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MODERN TECHNIQUES IN FORENSIC SCIENCE AND THEIR UTILITY IN THE CRIMINAL JUSTICE SYSTEM IN INDIA.

- SapreshDevidas[1]

ABSTRACT

The advancement in the field and technological innovation, socio economic upheaval, population growth, easy access to scientific knowledge, fast communication and transport facilities have definitely changed the shape and modus operandi of the modern day sophisticated crimes. In a country like India where witnesses often turn hostile for one reason or other thus weakening of the prosecution case and the benefit of doubt easily goes often to the criminals. This has posed a serious challenge to the effective criminal justice delivery system. Hence a detailed analysis regarding the nature and scope of new emerging techniques of these forensic their admissibility shall be undertaken by the humble researcher. The polygraphic test, the brain mapping test and Narco analysis test are the major tests that have been recently developed for extracting confessions from the mouth of alleged suspects. These psychoanalytical tests are also used to interpret the behaviour of the criminal and corroborate the investigating officer's observations. In the present article the role and significance of modern techniques in forensic science such as DNA testing, Narco Analysis test, polygraphic test in India would be deeply analysed.

Introduction

The nature of law is dynamic and not static, so the law also changes when society change. Criminal justice forms part of the set of processes, bodies and institutions that aim to secure or restore social control. Administration of criminal justice primarily rests on police, prosecution, courts and prisons. These four organs are engaged in the vital task of prevention, detection, prosecution, adjudication and penalization of offenders in society. Effective criminal justice machinery ensures a safe and peaceful society.

[1]Advocate, : B Sardessai and Associates

With the advancement of science and technology, the criminals have adopted new methods and techniques for committing the offence, but science also helped the investigating authorities in their efforts to find out the criminals or real culprits. The area of forensic science is changing very fast with new technologies and methods. Nowadays the use of DNA tests, high-performance liquid chromatography, mass spectrometry, 3-D computer imaging, and other sophisticated technologies are used by scientists to reconstruct the offence and the mishap. The modern forensic science can differentiate trace element and organic materials down to the level of merely a few hundred molecules. Forensic Science is one of the advanced techniques used in recognizing crimes and criminals. It is very challenging, charming, dynamic, and exciting science. The application of advance science which embraces all institution like Chemistry, Ballistic, photography, Physics, Brain Fingerprinting, Toxicology, Narcotics, DNA Profiling, Narco-Analysis, Biology, etc. in criminal law is commonly understood as the forensic science in the field of law[2].

Definitional Aspect

Forensic science in today‘s world is an advanced scientific technique which is used in criminal and civil investigations, it is capable of answering important questions and forms an integrated part of the criminal justice system. Forensic science is science used for the law and thus any branch of science used in the resolution of legal disputes is forensic science. In the broadest sense, forensic science is any science used in the resolution of legal conflicts. The word "forensic" is rooted in the Latin word 'forensic'. The dictionary meaning of the word "forensic" is "relating to court or law" or "relating to court of law". But in legal terminology, it may mean "the science which deals with the principles and practice of different branches of science which elucidates doubtful questions in a court of justice". It is a science composing of those matters which may be considered as common ground to both the scientists and the legal practitioners. It includes all well-known techniques such as fingerprint analysis,

[2] Deepak Ratan and Mohd Hasan Zaidi, An Introduction to Forensic Science in Justice Delivery System 13 forwarded by Keiichi and Chikushi,(Alia Law Agency, Allahabad, Edn. 2008).

DNA analysis, ballistic, firearms or explosive culture etc. It helps to convict those guilty of a crime as well as can exonerate the innocent.[3]

Importance Of Forensic Science In Law

The legal system widely recognizes the role of forensic evidence in the trial of criminal offenders. This is because when scientific techniques and methods are used, there is not much scope for bias or injustice. That is why DNA profiling and a host of other forensic evidence are widely accepted in courts across the world. Interestingly, the first forensic technique ever used involving finger and palm print identification dates back to the Chinese (650 A.D.).Forensic evidence is extensively used worldwide to both convict and exonerate defendants. Thus, forensic science laboratories have mushroomed up all over the globe in the past couple of decades. Special acts have been enacted in the US, Canada, and Australia to improve the rendering of forensic services. This would ensure that crimes are detected with greater certainty and consequently conviction rates can increase. Such acts place a great emphasis on time-efficient and quality management of the crime scene.[4]

Role Of Forensic Science In Criminal Investigations

Forensic science is that piece without which the puzzle of a criminal investigation is incomplete. Without the application of forensic science, criminals can never be convicted unless an eyewitness is present. While detectives and law enforcement agencies are involved in the collection of evidence, be it physical or digital, it is forensic science that deals with the analysis of those evidence to establish facts admissible in the court of law.

