Scientific Evidence and the Law: Challenges and Prospects

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Abstract
Scientific Evidence would include all those evidence which could be collected by way of use of scientific methods, be it in the criminal matter or civil matter, like chemical tests, Fingerprinting, Narco-Analysis Test, DNA-Profiling, Polygraph or Lie Detector, Voice Analysis or Trace Evidence in form of fragments of glass, Fibers or tire marks. However, their utility at during the investigation is one thing while their admissibility in Law Courts in the form of evidence is another, and latter is difficult than the previous. This is the epicenter of problem relating to admissibility of such nature of evidence.

In the words of Terrence F. Kiely “Science and the Criminal Law is intended to serve as an introduction and guide to the appreciation and understanding of the significant historical, contemporary, and future relationship between the world of the forensic sciences and the criminal justice system”¹. However, this seems to be a difficult one as science may of immense utility to law and justice including scientific evidence but the latter is not as easily admissible in the Law Courts as the eye witness evidence.

The desire to develop a model for the validation of scientific discoveries and methodology has been a constant struggle since the very early period of modern scientific thinking, in 17th-century England. Sir Francis Bacon, Lord Chancellor and one of the fathers of modern scientific thinking, composed a work called the New Atlantis, wherein he created a mythical institution called Saloman’s House or the College of the Six Days Work. There, inhabitants were devoted to a serious and widespread search for the identification of scientific discoveries and to developing rigorous standards for testing their credibility. A complex system of experts was described by Bacon whose duties were focused on strict examination of practical results to serve as the basis for more generally applicable scientific principles².

The Problem of Reliability:
Reliability of evidence by a judge in the Courtroom depends upon this question that how certain that evidence is? Especially in the Criminal Matters a crime must be proved beyond any reasonable doubt, otherwise the conviction of an accused shall be bad. As far as standards of “proving a fact” are concern they are simply at par with wit of an ordinary prudent man, as “a fact is said to be proved when after considering the matter before it the court either regards that fact as proved or consider its existence so probable that a prudent man ought, under the circumstances of a particular

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² Ibid, p. 1
case, to act upon the supposition that it exists\(^3\). Sadly, scientific evidence needs much more to convince such prudent man to rely upon them.

As most of the scientific evidence exists in the form of Expert Opinion, which itself based upon certain experimentation and application of field of various sciences, question always raised upon the accuracy of such opinions. Moreover, scientific devices and instruments are used for analyzing the data, accuracy and reliability of such scientific instruments would be doubtful. Besides this, procedure followed in collection, packaging and maintenance of forensic data by the Crime investigators raised serious doubt about its admissibility if any faulty procedure is employed.

But not all expert opinions are baseless, though, they may not admissible in the Law Court, as depicted in this observation of an American Court: “Taking as true the plaintiffs’ expert’s affidavit asserting that the extrapolation method is commonly used by the scientific community as well as various federal agencies, taken along with the similarity between some of the defects described in the scientific literature and those exhibited by Lindsay, we find that the trial court abused its discretion in finding that the plaintiffs’ extrapolation from the studies was not a technique sufficiently established to have gained general acceptance in this particular scientific field. Thus, we conclude that the plaintiffs’ experts may give their opinions as to causation and the weight to be afforded those opinions are matters for the jury to resolve. Under the circumstances of the case at bar, the fact that plaintiffs’ experts had to ‘extrapolate’ from various studies in arriving at their opinion rather than rely on a specific epidemiological study affects the weight of the testimony and not its admissibility\(^4\).”

On the other hand, pointing out the problem, Robert Hooke, the early-17th-century inventor of the microscope and an associate of the great experimentalist Sir Robert Boyle, along with Francis Bacon also recognized the difficulty of finding adequate standards for the testing of scientific validity, especially in cases of attempts to fashion one uniform set of constructs for any such task\(^5\):

For the limits to which our thoughts are confined, are small in respect of the vast extent of Nature itself; some parts of it are too large to be comprehended, and some too little to be perceived, and from thence it must follow that not having a full sensation of the object, we must be very lame and imperfect in our conceptions about it, and in all the propositions which we build upon it; hence we often take the shadow of things for the substance, small appearances for good similitude, similitude for definitions; and even many of those, which we think to be the most solid definitions are rather expressions of our misguided apprehension then of the true nature of the things themselves\(^6\).

