CHAPTER-II

SCIENTIFIC AIDS USED IN POLICE INVESTIGATION

2.1 Introductory

As the crimes are increasing day by day, thus it is the duty of the State not only to keep a check on the increasing crime, but also to punish the offender and create a crime free atmosphere. The police and other para military forces are established for the maintenance of law and order in our country. No doubt, they are performing their duty with great zeal entrusted to them, but poverty, unemployment, illiteracy and other unwanted desires are the main causes which encourage the offenders to commit crime. When a crime is committed, it is the duty of the police officer to trace out the criminals and send them behind the bars. First of all, the crime scene is a very important place from where an investigating officer can get the useful information. The primary function of a crime scene search is to gather evidences of what occurred during the commission of a crime. The crime scene can be a rich source of physical evidence.¹ The search for physical evidence at the crime scene is not a game played in the manner of a Children’s Easter egg hunt. It is a serious business, the end result of which often encompasses matters of life and death.² In the old days, the task of investigation was easier than at present. The trends and techniques used by criminals in the present age are of very high

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¹ Dr. RC Mishra IPS, Crime Trends and Criminal Justice (2001), p.28
² George B. Mettler, Criminal Investigation (1977), p.73
standard. It is not easy to trace the culprit among the members of a family. It is a very difficult task for an investigating officer to find out the culprit. Therefore, a great emphasis on the investigation work is the need of the hour. No eye-witness is available and if available he can be hostile. Only the scientific aids are the main source which can help the investigating officer to conclude an investigation.

In this chapter, meaning and concept of Scientific Aids, meaning and concept of police investigation and what are the different scientific aids which a police officer or an investigating officer can utilize during the investigation of a crime are discussed comprehensively.

2.2 Scientific Aids- Meaning and Concept

According to Mahamaya dictionary ‘Scientific’ means pertaining to science and ‘Aids’ means to assist, to help. In this way scientific aids are helpful to the investigating officer in order to utilize the science which assists him in solving the criminal case in scientific way. The police officer of the last century dealing with the investigation of crimes was in a fortunate position in the sense that he did not have to handle so many types of crimes as the police officer of today has to.³ Scientific aid is an important tool to assist the Criminal justice delivery system. Scientific aids to investigation provide general as well as specific technical information on different aids of detection and investigation of crime.⁴ There are numerous occasions when evidence recovered from crime scene is forwarded to laboratories

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for scientific examination.\textsuperscript{5} There are a number of scientific aids which are utilized by the police or forensic scene of crime team experts in criminal investigation.

It is significant to note that these scientific aids are concerned chiefly with the identification of objects and things through the applied processes of the physical science. It is of further significance that these scientific aids are primarily adaptable to the administration and enforcement of criminal justice.\textsuperscript{6}

The society for its continued welfare and progress wishes to keep the crime in check. Criminal of modern society is cleverer than the past. He applies the modern techniques in committing crime. It is the prime duty of the State to check the criminals and put them in the prison. Of course, it is not an easy task for the State. There is a need for increasing awareness of the role and significance of (forensic) scientific aids in criminal justice by the police and the courts. Over the years, application of scientific methods in the investigation of crime has developed into a full-fledged field of specialization termed as Forensic Science or Criminalistics.

\textbf{2.2.1. Physical Evidence: Sources and Importance}

Every investigating officer conducting the investigation of any case/crime must understand the meaning of physical evidence and its importance in solving the criminal case. The quality of investigation of a criminal case is more dependent to a great extent on the method or technique used by the

\textsuperscript{5} Dr. M. K. Goyal, \textit{FSL BULLETIN}, (June, 2008), p. 2
\textsuperscript{6} James R. Richardson, \textit{Modern Scientific Evidence Civil and Criminal}, (1961), p. 15
investigating officer in collecting, packaging, documenting and forwarding the physical evidence to the laboratories of forensic science for examination. It is very important to note that physical evidence is not only found at crime scene but it can be collected from the victim or the perpetrators or both and on the places of extensions.

Physical evidence is the evidence having a physical or material quality - a tangible article, no matter whether microscopic or macroscopic. It encompasses any and all objects, living or inanimate, solid, liquid or gas. For instance, any contact between the criminal and the crime scene will leave some traces of materials/impressions.

Physical evidences are the basis of scientific crime investigation. It is encountered in almost all the crime cases and it is up to the investigating officer to locate, collect and send them to the forensic science laboratory for examination. As far as evidentiary value is concerned, physical evidences are more acceptable when compared to human testimony. With the passage of time the witnesses change their stand whereas physical evidence does not.

It is almost impossible for a person to commit a crime without leaving some kind of evidence of the act. The evidences may be of testimony, documentary, demonstrative and physical. Physical evidence is the most important evidence which is

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8 Quoted from LNJJN National Institute of Criminology and Forensic Science, *Course on Crime Scene and Forensic Evidence Collection* (2009), p.3
tangible objects, such as blood, hair, fingerprints etc. Physical evidence is the basis for scientific crime investigation. It can establish that a crime has been committed or can provide a link between a crime and its victim or a crime and its perpetrator. It can also provide leads to the investigator during the conduct of investigation of a criminal offence. Physical evidence can only achieve its optimum value in investigation when the investigator is fully conversant with the crime laboratory’s techniques, capabilities, and limitations. He must also be skilled in the handling, collection, preservation, packaging and forwarding of such evidence. The investigator must maintain the chain of custody of the evidence to ensure its evidential nature.\(^{11}\)

Moreover, scientific criminal investigation involves use of science to identity and link the culprit with the crime, the victim, the scene, the weapon of offence and other evidence inter se, decisively. Science has progressed much, in recent years that it has crossed all physical barriers as far as the analytical techniques are concerned. If the collection, preservation, authenticity and integrity of the evidence is proper and beyond doubt, the evidence it provides is sure and certain.\(^ {12}\)

### 2.2.2. Sources of Physical Evidence

Although the primary source of physical evidence is generally the crime scene itself, it is by no means the only source. Many crimes have moving or multiple scenes; many criminals carry physical evidence away from the actual scene in addition to leaving evidence behind. Witnesses as well as participants in the crime are often major sources of physical

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evidence, as indeed is the victim himself. In addition, there are many types of evidence that are not susceptible to discovery by normal investigative measures and require scientific treatment beyond the capability of the investigator.  

