

Lecture Session on

**Scientific Techniques of Investigation and their admissibility in the
Criminal Trials**



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Scheme of Presentation

1. Introduction to Scientific Investigation in Criminal Trials
2. Evolution of Scientific Evidence and its utility
3. Prominent Forms of Scientific Evidences as used in Criminal Investigation
4. Judicial Trends on admissibility of Scientific Evidences
5. Factors affecting the admissibility of Scientific Evidence

Outcomes of the Lecture Session

1. Able to appreciate the synergy of Law and Science in effective Criminal investigation.
2. Able to trace the development of Jurisprudence relating to Scientific Evidence in Criminal Trials.
3. Able to acquaint with the emerging forms of prominent Scientific Evidences.
4. Analyse the Judicial standards set for admissibility of Scientific Evidences.
5. Identify the factors responsible for non admissibility of Scientific Evidences.

1. Introduction to Scientific Investigation in Criminal Trials

- ✓ Criminal investigation is a multi-faceted, problem-solving challenge.
- ✓ Investigator is expected to preserve the crime scene, collect the evidence, and devise an investigative plan.
- ✓ Securing Tangible Evidences or Direct Evidences is always a matter of concern or the available/ collected might be inadequate/ irrelevant or sometimes even contaminated.
- ✓ In such criminal cases, especially based on circumstantial evidence, science plays a pivotal role, which may assist in establishing the element of crime, identifying the suspect, ascertaining the guilt or innocence of the accused.
- ✓ Use of Scientific Evidence can improve the quality of investigation and also handle the emerging forms of complex crimes which are committed using technology.
- ✓ Scientific evidence is not be used as rule for all cases as a matter of law, but the utility of scientific evidence to detect and prove crimes over and above the other evidence, needs to be appreciated.

2. Evolution of Scientific Evidence and it's utility

- ✓ Physical evidence can be used to connect an accused to their victim or used at a crime scene to establish guilt or innocence.
- ✓ However Physical evidence is the buried treasure for criminal investigators.
- ✓ Scientific Evidence may prove a point in fact that confirms or contradicts the claims of the victim/ accused, or one that corroborates or contradicts the testimony of a witness.
- ✓ It can help the investigators to locate and utilize physical evidence that enables circumstantial links between people, places, and events to prove the facts of criminal cases.
- ✓ Scientific discoveries in a wide range of disciplines have contributed to the development and evolution of various forms of scientific tools of investigation such as Finger Print matching, chemical analysis, barefoot morphology, odontology, toxicology, ballistics, hair and fibre, biometric analysis, entomology, and, most recently, DNA analysis.

Types of Evidences – A Brief Note

- ✓ Direct evidence is evidence that will prove the point in fact without interpretation of circumstances. It can show the court that something occurred without the need for the judge to make inferences or assumptions to reach a conclusion.
- ✓ Indirect evidence, also called Circumstantial evidence, does not by itself prove the offence, but through interpretation of the circumstances and in conjunction with other evidence may contribute to a body of evidence that could prove guilt beyond a reasonable doubt.
- ✓ It demonstrates the spatial relationships between suspects, victims, timelines, and the criminal event and that the accused person had a combination of intent, motive, opportunity, and/or the means to commit the offence, which are all meaningful features of criminal conduct.
- ✓ It can assist the court in confirming assumptions and inferences to reach conclusions assigning probative value to connections between the accused and a person or a place and the physical evidence.
- ✓ The circumstantial evidence that only leads to one logical conclusion can sometimes become the evidence the Court uses in reaching belief beyond a reasonable doubt to convict an accused

- ✓ Corroborative evidence refers to any type of evidence that tends to support the meaning, validity, or truthfulness of another piece of evidence that has already been presented to the court.
- ✓ DNA sample from an accused matching the DNA found on a victim is the classic form of Corroborative Evidence.
- ✓ The courts assign a great deal of probative value to corroborative evidence because it assists the court in reaching their belief beyond a reasonable doubt.

Evidence Transfer Theory – Apt to appreciate to nature of Scientific Evidence

- Evidence will transfer from a suspect to the crime scene, a suspect to a victim, from the crime scene to the victim, or from the crime scene to the suspect.
- The ability to link a suspect back to a crime and to form reasonable grounds for belief to make an arrest can depends on the existing evidence transfer.
- DNA or fingerprints that can contribute to connecting a suspect to a criminal event, Hair and fibre, shoe prints, tool marks, bite marks, ballistics, contribute to the theory of Evidence Transfer.

