces, stuffed into three bags and set on fire in a forest. From the charred bones forensic experts collected three teeth, femur bones and some other residue so as to extract the DNA sample from it.The collected DNA sample was then matched with that of his parents and it was established that the charred bones and teeth were indeed that of Grover.The forensic evidences also proved the involvement of Ms. Maria Susairaj, a struggling Kannada actress and her fiancé Emile Jerome in the murder.

5. Nirbhaya's rape case: (2012)

In December 2012, a23-year-old girl was brutally gang raped by six men including aminor, in a moving bus in New Delhi. Forensic science played a major role in identifying the offenders. Finger print, DNA and bite mark analysis was used to connect the suspects to the crime. One of the six accused, Ram Singh was found hanging in judicial custody. Based on the scientific and forensic evidences the trial court found four accused guilty of rape and murder and sentenced them to death sentence. This order of the trial court was subsequently confirmed by the Supreme Court. The juvenile offender was also found guilty of rape and murder and was sentenced to maximum punishment of three years in reform facility.

6. Sheena Bora Murder case:(2015)

Sheena Bora, an executive working in Mumbai, went missing on 24 April 2012. In August 2015 Mumbai Police arrested her mother Indrani Mukerjea, her stepfather Sanjeev Khanna, and her mother's driver, Shyamvar Rai, for allegedly abducting and killing her and subsequently burning her corpse. Sheena Bora's body was identified several years after her murder by a DNA test.

7. **Kirti Vyas murder case: (2018)**

Kirti Vyas, a salon executive who was allegedly murdered by two colleagues. The police arrested the two accused Siddhesh Tamhankar and Khushi Sahjwani on the basis of DNA test conducted on two drops of blood found in the boot of a vehicle.

Conclusion:

Forensic science has thus proved to be of utmost importance in solving criminal cases. With the advancement of science and technology the forensic science is improving day by day. It makes the work of investigation of criminal matters and justice delivery system much easier as investigators and the judges can rely on the accuracy of the evidence provided by the forensic scientists. Forensic science with all its branches has thus become indispensable for criminal justice administration.