In short, the scene of crime, the victim and the suspect and his environment are the sources of physical evidence. When a crime occurs, there are three primary sources of physical evidence available to the CSI officer (crime scene investigation officer): the crime scene, the victim, and the suspect. Where the blood marks found on the sites, they corroborate the prosecution story. Where the blood marks are found along the paths, they support the theory of dragging. The absence of blood on the alleged scene of occurrence renders the prosecution story doubtful. For example, where the blood stain found on the motorcycle of the accused matched with the blood group of the deceased, it was held that the said circumstance is not decisive enough to point to the involvement of the accused in the murder of the deceased. Acquittal of accused under ss 302, 364 r/w s 120 B of the Indian Penal Code, 1860, held on facts, was not liable to be interfered with.

Since the entire purpose of crime scene investigation is to tie the suspect to either the victim or the crime scene, and to reconstruct the events of the crime, it will be beneficial to review the basic components of a crime scene.

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17 *Nihal Singh v. State of Rajasthan*, 1986 RLW 128 (DB)
2.2.3. Importance & Utility of Physical Evidence

As far as evidentiary value is concerned, physical evidence is more acceptable when compared to human testimony. With the passage of time the witnesses change their stand whereas physical evidence does not. Even physical evidence helps the investigating officer to reconstruct sequence of events leading to the commission of crime.\(^{20}\)

Of course, an abundance of physical evidence might exist right under a investigator's nose and yet not be recognized as such. A wide range of general knowledge concerning life and the affairs of man will best aid the investigator in spotting significant, relevant evidence.\(^ {21}\) In India, a number of cases have been solved with the help of DNA fingerprinting, including paternity disputes. Even Dhanu and Sivarasan, alleged assassins of the late Prime Minister Mr. Rajiv Gandhi, were identified by DNA profiles.\(^ {22}\)

The help that the police investigating officer can get from the scientific aids are as under:

(i) Physical evidence can establish ‘corpus delicti’ i.e. to establish that a crime has actually been committed;
(ii) Physical evidence can link the suspect with the victim or with the crime scene;
(iii) Physical evidence can establish the identity of persons involved in the crime;
(iv) Physical evidence can exonerate the innocent;
(v) Physical evidence can corroborate the victim’s testimony;

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22 Editorial, Sciential, August 1995, Vol 9, No. 8, p 1
(vi) A suspect confronted with the physical evidence may admit his guilt;

(vii) Physical evidence is factual and hence more reliable than eyewitnesses who often tend to turn hostile;

(viii) Physical evidence has recognition in occurs of law;

(ix) Physical evidence is, at times, the only evidence in the absence of direct or other circumstantial evidence.23

(x) The absence of physical evidence may provide useful information or stop defense arguments at the time of trial.

There are some decisions of various courts which assist in deciding that physical evidence are very useful in criminal offences. In State of Assam v. U N Rajkhowa24 the accused committed the murder of his wife and three daughters and buried them in pits on the night of 10 February, 1970. Four skeletons were taken out from the pits on 11 February 1970 and the accused was charged for murder. On the examination of the skeletons, the ratios indicated a striking correspondence between the skulls and their respective photographs and it was found that the four skeletons were of the wife and three daughters of the accused. Based on this, the accused was convicted. In Santa Singh v. State of Punjab,25 the prosecution case was that the accused that had a rifle with him shot at the deceased from the back. According to the medical evidence, the shot was fired from a very close range about nine inches and a yard or a yard and a half, but according to what was shown to the draftsman by the eyewitnesses the rifle was fired from a

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23 B.S. Nabar, Forensic Science in Crime Investigation (2010), p. 31
24 1975 Cr L J 354 (Gau)
25 AIR 1960 SC 526
range of about 25 feet. Justice Chandrasekhara Aiyar who delivered the majority opinion, held that in the face of the medical evidence, the testimony of the eyewitnesses could not be safely accepted.

Physical evidence can take any form. It can be as large as a residence or as small as a fibre, as fleeting as an odor or as obvious as the scene of an explosion. Indeed, the variety of physical evidence that may be encountered by a police officer is enormous.\textsuperscript{26} Physical evidence must be handled carefully to prevent its contamination, alteration, or destruction. The composition of physical evidence may be altered by natural course (e.g., rain and wind), by accident, by negligence, by intentional act, or by theft. Although special precautions must occasionally be taken, the use of reasonable care and common sense in handling evidence will normally suffice.\textsuperscript{27}

2.2.4. Forensic Science- Meaning and Definition

According to \textit{Mahamaya Advanced Perfect Dictionary} the word ‘Forensic’ means ‘pertaining to law courts’. The term ‘Forensic’ is derived from the Latin word ‘Forensis’ which means belonging to courts of justice or to public discussion and debate. In this way, ‘Forensic Science’ means the science which is used in the courts of justice. Forensic Science in its broadest definition means application of science to law. However, a more practical definition of forensic science would be application of scientific principles and methods for the investigation of crime. For achieving this objective all basic sciences and their methodology have been made applicable for analysis and

\textsuperscript{27} George B. Mettler, \textit{Criminal Investigation} (1977), p.117
comparison of physical evidence associated with a crime.\textsuperscript{28}

Forensic Science can be defined more broadly as \textit{that scientific discipline which is directed to the recognition, identification, individualization, and evaluation of physical evidence by the application of the principles and methods of natural sciences for the purpose of administration of criminal justice}. \textquote{Criminalistics} is another synonymous term which is commonly used in U.S.A.\textsuperscript{29}