3. Prominent Forms of Scientific Evidences as used in Criminal Investigation

- Various types of physical evidence can be found at almost any crime scene. The types of evidence and where it is found can assist investigators to develop a sense of how the crime was committed.
- Following are the forms of Scientific Evidence (Based on the times of inventions)
 - A. Fingerprint Matching
 - B. DNA Analysis - Forensic Pathology, Archaeology, Odontology and Engineering.
 - C. Ballistic Analysis
 - D. Narco Analysis Test
 - E. Polygraph Test
 - F. Brain Mapping Test

A. Fingerprint Matching

- Fingerprints are unique patterns of lines and ridges that exist on the areas of our hands and known as the plantar surfaces.
- Fingerprints are often left on items we touch because the oils our bodies produce act like an invisible ink adhering to smooth surfaces we touch, thus transferring these fingerprint impressions to those surfaces.
- The unique lines and ridges of an unknown fingerprint can be searched in a database of known criminal fingerprints for identification.
- This type of search is done electronically using a biometric scanning process known as Automated Fingerprint Identification System (AFIS).
- The location and identification of a suspect's fingerprint at the scene of a crime, or on some crime related object, is strong circumstantial evidence from which the court can draw the inference that the suspect is, in some way, connected to the crime.
- Collection and use of Fingerprint is not violative of Article 20(3)

B. DNA Analysis

- Deoxyribonucleic acid, is a molecule that holds the genetic blueprint used in the development, functioning, and reproduction of all living organisms.
- Except for identical twins, the DNA profile of each living organism is unique and distinct from other organisms of the same species.
- Bodily substances containing cellular material, such as blood, semen, seminal fluid, saliva, skin, and even hair root tissue can often be compared and matched back to its original owner with high statistical probabilities of comparison.
- DNA comparison can enable high probability matches to be made between discarded bodily substances and the person from whom those substances originated.
- DNA analysis has allowed investigators for advocates to re-examine historical evidence and exonerate persons wrongfully convicted and imprisoned for criminal offences.
- Even very old bodily substances, such as dried blood, dried saliva, or seminal stains, can be analyzed for a DNA profile
- DNA data-banks of known criminals and unsolved crimes are now in vogue.

Forensic Pathology

- It is the process of determining the cause of death by examining the dead body during an autopsy.
- In the case of a suspicious death or a confirmed homicide, a Forensic pathologist dissects the body carefully examining, documenting, and analyzing the body parts to determine the cause of death.
- Forensic pathologist will make an estimate of the time-of-death by observing evidence of four common post-mortem (after-death) indicators, which are body temperature, the degree of rigor mortis, post-mortem lividity, and progress of decomposition.

Forensic Archaeology

- It is the use of archaeological methods by experts to exhume crime scenes, including bodies.
- The recovery of artifacts (evidence), such as human remains, weapons, and other buried items, that may be relevant to the criminal event are documented.

Forensic Odontology

- It is essentially forensic dentistry and includes the expert analysis of various aspects of teeth for the purpose of Investigation.
- Dental records have been used as a reliable source of comparison data to confirm the identity of bodies that were otherwise too damaged or too decomposed to identify through other means.
- Even in a badly decomposed or damaged corpse, teeth can retain DNA material inside the tooth, allowing it to remain a viable source of post-mortem DNA evidence.
- Forensic odontology can sometimes also provide investigators with assistance in confirming the possible identity of a suspect responsible for a bite mark.

Forensic Engineering

- Investigative engineering that examines materials, structures, and mechanical devices to answer a wide range of questions.
- It is used in cases of car crashes, forensic engineers can often estimate the speed of a vehicle by examining the extent of damage to a vehicle.
- If damage to a building, an object, or a piece of equipment poses an investigative question, the tools of forensic engineering should be used to seek answers.

C. Ballistic Analysis

- Ballistics is the study of all things that are launched into flight, how they are launched, and how they fly.
- Ballistic comparisons seek to determine if a particular gun was the originating source of an unknown bullet or cartridge casing, this examination process is sometimes referred to as ballistic fingerprinting.
- The analogy being that if a particular gun touched a particular bullet or cartridge-casing, it will leave behind some unique identifiable marks or a ballistic fingerprint.
 - ✓ Handguns as either semi-automatic pistols or revolvers
 - ✓ Long rifles that are single shot bolt action, automatic, or semi-automatic
 - ✓ Shotguns that are breach loading or chambered pump action

D. Narco Analysis Test

- Narco-analysis/ Truth Serum Test/ Psycho analysis means using drugs to induce a state akin to sleep.
- Drug like sodiumamytal is used as a truth drug on the suspect for determination of facts about the crime and the person administered with such drugs suppresses his reasoning power without affecting memory and speech, he can be made to tell the truth.
- In the narcoanalysis test, the subject's imagination is neutralized and reasoning faculty affected by making him semiconscious., where the subject is not in a position to speak up on his own but can answer specific and simple questions.
- The revelations made during this stage are recorded both in video and audio cassettes. The report prepared by the experts is used in the process of collecting evidence.
- This procedure is conducted in government hospitals after a court order is passed instructing the doctors or hospital authorities to conduct the test. Personal consent of the subject is also required.

