

## REVIEW PAPER

# Improving the practice and use of forensic science

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## ABSTRACT

Forensic science can be defined as criminalistic science. In other words the scientific studies or investigation of crime can be termed as Forensic Science. Along with the development of science and technology the pattern of our society has also changed to cope with the day to day development. Nowadays criminal use different techniques for commission of various crimes<sup>1</sup> within the society. So it has become a problem for the law enforcing agencies to check the potentiality of crimes. For such checking the need of forensic science becomes an essential prerequisite on the part of the investigative agencies. Considering the necessity and importance of forensic science, Government of India has established a few forensic sciences laboratories in the different parts of our country. Similarly the Government of various states has also established some forensic science laboratories. In the same spirit, the Government of Assam has also established a forensic science laboratory at Guwahati<sup>2</sup>. Forensic Science Laboratory, Assam is a scientific institution under the Police Department established in the year 1967. This laboratory has been established in the pattern of an ideal forensic science laboratory, comprising eight important branches of science like Chemistry, Physics, Biology, Serology, Ballistics, Toxicology, Question Documents and Photography.

**Key Words :** Physical science unit, Biology unit, Firearm unit, Stages

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### Different units of the forensic laboratory:

Basic services provided by crime laboratories in the field of investigation is a milestone and helps to fast track investigation crime laboratories provides services in relation to—

#### *Physical science unit:*

The physical science unit applies principles and techniques of chemistry, Physics and geology to the identification and comparison of crime scene evidence; it is staffed by criminalities that have the expertise to utilize chemical tests and modern analytical instrumentation for the examination of items as diverse as drugs, glass, paint, explosives

: and soil. In a laboratory that has a staff large enough to permit  
: specialization, the responsibilities of this unit may be further  
: subdivided into sections devoted to drug identification, soil  
: and mineral analyses and the examination of a variety of trace  
: physical evidence.

#### *Biology unit:*

: The biology unit is staffed with biologists and  
: serologists who apply their knowledge to identification and  
: typing of dried bloodstains and other body fluids, the  
: comparison of botanical materials such as wood and  
: paints.

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**Firearm unit :**

The examination of firearms, discharged bullets, cartridge, shotgun shells, and ammunition of all types is conducted by the firearms units. Garments and other object are also examined in order to detect firearm discharge residues and to approximate the distance from a target at which a weapon was fired. The basic principles of firearms examination are also applied here to the comparison of marks made by tools.

**Document examination:**

The handwriting and typing on questioned documents are studied by the documentation unit to ascertain authenticity and or source. A related responsibility includes analysis of paper and ink as well as examinations of indented writings, obliterations, erasures, and burned or charred documents.

**Photograph unit :**

A complete photographic laboratory is maintained to examine and recorded physical evidence. It is procedures may require the use of highly specialized photographic technique<sup>1</sup> such as infrared, ultraviolet and x-ray photography to make invisible information visible to the naked eyes. This unit also aids in the preparation of photographic exhibits for courtroom presentation.

**Toxicology unit :**

Body fluid and organs are examined by the toxicology group to determine the presence or absence of drugs and poisons, Frequently, such functions are shared with or may be the sole responsibilities of a separate laboratory facility placed under the direction of the medical examiner's or coroner's office.<sup>2</sup> In most jurisdictions, field instruments such as the intoxilyzer are used to determine the alcoholic consumption of individuals often the toxicology section has the responsibility of training operators as well as maintaining and servicing instruments.

**Polygraph unit :**

The polygraph or lie detector, has come to be recognized as an essential tool of the criminal investigator rather than the forensic scientist, however, during the formative years of polygraph technology, many police agencies incorporated this unit into the laboratory's administrative structure, where is sometimes remains today . In any case, its functions are handled by people trained in the techniques of criminal investigation and interrogation.

**Voiceprint analysis unit:**

In cases involving telephoned threats or tape recorded messages, investigators may require the skills of the voiceprint

analysis unit to tie the voice to a particular suspect. To this end a good deal of casework has been performed by the sound spectrograph, an instrument that transforms speech into a visual graphic display called a 'voice print'<sup>3</sup>. The validity of this technique as a means of personal identification rests on the premise that the sound pattern produced in speech are unique to the individual and that the voiceprint display this uniqueness.

**Evidence collection unit :**

The concept of incorporating crime scene evidence collection into the total forensic service is slowly gaining recognition in the U.S. this dispatches specially trained personnel (civilian and or police) to the crime scene to collect and preserve physical evidence that will later be processed at the crime laboratory.