Forensic Science is science in the service of crime detection, Law and Justice, its practice includes scientists of various disciplines, physicists, biologists, ecologists, firearm experts, chemists, toxicologists, document experts and others. Despite a wide overlap with the field of forensic medicine which is basically a vital part of the forensic science, the necessity of having forensic science service or a separate discipline has arisen and is now well established.\textsuperscript{30}

\textbf{2.2.5. Scope of Forensic Science}

Forensic Science covers almost all the basic sciences and their application to wide sphere of physical evidence materials. A brief survey in this respect is given to highlight the areas covered by forensic science today. Most of the Central or State Forensic Science laboratories have following divisions or branches:

(1) \textit{Ballistic Division}

Ballistics is the science that deals with the launching,
flight, behavior, and effects of projectiles, especially bullets, gravity bombs, rockets, or the like.\textsuperscript{31} The Science of ballistics has become an important investigatory aid in revealing the perpetrators of crimes of violence, particularly homicide, and an important evidentiary aid in establishing guilt. And, it has been stated in the course of an opinion that it is now common knowledge that the science of ballistics has made it possible to determine that a bullet was fired from a certain weapon and that it was the modern tendency of our courts to allow such expert testimony to show that the bullet which killed the particular deceased person was fixed from a weapon which was shown to belong to the defendant in the case where it is first definitely shown that the expert witness is qualified by experience and tracing in the field of ballistics.\textsuperscript{32} This division also helps police to reconstruct the sequence of events and the situations/ factors responsible in fire-arm cases.\textsuperscript{33}

(2) \textit{Biology Division}

This division deals with physical evidence pertaining to living beings, like human and animal, as well as materials of plant origin. This division generally handles the following items of work:-

(i) Bacteriological and entomological examination of exhibits.

(ii) Anatomical examination of human and animal bones, skeletal remains, teeth etc.

(iii) Morphological examination of materials like hairs, wool,

\begin{itemize}
  \item See https://en.wikipedia.org/wiki/Ballistics
  \item James R. Richardson, Modern Scientific Evidence Civil & Criminal (1961), p 428
  \item Dr AK Bapuly, Forensic Science Its Application in Crime Investigation (2006), p.3
\end{itemize}
fibre, wood and wood fragments, seeds, leaf fragments, pollens, micro flora, diatoms etc., with a view to identifying the material.\textsuperscript{34}

The following discussion is necessary to ascertain the advantages of this division. They are discussed as follows:

(i) Examination of hair is done to link the accused with crime link murder, sexual assault etc.
(ii) Examination of skeletal remains, bones and teeth offers valuable clues for determination of species, age, sex, stature and often even identity a person.

(3) \textit{Chemistry Division}

This division carries out chemical analysis, both qualitative and quantitative, of various substances such as adulterated petroleum products, fertilizers, medicines, burnt remains etc.\textsuperscript{35}

This division deals with the following items of evidence\textsuperscript{36}

(i) Examination of metal alloys and metal fragments for identification and comparison.
(ii) Examination of inflammable material in suspected cases of arson, dowry deaths etc.
(iii) Examination of sub-standard construction material like bricks, cement, concrete, etc., besides adulteration in these materials.
(iv) Examination of petroleum products like petrol, diesel and kerosene.
(v) Analysis of pesticides for their identification.
(vi) Analysis of narcotics, dangerous drugs such as opium,

\textsuperscript{34} B.S. Nabar, \textit{Forensic Science in Crime Investigation} (2010), p 12
\textsuperscript{35} Dr AK Bapuly, \textit{Forensic Science Its Application in Crime Investigation} (2006), p.3
\textsuperscript{36} B.S. Nabar, \textit{Forensic Science in Crime Investigation} (2010), p 12
ganja, bhang, LSD, heroin, pethidine, methadone, etc.

(vii) Analysis of dyes, paint, ink and other chemical with a view to ascertaining their identity, quality and composition.

Determination of alcohol in blood and urine in cases of suspected drunkenness, and analysis of fermented wash, illicit liquor, varnish, etc. in prohibition and excise cases.

(4) **Computer Division**

There are computer labs in all laboratories in India. Cyber crimes are handled with this branch in district level.

(5) **Document Division**

Document division is very important division which deals with the examination of all types of questioned documents, handwritten, type written or printed matter to give opinion in the matters shown as under:-

(i) Comparison of disputed writings with standard writings. For instance, in cases of suicide notes and will etc.

(ii) Determination of age of ink, paper and document.

(iii) Detection of forged lottery tickets and currency notes etc.

(iv) Examination of printed matter to identify the plates used in type matter.

(v) Examination of rubber stamp’s impressions and metal seal.

(vi) Examination of writing material such as paper, pencil, pen and inks etc,

(vii) Examination of typewriter and to identify the make, model and age of that machine.

Today, sophisticated photography is widely used to detect the discrepancies in forged and altered documents. Similarly, micro-analysis of inks as well as physic-chemical examination of paper etc. has greatly contributed towards detecting the forged
documents and currency notes. Method for the detection of invisible inks as well as defaced, erased and altered inscriptions on paper, metals and other surfaces have also been developed considerably. As regards counterfeiting of coins, use of x-ray photography, chemical analysis and other physical examination can very easily detect false crime.\textsuperscript{37}

(6) DNA Division

This is an important division. In this division paternity disputes are solved by comparing the de-oxynucleob nucleic acid.

(7) Fingerprinting Division

Fingerprinting division is the main part of forensic science laboratories. In some states this division is a separate bureau such as Fingerprint Bureau is a part of State Crime Record Bureau, Haryana situated at Madhuban, Karnal. The main function of this division is to collect and store the fingerprints of criminals involved in various criminal cases.

(8) Forensic Psychology

Forensic psychology is the intersection between psychology and the justice system. It involves fundamental legal principles, particularly with regard to expert witness testimony and the specific content area of concern as well as relevant jurisdictional considerations in order to be able to interact appropriately with judges, attorneys and other legal professionals.\textsuperscript{38} In forensic science laboratory psychologist are treated as an expert who can satisfy the courts answers in various criminal cases according to the nature of a particular case.