The basic legal antagonism between forensic scientists and the courts can be encapsulated in a single question: how far do forensic scientists say they can go in making a definitive statement about a crime scene or the linking of a suspect to it because they have a microscope, and how far do we let them go because we have a constitution, which puts bar in extracting the insider knowledge of an accused person\(^7\).

The importance of this question lies in the recognition of just how far and on what empirical basis any such statements (made by an expert) can be made at all, and the impact that any such statements may have on a judge in causing any such match testimony, albeit given in a qualified manner, to be taken as true by a judge. The concern has always been that a criminalist’s testimony that a hair or fiber obtained from a suspect was consistent in all respects or not dissimilar will be internalized by jurors as a statement of a definite match. It is important in this respect to realize that with the possible exception of fingerprint and ballistics testimony, the opinions of most forensic experts are typically only permitted to be couched in such qualified terms\(^8\).

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\(^3\) Indian Evidence Act, 1872; Section 3

\(^4\) Duran v. Cullinan, 286 111, App. 3d 1005, 677 N.E.2d 999 (1997), at 1013

\(^5\) Robert Hooke: Micrographia, or Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses with Observations and Inquiries Thereon (London, 1667), at preface, 2.

\(^6\) Id, p.3

\(^7\) Constitution of India, 1950; Article 20(3)

\(^8\) Supra note 1, p. 27
Thus, the reliability of scientific evidence comes into question because of uncertainties in methods employed for gathering and packaging such traces. Moreover, testimony of Expert also is merely an opinion and court may take it either as a whole or in part or reject it altogether. However, on the bright side, forensic evidence generally relates with information generated by one or more of the forensic sciences which include physics, chemistry, biology, medicine etc. and comes before the law Court in one or both of two forms.

The first is referred to as a class characteristic statement that speaks generally to some aspect of the crime scene under examination. Testimony that the pubic hairs found on a rape-homicide victim came from a Caucasian male or that shell casings found at the scene came from a certain make and model of firearm are two typical examples of such type of statement.

The second type of potential testimony generated by a forensic science is known as individual or matching statements, i.e., that serve to link some data found at the crime scene to a particular defendant. Testimony finding that court-ordered pubic hair exemplars obtained from the defendant are consistent in all respects to the hair located on the victim, or that fibers found on the victims clothing are consistent with fibers from the defendant’s jacket will serve as examples.

The phrase “Forensic Science Evidence” encompasses two distinct ideas and processes. The forensic part refers to the processes utilized in the forensic science at issue through which facts are generated. The manner in which DNA is extracted, tested, and subjected to population analyses serves as a major example. The methodologies of hair, fiber, and fingerprint examination are other illustrations. The area of forensic science encompasses a fairly discrete number of well-known disciplines, whereas the “science” addressed in product liability and environmental civil cases does not lend itself to such finite boundaries. Although there are repetitive areas of scientific focus in civil cases, such as chemistry and pharmaceuticals or biological, mechanical, or electrical engineering, there is much less of an opportunity to discuss the general outlines of acceptable methodology in such cases. The forensic sciences, traditionally associated with the prosecution of crime, do allow for such broad methodological reviews and, accordingly, are required to varying degrees by criminal courts. Nonetheless, the legal concerns are basically the same.

The evidence part of the concept of forensic evidence refers to a distinct set of procedures unique to the litigation process, separate and distinct from the processes of any forensic science or sciences that are the basis for the proffer of facts in criminal cases. At this point a discussion of the basic components of what may be referred to as the forensic science process, across individual disciplines, is necessary, as a means of furthering an understanding of the broad judicial support given the evidentiary contributions made to the criminal justice system in the form of factual assertions and/or opinions from the forensic community.

In the civil as well as criminal cases, the parties are seeking to prove or disprove a sufficiently strong connection between the defendant’s act or omission and the death or injury in a suit. However, the science at issue usually consists of studies that may only be probative of any such connection by way of extrapolation, without the individualizing expert testimony typically provided by forensic scientists.

As noted by Robin Weeks, “Evidence means different things to different people, of course. The historian tends to think mainly in terms of documents. A lawyer will mean something rather different by the word, as will a sociologist, or a physicist, or a geologist, or a police officer at the moment of making an arrest. For certain problems evidence must be ‘hard,’ while for others it may be ‘soft.’ Even if no acceptable or agreed-upon definitions of evidence may be given, most of us recognize intuitively what we mean when we use the word.”