E. Polygraph/ Lie Detector Test

- Lie-detector” or “Lie Detecting Machine” is an instrument for detecting physiological evidence of the tension that accompanies. It records tracings of several different pulsations as arterial and venous pulse waves and the apex beat of heart.
- The test of Polygraph was for the first time judicially noticed in USA in 1923 in the case of Frye vs. United States.
- Polygraph instrument is stated to record with 100% accuracy the physiological changes in breathing, perspiration, blood pressure and pulse rate to determine a truth or a lie.
- The polygraph test cannot take place of a thorough investigation and before making request for polygraph test, the investigating officer must exhaust all avenues of investigation.
- It can induce criminals to confess to crimes committed by them, it replaces third degree methods used during police interrogations, it can help in discriminating the innocent from the guilty

F. Brain Mapping Test/Brain Wave Finger Printing

- It involves series of steps commencing with the accused being first interviewed and interrogated to find out whether he is concealing any information.
- Then sensors are attached to the subject's head and the person is seated before a computer monitor, after which he is then shown certain images or made to hear certain sounds.
- The sensors monitor electrical activity in the brain and register P300 waves, which are generated only if the subject has connection with the stimulus i.e. picture or sound.
- For example, if weapon of an offence is recognized by the culprit the instrument would show the change in the brain wave patterns. The brain waves also called as Electro-signals are recorded by Electroencephalograph EEG
- Brain finger printing test matches information stored in the brain with information from the crime scene. It is said to be non-invasive and can detect covert responses to stimuli.
- This is the only method to record brain activity directly as other methods rely on blood flow or metabolism.

4. Judicial Trends on admissibility of Scientific Evidences

- The result of incomplete or defective investigations often results into the acquittal of the accused even if he/she was involved in commission of heinous offences.
- The shortcomings, loopholes and weaknesses that are left behind by the investigating agencies make the case setup by the Prosecution in the court is ultimately found on weak footings and the Perpetrators of the crimes stand benefited.
- Emerging new types of crimes and their level of sophistication, the traditional methods and tools have become outdated, hence the necessity to strengthen the forensic science for crime detection.
- It is believed that Scientific evidence can aid in the criminal investigation and Judiciary should also be equipped to understand and deal with such scientific evidences.
- Constant interaction of Judges with scientists, engineers would promote and widen their knowledge to deal with scientific evidence and to effectively deal with criminal cases based on scientific evidence.

- Case Name : Selvi vs. State of Karnataka AIR 2010 SC 1974
- ❖ The case involved challenge of constitutionality of three investigative techniques: narco-analysis, polygraph test, and the Brain Electrical Activation Profile.
- ❖ All the three scientific techniques were declared Unconstitutional as violative of Article 20 (3) (Right against Self Incrimination) and also on the ground of Privacy under Article 21.
- ❖ Since in all these forms, the testimony was not voluntary or was made in a state of inducement, they are impermissible.
- ❖ Crime Control Model requires Investigation for conviction, but due process model requires, the procedure of investigation to be fair and constitutional.
- ❖ The three methods were considered as Testimonial and not Physical Evidence (Finger Print, Blood Sample, Handwriting) which is permissible under Article 20 (3).
- ❖ *“The compulsory administration of the impugned tests impedes the subject’s right to choose between remaining silent and offering substantive information” (Right to remain Silent)*

5. Factors affecting the admissibility of Scientific Evidence

The pre-conditions for the admissibility of the scientific evidence (u/s. 45 of the Evidence Act) are as under--

- ☐ Whether the principle or technique has been or can be reliably tested?
- ☐ Whether it has been subject to peer review or publication?
- ☐ It's known for potential rate of error?
- ☐ Whether there are recognized standards that control the procedure of implementation of the technique?
- ☐ Whether it is generally accepted by the Community?
- ☐ Whether the technique has been introduced or conducted independently of the litigation?

These are borrowed from the cases of *Frye vs. United States*, (293F1013 DCcir 1923) and *Daubart vs. Merryll Dow Pharmaceuticals Inc.*, 113SCt. 2786 (1993)

Q and A Session

Please feel free to seek clarifications or assistance for better understanding

Thank you for your patient hearing and for your virtual presence

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