\textsuperscript{37} Quoted from LNJJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection}, (2009), p.6

\textsuperscript{38} See https://en.wikipedia.org/wiki/Forensic_psychology
(9) **Explosive Division**

The services of this division are predominately used in determining the chemical nature of the explosive substances in a post-blast situation, damage assessment of bomb blast, identification of the site of blast, switching device, firing mechanism, quantity of charge etc. In pre-blast situations, services of the experts are requisitioned to locate the explosive device including IEDs, triggering mechanism, strategy to be adopted to defuse and dispose such device.39

(10) **Instrumentation Division**

Instrumentation division is responsible to maintain and repair sophisticated and expensive equipment of the laboratory. Moreover, this imparts tracing to the officials/experts about the handling of the equipment.

(11) **Lie-Detection Division**

This division helps investigating officers now-a-days. This division examines those suspects who are associated with crimes such as theft, murder, forgery, rape and burglary etc. to avoid third degree methods. A number of cases have been solved by the help of this division. There are instances where the accused has given important information to the scientific officer, which aid the investigator to the recovery of clinching evidence. However this is a new division, yet it is intended to assist the police in interrogation suspects to detect the truth in various crimes.

(12) **NDPS or Narcotics Division**

This division deals with the samples of all narcotic drugs

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(13) *Photo section or Photography Division*

Crime scene photographs are sent to this division to certify their genuineness and authenticity. In case of Relu Ram, Minister of Haryana, some important clues could be traced through photographs.

(14) *Prohibition and Excise Division*

This division deals with the samples of illicit liquors, alcohol beverages, blood alcohol level etc.

(15) *Physics Division* – This division deals with

(i) Building materials like adulterated cement samples, cement-sand proportions, strength of building materials etc.

(ii) Tool and cut mark identification, restoration of obliterated marks or writings or numbers are a few important tasks that are carried out by this division. Moreover,

(iii) Examination of soil, dust, dirt and debris.

(iv) Examination of glass, paint chips and other contact traces in hit and run cases.

(v) Examination and comparison of torn fabric, ropes etc.

Suitable comparison is able to establish the origin of these trace materials thus providing the mixing link in the chain of
events connected with a crime.\textsuperscript{40}

(16) \textit{Serology Division}

In earlier days, biology division was also looking after serological examination of blood, semen, saliva and other human tissues. However, with ever-increasing load of serological examinations, separate serology division was created in many state forensic science laboratories.\textsuperscript{41}

This division deals with the following matters:-

(i) Serological examination can help in solving the problems connected with disputed paternity cases.\textsuperscript{42}

(ii) Examination of articles stained with blood, semen, sweat, saliva to determine their nature, origin, grouping, DNA profiling etc.\textsuperscript{43}

(iii) Determine origin and groping of fragments of muscle, skin, bones, etc., on objects like bullet, fingernails, etc.\textsuperscript{44}

(iv) Individualization of blood and bloodstains based on enzymatic studies using latest techniques.\textsuperscript{45}

(17) \textit{Toxicology Division}

Toxicological examination is required to identify a drug or poison in a suspected article or viscera or post-mortem blood of a victim of poisoning. The present day requirement is not merely to identify the toxic material qualitatively by general and non-

\textsuperscript{40} Quoted from LNJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection}, (2009), p.4
\textsuperscript{41} Dr AK Bapuly, \textit{Forensic Science Its Application in Crime Investigation} (2006), p.3
\textsuperscript{42} Quoted from LNJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection}, (2009), p.3
\textsuperscript{43} B.S. Nabar, \textit{Forensic Science in Crime Investigation} (2010), p 14
\textsuperscript{44} B.S. Nabar, \textit{Forensic Science in Crime Investigation} (2010), p 14
\textsuperscript{45} \textit{Ibid.}, p 14
specific tests of yesteryears, but also to identify it specifically using efficient extraction procedures and modern techniques. In addition, it is necessary to quantitate the drug/poison and to know the distribution of poison in various organs and to look for metabolites if any in order to have clearer picture of alleged poisoning. Various techniques involved are: ultraviolet, and infrared spectrophotometer, electrophoresis, polygraphy, thin layer chromatography, G.C.M.S., etc.\textsuperscript{46}

In short, this division undertakes chemical analysis of all materials related to suspect poisoning which includes examination of stomach wash, vomit, viscera, injection site, etc. It also examines all the human tissues and remains for toxic materials in suspected cases of poisoning.

(18) \textit{Voice Analysis}

Voice analysis is the study of speech sounds for purposes other than linguistic content, such as in speech recognition.\textsuperscript{47}

\textbf{2.2.6. Historical Background of Forensic Science}

In giving consideration to the development and acceptance of scientific aids to fact-finding, it is useful and informative, both for historical and comparative purpose to do so in the light of certain progressive steps. It is impossible to put an exact date to the birth of forensic medicine; it evolved gradually as its component parts, medicine and law, evolved.\textsuperscript{48} A chronological history of forensic science has been discussed as follows.

\begin{flushright}
46 Quoted from LNJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection}, (2009), p.4
47 See https://en.wikipedia.org/wiki/Voice_analysis
48 Brian Lane, \textit{The Encyclopedia of Forensic Science} (1993), p.11
\end{flushright}
1. During 2030 BC trial by ordeal

According to dictionary meaning ordeal means a trial by fire or water, a severe test. The Code of Hammurabi makes mention of trial by ordeal, and the ordeals of fire, water and the morsel and others were widely practiced among some Germanic tribes from very early times to determine guilt or innocence.

In primitive India, the Hindu priests required one suspected of crime to chew dry rice for a given time and then to eject the bolus upon a piece of dry bark. If the rice was still dry the suspect was guilty. This procedure had a pseudo-scientific rationale; it was believed that the fear of detection and punishment would inhibit the nervous mechanism of the salivary gland and prevent the flow of saliva.