**Use of forensic science:**

In rejecting the scientific validity of the lie detector (polygraph), the Columbia Circuit Court in 1923 set forth what has since become a standard guideline for determining the judicial admissibility of scientific examination. In *Frye vs United State*<sup>4</sup>, the court stated the following,

Just when a scientific principle or discovery crosses the line between some where in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting experts testimony deduced from a well recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.

To meet the *Frye Standard*, the court must decide if the questioned procedure, technique and principles are 'generally accepted' by a meaningful segment of the relevant scientific community. In practice, this approach required the proponent of a scientific test to present to the court a collection of experts who testify that the scientific issue before the court is one that is generally accepted by the relevant members of the scientific community. In a landmark ruling in the 1993 case of *Daubrt vs. Merrell Dow pharmaceutical, Inc*<sup>5</sup>. The U.S. Supreme Court arrested that, 'General acceptance' or the *Frye standard* is not an absolute prerequisite to the admissibility of scientific evidence under the federal rules of evidence. According to the court, the task on ensuring that an experts testimony rests on a reliable foundation and is relevant to the task at hand.

'Forensic science laboratory was established, to provide impartial scientific evidence following examination of items from crime scenes. Its missions, as set out in its strategy statement, is to assist in the investigation of crime and to service and administration of justice in an effective manner by a highly trained and dedicated staff providing scientific

analysis and objective expert evidence to international standards.<sup>6</sup>

Fingerprint was originally used to establish and to make readily available the criminal records of an individual offenders, at it quickly came to be widely used as a means of identifying the perpetrators of particular criminal acts. Most major police forces maintain collection of fingerprints that are taken from known criminals in order to identify them later should they commit other crimes. The FBI, ex- reportedly held millions of prints in its electronic database at the beginning of the 21<sup>st</sup> century fingerprints found at crime scenes thus can be matched with fingerprints in such collections<sup>7</sup>.

During the process of investigation in the recent trend use of insects is increased which is help to detect the events, the first recorded instance when insects where used to solve crime is from china in the 13<sup>th</sup> century.<sup>8</sup> Forensic entomology emerged as a major discipline with passage of time in developed countries and its role in investigations about crime has continued to become more and more relevant.

The use of forensic science is seen when investigative authority with help of forensic science detects the criminal Decomposition is a continuous process, many forensic scientists have divided it into separate successive stages for better understanding. These are fresh, bloated, decay and dry stages.

#### *Fresh stage:*

This stage begins at the moment of death ad ends when bloating is first evident. The first organisms to arrive at the remains are the flies belonging to the family's calliphoridae (Blowflies) and sarcophagidae (flesh flies). Larvae or eggs are deposited around the natural body openings associated with the head and urino-genital regions.

#### *Bloated stage :*

Putrefaction, the principal component of decomposition begins, during this stage. Gases produced by the metabolic activities of anaerobic bacteria first cause of slight inflation of the abdomen and the corpse may later assume a fully inflated, balloon like appearance. Internal carcass temperatures begins to rise during this stage as a combined results of the putrefaction processes and the metabolic activities of dipteran's larvae. Calliphoridae are strongly attracted to remains during this stage, reaching the greatest numbers at the peak of inflection, fluids seeping from natural body opening during this stage combined with ammonia produced through the metabolic activities of dipteran's larvae cause the soil beneath the carcass to become alkaline. Normal soil fauna will depart the area beneath the remains during this stage.

#### *Decay stage :*

This is the only stage having a distinct physical event

marking the starting point. It is considered to begin when skin is broken, allowing gases to escape and the remains deflate. Dipterans larvae forming large feeding masses are the predominant taxa present during this stage. Coleopterans also arrive during the decay stage. Both necrophagous and predatory taxa are observed in large numbers during the later portions of this stage. By the end of this stage most members of calliphoridae and sarcophagidae compete their larval development and depart from the remains for pupariation. The carrion temperature during his stage is considerably higher than the soil temperature and even higher than the surrounding air temperature a fly maggots consumed 90 per cent of the carcass biomass by the end of this stage and this was observed to be so during the present study as well.

#### *Dry stage:*

This is the final stage of decomposition. The carcass consists of only dry skin, furcartilage and bones. Internal carcass temperature approximates that of ambient. The end of his stage is difficult to define as noted by various authors due to its long duration and lack of pronounced marking events. However, reed stated that this stage might last up to a point when no carrion fauna remains.

During earlier stages of decomposition, the time elapsed since death or Post Mortem Interval (PMI) may be determined by calculating the time required for a given species to reach the particular stage of development recovered from the corpse at the time of discovery. The insects involved in this approach are mostly dipterans, especially those belonging to families calliphrodae and sarcophagidae.