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9. Supra note 3; Section 45
11. Supra note 1, p. 20
12. Id.
Prospects of Scientific Evidence:

As the science and technology advances with the advancement of the society keeping in pace with time, the modus operandi of criminals have also undergone a tremendous change and they are using the science and technology in committing the crime as well. Therefore, it is need of time to use scientific methods and techniques extensively to resolve out these outlaws activities. Therefore, forensic evidence deals with scenarios far different from civil law tort cases, where in the latter type of case no real science is done to serve the theoretical need to prove causation. In the criminal case the use of forensic science means that some form of research or laboratory work is performed to resolve factual matters in the case itself. In both civil and criminal cases the information provided from scientific sources must be relevant to one of the issues in the case. In civil cases this typically involves the question of whether some commercial application of some scientific formulation “caused” the plaintiff’s death or injury.

Nobody can deny the accuracy of scientific finding if it is based on accurate and reliable data. However, the value of forensic evidence for police and prosecutors lies in its ability to interpret multiple physiological aspects of a crime scene and, it is hoped, to link a particular suspect to it. In this respect it is of central importance to recognize that in any criminal case there are actually four crime scenes involved, each with its own set of rules and guiding principles:

- The physical crime scene created and left by the perpetrator.
- The crime scene material collected by the crime scene personnel.
- The crime scene material capable of being tested by the crime laboratory and the results of any such tests.
- The crime scene information allowed into evidence by the trial court according to the case issues and the rules of evidence.

No doubt, any discussions of the use of science in the criminal law typically revolve around the subject of forensic evidence. Forensic evidence refers to facts or opinions proffered in a criminal case that have been generated or supported by the use of one, typically by more than one, of the corpus of forensic sciences routinely used in criminal prosecutions. The more important among the body of forensic sciences are set out below:

- Hair Analysis.
- Fiber Analysis.
- Glass Fragments and Paint Chips Analyses.
- Soil Analysis.
- Ballistics and Tool Marks.
- Fingerprints.
- Footwear.
- Tire Impressions.
- Blood Spatter Analysis.
- DNA Analysis.

Besides these, forensic science has its own branches and sub branches on the basis of subject matter with which it is dealing with. It is not unworthy to discussion some of them in brief because they can answer those questions which nobody else in this materialistic world can answer.

Forensic Anthropology: Forensic anthropology applies the science of physical or biological anthropology to the legal process. Anthropology is the study of humans, and in this forensic discipline
physical or biological anthropologists focus their studies on the human body as it relates to explaining the circumstances of an accident or solving a crime – often homicide.\textsuperscript{14}

Forensic anthropology involves applying anthropological research and techniques to medico-legal issues. There are three subsections within the field of forensic anthropology, including:

- Forensic Osteology (the study of the skeleton)
- Forensic Archeology (involves the controlled collection of human remains)
- Forensic Taphonomy (involves the study of changes to the body after death, including decomposition and environmental modification)

Forensic anthropologists analyze human remains, typically in criminal investigations. Their study of human remains aids in the detection of crime by working to assess the age, sex, stature, ancestry and unique features of a skeleton, which may include documenting trauma to the skeleton and its postmortem interval.\textsuperscript{15}

**Forensic Archaeology:** A forensic archaeologist’s first involvement may be to help the police locate the site where a body and victim’s personal items, or stolen goods are buried, through geological and geophysical surveying techniques, as well as using imaging and photography.\textsuperscript{16}

The forensic archaeologist may also help with the excavation, using similar tools and expertise to those used at an archaeological dig. This has to be done slowly and painstakingly, and the archaeologists will record and preserve anything found at every stage and depth (for example paint flakes, hair, clothing or DNA) as it may be vital evidence. The colour and state of the soil may be useful in the investigation. Forensic archaeologists can date items found in grave sites, including bones, using a range of techniques. Carbon dating can determine whether the grave site is recent or ancient.

Moreover, Forensic archaeologists may be involved in the excavation of mass graves to produce evidence for war crimes trials, or in the collecting and collating of human remains and personal effects at mass fatalities, such as bomb or gas explosions, or plane crashes. Evidence from forensic archaeologists about how materials degrade or decompose over time and in specific conditions is important, as this can help determine, for example, how long a body has been buried by the state of the clothes or the surrounding soil, or how long stolen goods have been buried by the subsequent damage to metal and other materials.\textsuperscript{17}

Forensic archaeologists may have to give evidence in court as an expert witness, and need to be able to communicate complex issues to a lay audience. They may also have to communicate with distressed and bereaved relatives.