2. During 1000 BC

During the period of 1000 BC, psychology was used to make the justice. Paternity cases were solved by the King himself. They used psychology forensic. Where there were two claimants of a child, then the judgment of King Solomen as to which of two female claimants was the actual mother of a child was based on their contrasting reaction to the proposal that the body of the infant be severed by a sword with each claimant taking one-half.

3. During 600 BC- 500 AD

A resourceful husband, seeking grounds for divorcing his wife, contrived to get her and his guests drunk at a party. He then carried the wife and a male guest to a couch and threw egg albumen between them. The “outraged” husband then called

neighbors to bear witness to the evidence of adultery. However, the wife was not without resource on her own part. Upon becoming sober and being confronted with the baseless charge, she summoned her physician who identified the incrimination substance as egg-white, not seminal fluid. This body of Jewish civil and canonical law does not reveal what method was used by the physician. Today, however, the microscope, immunological methods or specific tests such as the Florence Test (Florence, 10 Arch. d’Anthrop. Crim. 417, 1896) would be available.\textsuperscript{50}

4. During 287 BC-212 BC

The term ‘Eureka’, would also know where the History of Forensic Science started. History considers Archimedes (287-212 BC), the man behind the exclamation ‘Eureka’, as the father of Forensic science. He had exulted when he had found out that a crown was not made of gold, (as it was falsely claimed) by its density and buoyancy.\textsuperscript{51}

Archimedes wanted to determine whether the suspect had used silver alloy in a gold coin. While taking a bath, Archimedes struck upon the idea of immersing the coin in water to see how much liquid it displaced as compared with a genuine coin. Thereupon, imbued with true scientific ardor, Archimedes sprang from the public bath and ran unclothed through the streets shouting “Eureka”- I have found (it).\textsuperscript{52}

5. During 15 BC-19 AD

In early times the belief was rather prevalent among the more enlightened that non combustibility of the heart was proof

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\textsuperscript{50} Ibid., p.8 \\
\textsuperscript{51} http://www.santoshraut.com/forensic/foreshistory.htm \\
\textsuperscript{52} Richardson, \textit{Modern Scientific Evidence} (1961), p.9
\end{flushleft}
of death by poisoning. This belief was challenged as an unwarranted assumption by defence counsels in the trial of Plandina, wife of Piso, for the murder of Germanicus. The defense admitted that the heart of Germanicus was in fact non-conbustible, since it was found uncharred amidst the other of his funeral pyre, but claimed that this condition was traceable to a pre-existing heart ailment. An unbiased review of all the evidence leads to the conclusion that the defence was probably right, and that Germanicus probably died of natural cause.

6. **During 1591.**

During 1591 the first forensic microscopy was designed by Zacharias and Hans Jansen. This was the first practical microscope, though the Egyptians are known to have experimented with lenses centuries prior to the accreditation of the Jansen. There is also evidence sustaining the claim that Leonard Digges Fashioned and used a telescope about the years 1550.

7. **During 1728.**

Johan Heinrich Schulze, a German physician, demonstrated the possibility of imposing photographic images of objects on a solution of chalk and silver nitrate. It was not until 1822 that Louis Daguerre perfected a reliable photographic process.

8. **During 1800–1900**

Tables for determining normal life expectancy were hypothesised during this period. They were based on actual

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55 Ibid.,
observations in the towns of Carlisle and Northampton and were generally admitted in evidence in this country, though restricted in scope, for the purpose of evaluating life estates and calculating lost earning power in personal injury and wrongful death actions. They led to the development of standard American Mortality Tables which are impartial and disinterested and so nearly in the nature of an exact science or mathematical demonstration as to be credible and valuable. They are uniformly admitted in evidence to show probable expectancy of life when such proof is pertinent to the issues.\(^{57}\) In 1804, J.W. Ritter discovered ultraviolet rays; the forensic significance of which was the erased writing and blemishes could be detected by their means.\(^{58}\) In other words, ultra-violet light is used for such purposes as preliminary identification of stains and the revealing of obliterated writings in forgery and falsification of documents.\(^{59}\) In 1835, Calvin Goddard “Father of Ballistics” developed the technique to examine bullets, using a comparison microscope, to determine whether or not a particular gun fired the bullets. In 1836, James Marsh, English Chemist, released and described the “March test” for identifying minute traces of arsenic.\(^{60}\) James Marsh developed a test for detecting small traces of arsenic in human tissue. Mathieu J.B.Orfila, French chemist and toxicologist, is generally regarded as the originator of scientific toxicology, leading to the now highly developed field of scientific evidence in poisoning cases.\(^{61}\) He is generally recognized as the

father of modern toxicology. In 1858, Sir William Herschel was instrumental in introducing fingerprinting as the official system of personal identification in India. This can be regarded as the first really significant step in making criminal investigation a science. During 1860, Bunsen and Kirchoff identified evaporable inorganic materials, discovering that gas fumes under fluctuating temperature give off light and energy in relation to the molecular structure of the gas. In 1875, Professor Wilhelm konard Rohtgen of Wurtzburg discovered that solid objects placed so as to intercept cathode rays produce a secondary radiation which delineates the shapes of the solid matter. In 1879, Alphonse Bertillon who was “Father of Anthropometry” of France was the first to evolve a scientific system of personal identification. In 1879, he developed the science of Anthropometry, a systematic procedure of taking a series of body measurement to facilitate distinguishing one individual from another. This method, though largely replaced by fingerprint system, is still in use in certain parts of the world. No other individual can claim to have contributed more substantially to the field of personal identification than Alphonse Bertillon. With the invention of photography, he was the first to find its use in criminal investigation. In 1881, he began to take standard picture of all French Criminals and file them in the Bureau of Identification in Paris. He further systematized the technique of ‘Portrait Parle’, a method of identifying culprit from descriptions provided by victims and witnesses. Bertillon’s