Thus in a world devoid of forensic science, murderers, thieves, drug traffickers and rapists would be roaming scot-free. The duties and responsibilities of a forensic scientist in a criminal investigation is crucial as it involves the careful examination of evidence while ensuring that it is not tampered with. A diverse pool of forensic

[3] Deepak Ratan and Mohd. H. Zaidi, Application of Forensic Science in India and World, pg 28 (Alia Law Agency, Allahabad, edn. 2008).
[4]Importance of forensic science in criminal investigations and justice, available at https://ifflab.org/.

scientists and forensic tools go into the investigation of a criminal act.For instance, forensic pathologists are skilled at determining the cause of death by performing autopsies. An autopsy helps establish the cause and manner of death through the examination of body fluids and tissues. Forensic Scientists analyze physical evidence (fingerprints, blood, hair etc.) collected from the incident scene to identify suspects. Additionally, forensic professionals use image modification tools to search for criminals absconding from the law for a long time. This tool enables them to digitally age a photograph to understand how the individual would look at ageing.Additionally, forensic professionals use image modification tools to search for criminals absconding from the law for a long time. This tool enables them to digitally age a photograph to understand how the individual would look at ageing.

Modern Techniques In Forensic Science And Their Utility In The Criminal Justice System

In this paper, we examined various forensic sciences and the application of forensic sciences as practical tools to assist investigating officers in conducting investigations. The paper is intended to be an overview to demonstrate the broad range of forensic tools available. An investigator does not need to be an expert in any of the forensic sciences; however, it is important to have a sound understanding of forensic tools to call upon appropriate experts to deploy the correct tools when required. Themodern techniques of forensic science covered in this paper include:

- Narco-Analysis Test: Narco-Analysis is a process whereby a subject is put to sleep or put into semi somnolent state using chemical injection and was then interrogated while in this dream-like state, or the process of injecting a 'truth serum 'drug into a patient /suspect to induce semi-consciousness, and then interrogating the patient /suspect. This process has been utilized to enhance the memory of a witness.[5]During the process of Narco-Analysis test, a person has no power to think due to the effect of drugs which was injected torn him. His idea and experiment

[5]P.RamanathaAiyer's Law Lexicon, pg 3121, Edn. 2005.

gained a lot of limelight and attention and therefore led the introduction of Narco-Analysis in the criminal investigation.

- Polygraph or Lie Detector Test**:** The term 'Polygraph means 'many writings' therefore the name refers to a process in which selected psychological activities are recorded. It was designed to record blood pressure and changes in pulse rate. The very fundamental principle underlying Polygraph is that when a person lies he becomes nervous, which in turn causes mental excitation. To conceal the excitement which the person attempts, adrenal glands are stimulated to secrete Adrenalin, which on entering the bloodstream, sets up the blood pressure and rate of pulse and respiration. All these psychological changes when recorded are collectively called Polygram, which is analyzed and evaluated to find out whether, during the lie detection test, the subject experienced emotional stress with any of the questions asked.[6]

- Brain Mapping or P300 Test: This technique is also known as 'Brain wave fingerprinting'. In this technique, the suspect is first interviewed and interrogated to find out whether he is concealing any important information. Then sensors are attached to the head and the person is made to sit in front of a computer monitor. He is then shown and made to hear certain images and voice. The sensor attached to head monitors and records the electrical activity and P300 waves in the brain, which is produced only if the subject has a link with stimulus. The subject is not asked any question. To put it simply, it simply means that brain fingerprinting matches the information stored in the brain with that of the related crime and crime scene. In India, the first Forensic laboratory which used this technique is Forensic laboratory of Bangalore.[7]

- DNA Profiling: One of the latest growing and most reliable modes of investigation in forensic science is DNA profiling. DNA is the abbreviation of the term, "Deoxyribose Nucleic Acid". It is an organic substance which is found in every living cell and which gives an individual genetic blueprint. DNA can be obtained

[6]YawerQazalbash, Law of lie Detectors (Narcoanlysis, Polygraph, Brain mapping, Brain Fingerprinting) (Universal Law Publishing Co., New Delhi, 2011).
[7] B.B, Nanda and R.K Tiwari, Forensic Science in India.A Vision for the Twenty-First Century, pg28,(Select Publication, New Delhi 2001).

from a wide variety of sources like blood, semen, bone, saliva etc. DNA tests are highly effective because each individual's DNA is unique except the twins. The probability of DNA being same is one in three billion. And it is credible because it cannot tamper with DNA test can be used in various cases to such as to establish the parentage of a child, identify mutilated dead bodies etc.[8]

- Fingerprints: The identification of criminals through fingerprints was the first important break-through in the scientific investigation of crime. As usual, the judiciary and the public took some time to believe in the utility of fingerprints as a scientific aid.The same is now recognized throughout the world[9].