Detection of mode of death with help of forensic science is much easy a dead body having external injuries is more attractive to insects than one having none. So depending upon the degree of degradation brought about by maggots, an entomologist<sup>9</sup> may be able to suggest the possible more of death e.g. strangulation or mutilation. Another application is in the cases where death has occurred due to the intake of drugs. Chemical analysis of the maggots found on the dead body can reveal specific drugs, especially helpful when no human tissues are available for sending to the laboratory for chemical tests. Forensic Scientist can easily detect the place of death, the deceased may have been killed as a place other than where the body is found with knowledge about the carrion fauna of an area and specific habits of species found on the cadaver, an entomologist can help determine whether the person died at a place other than where the body has been found. Similarly, route of transport of a dead body may also be traced by using entomological data.

When a tragic end comes to the suffering of the victim in the form of murder, suicide or unnatural death, the availability of immediate eye witness is a remote possibility.<sup>10</sup> Here the forensic science department has to play a crucial role in

collecting scientific evidence it shall start from the scene of occurrence. The scene of occurrence will have to be preserved unaltered and undisturbed, for the examination by experts. In almost all the cases vital clues will be available from the scene itself. That would include burn remains, external object in the place of occurrence such as rope, weapons, piece of cloth, other material objects used for the crime such as bottles or canes of fuel poison etc.

The next important aspect is the examination of the body of the victims and to trace the pre-mortem injuries or marks on the body<sup>11</sup> of the victims must be put to scientific test so as to support the prosecution cases. Scientific examination of materials like hair, blood stains on the cloths, and on other objects, finger prints on the body of the victim. Finger print on material objects like weapons the wall, furniture etc. on the place of accurate foot marks in and a [sic] around the place of occurrence, hand writing and signature on suspected documents, letters, suicide note etc. will provide vital clues to the investigation.

Forensic science plays an important role in the investigation of serious crimes. One of the first significant achievements in the field was the development of techniques for identifying individuals by their fingerprints. In the 19<sup>th</sup> century, it was discovered that almost any contact between a finger and a fixed surface left a latent mark that could be made visible by a variety of procedures. e.g. the use of a fine powder. Fingerprinting was originally used to establish and to make readily available the criminal records of individual offenders but it quickly came to be widely used as means of identifying the perpetrators of particular criminal acts. Most major police forces maintain collections of fingerprints that are taken from known criminals in order to identify them later should they commit other crimes. The FBI<sup>12</sup>, for ex. reportedly held millions of prints in its electronic database at the beginning of the 21<sup>st</sup> century. Fingerprints found at crime scenes thus can be matched with fingerprints in such collections. Historically, searching fingerprint collections was a time consuming<sup>13</sup> manual task, relying on various systems of classification.

The development in the 1980's of computerized databases for the electronic storage and rapid searching of fingerprint collections has enabled researchers to match prints much more quickly. Documents can be revealed as forgeries on the evidence that the paper on which they were written was manufactured by a technique not available at the time to which it allegedly dates. The refractive index of even small particles of glass may be measured to show that a given item or fragment of glass was part of a particular batch manufactured at a particular time and place. With the help of forensic science it becomes easy for the police as well as to court to decide the matter; in the era of science world, criminals also taking help of science and planned to escape from the clutches of the law equally with help of the advanced science of forensic

laboratory a crime is easily detected and no criminal can run away from the punishments.

Scotland, however, has a totally different legal structure because its laws have developed separately from the laws of England. Nevertheless, many statutes passed by the UK parliament have effect in Scotland. In criminal trials, an accusation is not proved until it's established beyond a reasonable doubt. In serious criminal cases a body of unbiased citizen called a jury decides whether a case is proved. The jury must make its decision solely on the evidence before the court. Juries are not used in the trial of minor offences. In some cases, the accused may choose whether to be tried by a judge and jury or by magistrate.<sup>14</sup>

Scottish criminal laws are unlike that of most countries that use Roman law principals, because it's not codified. It is unlike English law in its procedure.