efforts have earned him the distinction of being known as the father of criminal identification system. In 1892, Francis Galton, a scientist from U.K. undertook the first systematic study of fingerprints. He delivered a methodology of classifying the fingerprints for filing purpose. In 1892, he published a book on ‘Fingerprints’ giving a sound statistical proof of uniqueness of personal identification through fingerprints. In 1893, Hans Gross of Austria, a lawyer by profession, spent many years studying and developing the principles of criminal investigation. He was born in 1847 and died in 1915. He was the “Father of Forensic Publications”. He wrote the book on applying all the different science disciplines to the field of criminal investigation. This resulted in the publication of his classic book in 1893, ‘Handbuch fur Untersuchungsrichter also System der Kriminalistik’ which was later published in English as ‘Criminal Investigator.’ In 1895, Professor Wilhelm Konard Roentgen, Wurzburg, Bavaria, discovered that when cathode rays encounter matter, they give off secondary rays which carry no charge but penetrate solids. Due to its direct visual quality of reproduction, X-ray evidence was readily admitted by the courts in furtherance of scientific fact-finding.

9. During 1900-1985

In 1900, Landsteiner made the first observations regarding differences between bloods of normal human beings. Even individuals’ blood falls into one of four classes and remains the same throughout life. The results of the test are accepted by science as conclusive, and those blood grouping determinations
have been useful in providing non-parentage in paternity suits and bastardy proceedings. In 1901, The German scientist, Uhlenhuth, first demonstrated that, due to protein specificity, an unknown blood can be identified as of human or animal origin by utilizing principles of immunology described by Bordet in 1898. Uhlenhuth was able to use the test to identify blood on test objects of wood, metal and cloth. The precipitin test was first used as evidence in a court of law in a murder trial in France in 1902. The test showed that blood stains on the accused clothing were human blood and not that of a rabbit as claimed. The year of 1906 marked the first reproduction in court of sound recorded by mechanical means. A phonograph recording made in a hotel room to demonstrate audibly the existence and extent of noise occasioned by lying of railway tracks opposite the hotel was admitted in evidence. This was the pioneering forerunner for the use in court of other sound recording apparatus, such as tape and wire recordings.

Dr. Edmond Locard was a Frenchman (1877–1966). He was the “Father of the Crime Lab”. According to him, “Every contact leaves a Trace.” He was a criminologist. In 1910, he established a police laboratory in Lyons and later founded the Institute of Criminalistics at the University of Lyons. He propounded the ‘principle of exchange’, which forms the basis of forensic examination of physical evidence. According to this principle, whenever two objects- animate or inanimate, microscopic or macroscopic, in whichever physical state come in contact with

\[\text{References:}\]

68 Richardson, Modern Scientific Evidence (1961), p.11
70 Ibid
71 B.S. Nabar, Forensic Science in Crime Investigation (2010), p 3
each other, there would be exchange of materials. These materials are known as physical evidence.\textsuperscript{72} For instance, any contact between the criminal and the crime scene will leave some traces of materials/impressions.\textsuperscript{73} In case of road accidents, when two vehicles struck, then struck mark and paint of each vehicle leaves on the other vehicle. In the same way, when a person enters in a house for the purpose of theft he may leave his fingerprints, footprints and other important clues (if other conditions are same and not disturbed).

During 1912, Bathazard improved comparison of bullets at the scene of a crime and bullets from a suspect gun by using photographic enlargements.\textsuperscript{74} The years between 1912 to 1930 consists of identification of instruments by markings, and is described as a positive science. Luke S. May carried extensive studies devoted to the identification of knives, tools and other instruments through photomicrographs of marks and scratches made in their use. Metallographic analysis was approved in \textit{Magnuson v. State},\textsuperscript{75} one of the most remarkable cases of scientific crime detection to be found in the law reports - exceeding in range even the Lindberg kidnapping case.\textsuperscript{76}

In 1915, first introduction of motion pictures in evidence in a case alleging that a movie was an infringement on the plaintiff’s rights in a novel.\textsuperscript{77} Motion pictures of those falsely

\begin{thebibliography}{9}
\bibitem{72} Dr AK Bapuly, \textit{Forensic Science Its Application in Crime Investigation} (2006), p.1
\bibitem{73} Quoted from LNJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection}, (2009), p.3
\bibitem{74} Brian Lane, \textit{The Encyclopedia of Forensic Science} (1993), p.15
\bibitem{75} 187 WIS 122, 203 NW 749 (1925)
\bibitem{76} Richardson, \textit{Modern Scientific Evidence} (1961), p.12
\bibitem{77} Glynn V. Western Feature Film Co., 114 LTR [Eng] 354. Quoted in book of Richardson p.12
\end{thebibliography}
claiming total disability, bribery attempts, and confessions to commission of crime have since been used in court. The first case involving a sound motion picture of a confession was Commonwealth v. Roller.78 Sound picture offers particular advantages for recording confessions to show the absence of coercion. Problems of admissibility are not significant but the administrative problems setting up screen, sound equipment and projector and darkening the courtroom may pose difficulties.

In the year of 1921 Larson began work on truth and deception tests. He constructed a portable “polygraph” for recording relative change in pulse, blood pressure and respiration. The guilt reaction due to anxiety is supposed to produce physiological change which is recorded on a graph by the polygraph. Estimates of the lie detector’s accuracy range from about eighty to ninety-five percent. Courts are not as yet favorably inclined towards reception of the lie detector’s findings but this will come in time. The machine is valuable in disclosing perjury, but cannot reveal the falsity of statements by the honest but mistaken witness.