- Brain fingerprinting: When a crime is committed, a record is stored in the brain of the doer. Brain Fingerprinting provides a means to objectively and scientifically connect evidence from the crime scene with evidence stored in the brain of the perpetrator. Brain Fingerprinting measures electrical brain activity in response to crime-relevant words or pictures presented on a computer screen and reveals a brain MERMER (memory and encoding related multifaceted electroencephalographic response) when, and only when, the evidence stored in the brain matches the evidence from the crime scene. Thus, the guilty can be identified and the innocent can be cleared in an accurate, scientific, objective, non-invasive, non-stressful, and non-testimonial manner.[10]

- Ballistic Fingerprinting: Ballistic fingerprinting is one of the important branches of Forensic Science. It is another type of evidence. In ballistic fingerprinting, the distinctive marking left on ammunition as a result of its use in a specific weapon. During the late 15th Century gun maker found that the addition of groove to the inner surface of a gun barrel improved the accuracy of the bullet fired from the gun. Bullets fired from rifled the gun barrel. The pattern of scratches on the bullet matches those in the gun barrel. A gun barrel with seven helical grooves, for example, results in a

[8]Dr., B.R. Sharma, Forensic Science in Criminal Investigation and Trial, pg 4 (Alia Law Agency,Allahabad 6th ed., 2008).
[9] Forensic Science in Criminal Investigation‖, Dr Jai Shanker Singh, Unique Law Publications.
[10] "Brain Fingerprint", available at: http://www.seminarszone.com/2013/02/download-abstract-onbrainfinger_4966.html

pattern of seven scratches on a bullet, fired from the gun. Since rifling pattern tends to differ from weapon to weapon, the pattern they produce on bullets fired from them tends to be distinctive, perhaps unique.[11]

- Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS): When broken glass is involved in a crime, putting together even tiny pieces can be key to finding important clues like the direction of bullets, the force of impact or the type of weapon used in a crime. Through its highly sensitive isotopic recognition ability, the LA-ICP-MS machine breaks glass samples of almost any size down to their atomic structure. Then, forensic scientists can match even the smallest shard of glass found on clothing to a glass sample from a crime scene.

- Alternative Light Photography: For a forensic nurse, being able to quickly ascertain how much physical damage a patient has suffered can be the difference between life and death. Although they have many tools at their disposal to help make these calls quickly and accurately, Alternative Light Photography is one of the coolest tools to help see the damage even before it is visible on the skin. A camera such as the Omnichrome uses blue light and orange filters to clearly show bruising below the skin's surface.

- High-Speed Ballistics Photography: You might not think of it right away as a tool for forensic scientists, but ballistics specialists often use high-speed cameras to understand how bullet holes, gunshot wounds and glass shatters are created. Virtually anyone, from a crime scene investigator to a firearms examiner, can operate a high-speed camera without any additional education or training.

- Video Spectral Comparator 2000: For crime scene investigators and forensic scientists, this is one of the most valuable forensic technologies available anywhere. With this machine, scientists and investigators can look at a piece of paper and see obscured or hidden writing, determine the quality of paper and origin and "lift" indented writing. It is sometimes possible to complete these analyses even after a

[11] David E. Newton,DNA evidence and Forensic Science pg21(Viva Book Publication, New Delhi,2006).

piece of paper has been so damaged by water or fire that it looks unintelligible to the naked eye.

- Digital Surveillance For Xbox (XFT Device): Most people don't consider a gaming system a potential place for hiding illicit data, which is why criminals have come to use them so much. In one of the most ground-breaking forensic technologies for digital forensic specialists, the XFT is being developed to allow authorities visual access to hidden files on the Xbox hard drive. The XFT is also set up to record access sessions to be replayed in real-time during court hearings.

- Forensic Carbon-14 Dating: Carbon dating has long been used to identify the age of unknown remains for anthropological and archaeological findings. Since the amount of radiocarbon (which is calculated in a Carbon-14 dating) has increased and decreased to distinct levels over the past 50 years, it is now possible to use this technique to identify forensic remains using this same tool.

- Magnetic Fingerprinting and Automated Fingerprint Identification (AFIS): With these forensic technologies, crime scene investigators, forensic scientists and police officers can quickly and easily compare a fingerprint at a crime scene with an extensive virtual database. Besides, the incorporation of magnetic fingerprinting dust and no-touch wending allows investigators to get a perfect impression of fingerprints at a crime scene without contamination.