Expert evidence in a criminal trial would be just a fraction of the totality of the evidence on the appreciation of which the judge or jury takes decision. The Court takes into account all the other evidence at hand along with the opinion of the scientific expert, which is just one piece of evidence required to be taken into consideration and appreciated for its evidentiary value. Even after the validity of the technique of brain fingerprinting satisfies Daubert's criteria, its application as a forensic tool in individual cases will depend upon the authenticity of the probes and other factors. The test would not be applicable in a case in which two suspects in an investigation were both present at a crime, but one was a witness and the other a perpetrator. The technique can only detect information from their memory that would place both at the scene of the crime and it cannot determine what their roles were, thereby creating a distinct possibility of an innocent eye-witness becoming a suspect of the crime and giving a dubious opportunity to the real culprit to create a situation of doubt. Furthermore, the technique would not be definitive in a case in which investigators do not know sufficient information about a crime to be able to test a suspect for crime-relevant information stored in the brain. The brain-fingerprinting test detects the presence or absence of information and not guilt or innocence *per se*. In some cases, a person may possess virtually all the available information about a crime, even though he is not a perpetrator. In such cases, possessing crime relevant information will not identify that individual as the perpetrator and the test cannot be applied to solve the case. A Primer for Tiers of Science," has proposed a five-step framework for a sound analysis of scientific evidence to meet the requirements of intellectual due process in making admissibility determinations. The heuristics proposed consists of five basic parts and emphasizes the underlying principles common to all fields of science. It is suggested by the author that the judges and the lawyers who assist them about their cases, must be able to do five things<sup>15</sup>:

(i) Identify and examine the proffered theory and hypothesis for their power to explain the data; (ii) Examine the data that supports (and undermines) the expert's theory; (iii) Use supportable assumptions to fill the inevitable gaps between data and theory; (iv) Examine the methodology; and (v) Engage in probabilistic assessment of the link between the data and the hypothesis.

Narcoanalysis tests which are also known as 'truth serum test' are used to analyze the behavior of the suspect as well as for the purpose of corroborating the investigating officer's findings.

It has been proved by scientific experimentation that if a person is administered with such drugs which may suppress his reasoning or power to think, he may be made to tell the truth. As discussed earlier certain drugs have tendency of creating a state called 'twilight sleep'<sup>16</sup>. Such drugs are being used in India in various kind of investigation. The Term Narcoanalysis was first introduced in India in the year 1936 for the use of narcotics in the investigation to induce a trance like state wherein a person may be subjected to various queries. The aim behind such administration of drug was that the person under the influence of such drug, being deprived of power of reasoning and self-control would talk freely and will not be able to manipulate any answer. The underlying theory is that a person can lie only by using his power of imagination thus, when devoid of such power, a person is bound to speak truth.

In Narcoanalysis test the subject's reasoning is neutralized and affected by making him semi-conscious. He may not be able to speak on his own but he is in state to make specific answers to simple questions. The investigation done under such circumstances are recorded both in audio and videocassettes. This procedure is conducted in governmental hospitals after obtaining due permission of the court<sup>17</sup>. Personal consent of the subject is also required. Police believes in narcoanalysis test as a scientific device aiding the process of investigation, which is not only helpful in solving pending criminal cases but also helps in crime prevention. Narcoanalysis being a scientific approach is preferred over traditional third degree method. But on the other hand questions are raised against authenticity of evidence collected through such procedure of investigation. Its application is also questioned as it suffers from various drawbacks such as the person conducting the test has to highly qualified physician, It is very essential to apply correct measure of dose as overdose may turn out to be of fatal consequence which may even result in death of the suspect, the test can fail if the suspect is an abuser or regular user of certain kind of narcotic substances.

Indian courts have accepted the role of DNA in criminal paternity case. In Rajiv Gandhi Case, the DNA samples of alleged assassin Dhanu were compared with her relatives,

which gave conclusive proof about her being involved in the gruesome attack. Similarly in Tandoor murder case, the DNA samples of the victim Naina Sahni were compared with that of her parents to establish her identity<sup>18</sup>

In the case of Gautam Kundu v West Bengal<sup>19</sup> the apex court has laid down certain guidelines regarding DNA test and their admissibility in the parentage case.

– The courts in India cannot order blood test as a matter of course.

– Whenever application is made for such prayer in order to have roving enquiry, the prayer of blood test cannot be entertained.

– There must be strong prima facie case in which the husband must have establish non-access in order to dispel the presumption arising under section 112 of Indian Evidence Act, 1872,

– The court should carefully examine as to what would be the consequence of ordering the blood test.

– No one can be compelled to give blood sample for analysis.

In the light of recent developments in the forensic science, the committee constituted under Dr. Justice V.S Malimath<sup>20</sup> suggested certain reform in criminal justice system. This committee suggested comprehensive use of forensic science in the criminal justice system. According to committee, DNA expert should be included in the list of experts given in the section 293(4) of Cr.P.C. one of the suggestion is, the laboratories should be upgraded to make them more useful in the fight against crime by making them more suitable to handle DNA samples. In USA, more than 140 people convicted of murder were exonerated using DNA test. Isn't it sufficient to prove the development very useful? The criminal justice system is supposed to be based on just and equitable principles. The task of the Court is to industriously understand the scientific evidence and assess its value.

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