**Forensic Pathology:** Forensic pathology is the discipline of pathology concerned with the investigation of deaths where there are medico-legal implications, for example, suspected homicides, death in custody and other complex medico-legal cases.

Much of the day-to-day work of forensic pathology is performing autopsies, for example in a case of stabbing, shooting or head injury, which are common methods of homicide in the United Kingdom. These autopsies are usually carried out under the authority of the coroner in England and Wales, with police present.\textsuperscript{18}

**Forensic Odontology:** A forensic dentist is an informal title for a forensic odontologist, a medical professional who is trained in odontology, a branch of forensic science that deals with the application of dental science in the identification of unknown human remains and bite marks. Forensic dentists

\textsuperscript{14} Steven N. Buyers; Introduction to Forensic Anthropology, 1 (5th Ed., Routledge, New York, 2017)

\textsuperscript{15} Ibid.


\textsuperscript{17} Id, p.5

use both physical and biological dental evidence to solve a number of medicolegal problems, including identifying human remains that result from crimes, terroristic activities, and natural disasters\textsuperscript{19}.

Forensic dentists have played very important roles identifying victims of major catastrophes, such as natural disasters, airplane crashes, and terrorist activities. These professionals were integral in identifying victims of such tragedies as the Oklahoma City Federal Building and the World Trade Center attacks and the crashes of Pan Am Flight 103 and American Airlines Flight 587\textsuperscript{20}.

**Questioned Document Analysis:** Questioned material may consist of identification cards, contracts, wills, titles and deeds, seals, stamps, bank checks, handwritten correspondence, machine-generated documents (such as those from photocopiers, fax machines, and printers), currency and electronic documents. In some circumstances, graffiti and digital signatures may be examined; however, the client should be aware that the examination of these types of evidence can be problematic.

When conducting examinations, forensic document examiners must have known specimens to which they compare the material in question. These samples may come from any number of known sources, such as a particular ink manufacturer or machine.

**Forensic Psychiatry and Psychology:** Forensic psychiatrists and psychologists are active in different areas of the justice system. However, both typically are highly active with the criminal population at some point in their career. Many times, they deal directly with the mental health of a criminal suspect. From different perspectives, the psychologist and the psychiatrist will determine the state of mental illness of the inmate.

Forensic psychiatrists have specialized training to help them identify and categorize the various symptoms associated with the inmate’s mental disorders. It is usually their work that is utilized in legal proceedings as a way to assess and evaluate the suspect, a victim or a witness if it is deemed appropriate by the court system\textsuperscript{21}.

**Conclusion:**

It is submitted that pros and cons are inherent in any subject and scientific evidence is not an exception to that. The central concept in the utilization of the findings of forensic science evidence is the crime scene. While a crime scene can consist of the basement of a counterfeiter or the broken door lock of a supermarket, typically the term refers to the scene of a violent crime such as a sexual assault or a homicide, which may have gone unobserved or witnessed by nobody. In such cases evidence may be collected by using the suitable scientific methods and techniques assisted by biological and chemical enhancer liquids in the form of reagents. The use of the crime scene paradigm is not only a familiar focus for the training of forensic scientists, it is also the central source and reference point for analysis of the many legal issues that are involved directly or indirectly in the field of forensic evidence. What types of materials are typically or often found at a scene of incident or at crime scene that may, through close examination by forensic scientists yield valuable information leading to an arrest and successful prosecution of the perpetrator or the equally important elimination or exclusion of a putative suspect.

\textsuperscript{19} David R. Senn, Richard A. Weems (Edi): Manual of Forensic Odontology, 424 (5\textsuperscript{th} Ed, CRC Press, Taylor & Francis Group, Boca Raton, Florida (U.S.), 2013)
\textsuperscript{20} https://www.crimesceneinvestigatoredu.org/forensic-dentist/ Visited on 20/03/2018
\textsuperscript{21} Curt R. Burtol, Anne M. Bartol; Introduction to Forensic Psychology: Research and Application, 6 (Sage Publication, London, 2012)