- Link Analysis Software for Forensic Accountants: When a forensic accountant is trying to track illicit funds through a sea of paperwork, link analysis software is an invaluable tool to help highlight strange financial activity. This software combines observations of unusual digital financial transactions, customer profiling and statistics to generate probabilities of illegal behaviour.[12]

Latest Judicial Pronouncements

[12]Modern forensic science technologies were available at https://www.forensicscolleges.com/blog/resources/10.

Here are some of the latest cases where the court has relied on forensic evidence and given verdict by taking into consideration of this piece of evidence.

In *Anil @ Anthony Arikswamy Joseph v. the State of Maharastra*[13], relying on scientific shreds of evidence including DNA profile and oral pieces of evidence, the accused was convicted and punished with death sentence and fine by the Sessions Judge, Nagpur for the gruesome murder of a minor boy aged about 10 years after subjecting him to carnal intercourse and then strangulating him to death.

In *Nitish Katara murder case*[14], the identification of the deceased victim was difficult due to the availability of only a small portion of one un-burnt palm with fingers. Here also, DNA profile helped in identifying the body remains by matching the DNA profile with parents of the deceased which helped the High Court of Delhi to uphold the conviction of the accused.

In *Krishan v. State of Haryana*[15], the Trial Court, considering the facts and circumstances of the case, more particularly relying on the FSL report convicted the appellant under Sec. 376 and Sec. 506 of IPC.

The operation of forensic science is nothing but the application of techniques and methods of basic science techniques and methods of basic science for different analyses of different crimes. Since its beginning, the scientists of the Forensic Science Laboratory, have been rendering invaluable service to the investigating agencies in various ways for the cause of justice.

Forensic Science Laboratories In India: Developments

In India, earlier there were only Fingerprints Bureau under the State CID (Criminal Investigation Department) which provided for the examination of finger printings, footprints and documentary pieces of evidence. Chemical scientists associated with police department mainly performed a blood test and test of viscera. Sometimes, the evidence collected by such methods fail to give any clue to the offender and the need

[13](2014) 4 SCC 69.
[14] Vishal Yadav v. State of Uttar Pradesh (2014) SCC Online Del. 1373.
[15] (2014) 13 SCC 574.

was felt for setting up Forensic laboratories during the middle of the twentieth century. Initially, due to the slow process, the progress in that regard was very slow and there was a lack of systematic development. State Governments set up Forensic Laboratories by restructuring their chemical laboratories.[16]

Incognito Forensic Foundation (IFF Lab) – A Significant Addition to the Indian Forensic Landscape.

With millions of cases still pending in courts across India, the need for more forensic labs and qualified forensic professionals is very high. Also, there is a mounting pressure on law enforcement agencies to collect evidence in a tamper-proof way. India currently has more than 5000 forensic experts. However, since government forensic labs often take months to deliver reports, sometimes justice is imparted too late to the victim.[17]

Incognito Forensic Foundation (IFF Lab) is a private forensic lab based in Chennai and Bangalore. It has already emerged as a frontrunner despite being very new in the forensic domain. With expertise in criminal investigations, cyber and digital forensics, they are indeed a valuable addition to the country's forensic domain. Their futuristic cybercrime and digital forensic centre offer solutions catering to different segments of the society such as law enforcement agencies, private investigators, individuals, corporates and the government. IFF Lab also caters to hesitant individuals who wish to resolve family disputes but are reluctant to approach the police. Thus IFF Lab is particularly helpful for corporates and individuals who wish to keep the disputable matter confidential fearing disrepute. Such cases involve fraudulent documents, identity theft, corporate frauds, paternity disputes, cyber-crimes, matrimonial scams etc.[18]

Conclusion

From the above discussion, it can be concluded that the forensic scientists by the very nature of their work are duty-bound for the establishment of justice to society.

[16]Importance of forensic science in criminal investigations and justice, available at https://ifflab.org/.
[17]Deepak Ratan and Mohd. Hasan Zaidi,Forensic Science in India and the world, Alia Law Agency 2008.
[18]Importance of forensic science in criminal investigations and justice, available at https://ifflab.org/.

Forensic scientists are playing a vital role in reducing the potentiality of crime and also in determining the root causes of crime in our society. There are various techniques relating to the important role in the detection of crime. DNA Profiling, Brain fingerprinting, Polygraph test, Forensic photography etc. are the important techniques in the field of forensic science which play a pivotal role in criminal investigation to find out the crime and criminals. At today the investigating authority is employing these effective modern techniques in solving the crime problems.