A Hans Mullner of Graz in 1923, Germany invented a method for casting at the scene of crime. He developed the moulage method of preserving imprints, such as footprints and tire tracks, being a quick means of making casts of impressions left in soft materials.79

The comparison microscope was devised by Gravelle of South Orange, New Jersey in 1925. It is an improvement over comparison by photographic enlargement in that it enables

78 100 PaSuper 120 (1930)
79 Brian Lane, The Encyclopedia of Forensic Science (1993), p.15
convenient microscopic comparison of two objects, as marking on a bullet taken from the scene of the crime and the markings on a test fired bullet.  

The Federal Bureau of Investigation established its Scientific Crime Detection Laboratory. Among other things, the Bureau trains local police officers in their methods and issues bulletins on: “Suggestions for Handling Scientific Evidence;” “Plaster Casts and Impressions Found on Firm Surfaces;” “Examination of Bloodstains; Blood”, “Hair, and Fiber Analysis;” “Grouping of Dried Blood Stains”; “Petrographic Aspects (rocks, soils, sediments) of Scientific Crime Detection”; “Laboratory Examination of Wood Specimen”; “Wire (wires, rails, metals, metallic fragments) Examinations.” J. Edgar Hoover was the “Father of the FBI”. He was first Director of FBI during the year of 1930.

Widmark in Sweden showed by experimental work that blood alcohol determinations are valuable indices of intoxication. This has led to the development of Herger Drunk meter or Intoximeter used to determine intoxication through breath analysis. Undoubtedly, body fluid tests will show the percentage of alcohol absorbed by the body, but the reliability of breath analysis remains to be demonstrated.  

In the year of 1948, the use of pharmacological agents as scopolamine and barbiturates (sodium pentothal and sodium amytal) to elicit the truth through inter-rogation of a suspect while under a drug-induced relaxation approaching a hypnotic trance has remained potential up to this time. Primarily narco

81 Ibid., p.14
analysis is valued for its therapeutic qualities in treatment of mental disorder.\textsuperscript{82}

During 1945 to 1952, the most commonly used automatic speed detector is the radar (formed from initial letters of “radio detection and ranging”) speed meter. The radar speed testing devices used in traffic control operate by a method similar to the “pulse” type employed by the military, but distinct in that a continuous beam of microwaves is sent out at a fixed frequency. The operation depends upon the physical law that when such waves are intercepted by a moving objects the frequency changes in such a ratio to the speed of the intercepted object that, by measuring the change of frequency, the speed may be determined. Most courts with rules of evidence, thus requiring qualified expert testimony as a basis of the introduction of the testimony of police officers who operate the devices from parked cars on the highways.\textsuperscript{83}

Walter Mc Crone born in 1916 is considered the “Father of Microscopic Forensics”. He developed and applied his microscope techniques to examine evidence in countless court cases. Using beams of electrons instead of beams of light, the Scanning Electron Microscope is capable of magnifications of the order of 150,000 xs.\textsuperscript{84}

By the year of 1984, the function of a police laboratory was not fulfilled merely by routine application of tried and true methods of routine cases. A constant search for new methods and techniques has to be maintained. A difficult case should be

\textsuperscript{82} Ibid.,
\textsuperscript{83} Richardson, \textit{Modern Scientific Evidence} (1961), p.14
\textsuperscript{84} Brian Lane, \textit{The Encyclopedia of Forensic Science} (1993), p.15
looked upon as a challenge to be met by the improvement of technique or the widening of theoretical knowledge. The spirit of research is the source of progress in any laboratory, and it will be found that police laboratory is especially fertile in research problems. It should be a rule of a laboratory that qualified persons are required to conduct research in some fields.85

**Sources of Scientific Assistance**

The following are the main institutions which are providing scientific help in scientific criminal investigation:

1. Forensic Science Laboratories.
2. Chemical Examiners’ Laboratories.
4. Fingerprint Bureaus.
5. Department of Explosives.
6. Serologist to the Government.
7. CID Scientific Sections.
8. Mobile Scene of Crime Laboratories or Mobile Forensic Science Units.
10. University Departments, especially those teaching Forensic Science.
11. Medico-legal Institutes.
12. Forensic Medicine Departments in Medical Colleges.
13. Consultancy Services provided by private individuals and organizations, especially those organized by retired specialists.86

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2.3. Police Investigation - Meaning and Concept

The meaning and concept of police investigation has been discussed as follows.

According to Mahamaya Advanced Perfect Dictionary, the meaning of 'Police' refers to civil administration of a city or town, the government department for the establishment of peace and order. Therefore, it is right to say that police is made for the public safety and security. In the present age, the police have to perform a number of duties. On the one hand, the police constable is responsible for the maintenance of law and order. On the other hand; he is responsible for the security of general public and his property. Moreover, the security of VVIPs and VIPs is the most important part of a police job.

2.3.1. Meaning and Definition of Police

Generally the organization of police is made for the security of the public and maintenance of peace in the State. The alphabets in the word of police refers the following meaning-

- P for polite;
- O for obedient;
- L for loyal;
- I for intelligent;
- C for courageous; and
- E for efficient.

According to August Vollmer87, “A Police Officer must possess the fleetness of mercury, the tenderness of Florence Nightingale, the medical knowledge of a Doctor and the Legal knowledge of a Judge.” The Father of Nation, Mahatma Gandhi

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87 Quoted in Shashi Kant Sharma, Haryana Police Act, 2007 (2011) p.xxiii
once said that his concept of Police is entirely different from that of the present day police. They would be servants of people rather than their ‘Swami’. People will themselves help them in all possible ways. With continued co-operation, they will be able to control riots, etc. They would need ‘police behaviour’ only with thieves and dacoits.\(^88\) Mahatma Gandhi has also said:

“In their work, they are neither Muslims nor Hindus nor Sikhs. They are Indians bound by oath to give full protection to the afflicted without regard to their religions. Thereby they did not cease to be less Muslims, Hindus or Sikhs, but become better”.\(^89\)

Dr. Manmohan Singh, the then Prime Minister of India has also said:

“We need a new-age policeman who is more professional, better- motivated, suitably empowered, well-trained and one who places greater emphasis on technology for investigation...”\(^90\)

2.3.2. Origin and Development of Police

From the very beginning, the existence of police is recorded in books. The word police are derived from the Greek word Politeia or its equivalent Politia. The word politia refers to the State or administration. In the early stage, there was only one king who had the highest authority. He was the supreme head of the legislative, executive and judiciary. He kept his men for security, surveillance and other administrative jobs. They could

\(^89\) Mahatma Gandhi - Prayer speech at Calcutta on 21.8.1947.
\(^90\) The then Prime Minister Sri Manmohan Singh addressing the DGPs’ conference on 15\(^{th}\) September 2009.
advise the king but the final decisions were left to the king. The king himself would appoint his ministers and other officials. During the Mauryan period, both the civil and the military officials were in existence. Spy system was an important feature of Mauryan administration. The royal agents and the spies could contact the king at any time. They also reported the various aspects to the king. There were some secret agents called ‘guptchar’ who worked for their king. The work of guptchar was to collect the information for their king from the kingdom.

Mughal rulers changed the legal system of Bharat. They handed over the charge of legal system to the Kazis and Mullahs. The police system was maintained in the times of Mughals. A kotwal was appointed as head of the police administration. He was responsible to maintain surveillance, do the night patrolling and other security duties.

The Mughal law was in existence when the British came to India. The Britishers came to India in 1600 as traders in the form of The East India Company.\textsuperscript{91} They created a new post of Darogha in every district. He was made responsible to the district Judge. This system was totally a total failure in India. Therefore, they enacted the Police Act (No. 5 of 1861). The present Police system is also based on this Act.

2.3.3. Position of Police in the Present Age

The Constitution of India provides that ‘Police’ is a ‘State Subject’.\textsuperscript{92} The states are responsible to maintain law and order in their state. But, in case of internal disturbances, the Centre is

\textsuperscript{91} Dr. J.N. PANDEY, THE CONSTITUTIONAL LAW OF INDIA (2013), P.2
\textsuperscript{92} The Constitution of India, Distribution of Legislative Powers between the Centre and the State, List 2, Entry 2.
responsible to protect the states and to intervene in the law and order problems of states.\footnote{Article 355. Duty of the Union to protect States against external aggression and internal disturbance. The Constitution of India.} Today, our country is independent, but the Police Act in various states is based on the Police Act of 1861 enacted by the Britishers. The Police force in the time of Britishers was created to suppress the Indian masses. But now the position has changed. We are living in a democratic nation. The work and behavior of police should be friendly with the public. The Human Rights Commission, the Supreme Court and the Citizen Charters provide the safeguard measures for the public. With a view to modernize and reform the police in India and making reforms in the working of the police, the Government of India, appointed a National Commission on 15\textsuperscript{th} November, 1977 under the Chairmanship of a Former I.C.S. officer and Governor Dharamvir with N.K. Reddy, K.F. Rustomji, N.S. Saksena, M.S. Gore, its members and C.V. Narsimhan as Member-Secretary\footnote{Ibid.}. Thus, National Police Commission recommended the setting up of an All-India Police Institute on the pattern of similar bodies of professionals, engineers and chartered accountants\footnote{Quoted in Shashi Kant Sharma, Haryana Police Act, 2007 (2011), p.xvi}.

2.3.4. **Structure of Police Department**

There are following posts in the police department rank-wise from Constable to Director General of Police as under-

(i) Constable

(ii) Head Constable (HC)

(iii) Assistant Sub Inspector (ASI)

(iv) Sub Inspector (SI)

(v) Inspector

(vi) Deputy Superintendent of Police (DSP)

(vii) Assistant/Additional Superintendent of Police (ASP)

(viii) Superintendent of Police (SP)

(ix) Deputy Inspector General of Police (DIG)

(x) Inspector General of Police (IG)

(xi) Additional Director General of Police (ADGP)

(xii) Director General of Police (DGP)

The Director General of Police is the head of the department.

2.3.5. **Modernization and Development of Police**

The Bureau of Police Research and Development (BPR&D) was set up on 28th August 1970 in furtherance of the objective of the Government of India for the modernization of Police forces. This bureau has following branches as under:

(i) **Research & Correctional Administration Division** - The main function of this division is to identify the needs and problems of police in the country and initiates research in this field.

(ii) **Modernization Division** - How to use new scientific aids

97 [www.bprd.nic.in](http://www.bprd.nic.in)
and technologies in investigation of crimes by the police. This activity is done by this division.

(iii) **Training Division**- This division functions as Central Police Training Directorate to cater to the training needs of Police Forces in the country. There are five Central Detective Training Schools (CDTS) situated at Chandigarh, Kolkata, Hyderabad, Jaipur and Ghaziabad.

(iv) **Administrative Division**- This division deals in administrative issues.

(v) **National Police Mission Division**- This division develops projects, fast tracking the development of police techniques in all aspects in a mission mode.

(vi) **Special Police Division**- This division deals in issues related to publications of Indian Police Journal, Police Vigyan, Data on Police Organization, Newsletter of BPRD and any other publications etc.

The Bureau of Police Research and Development is created to find out the new scientific techniques to make the police hi-tech.

**2.3.6. What is Investigation?**

According to dictionary meaning, investigation is an examination or research. In criminal cases, the purpose of investigation is to find out the truth, arrest the wrongdoer and produce him before the court of law. In common parlance, ‘investigation’ and ‘inquiry’ are used as synonymous or interchangeable terms. The Criminal Procedure Code, however, uses them differently and with specific distinct connotations.\(^{98}\)

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Hence, the meaning of investigation according to Section 2 (h) of Criminal Procedure Code, 1973 is “Investigation which includes all the proceedings under the code for the collection of evidence conducted by a police officer or by any person (other than a magistrate) who is authorized by a magistrate on this behalf.” On the other hand, an “Inquiry” means every inquiry which is conducted by a magistrate or court and which is not a trial. 99 It is to be noted that an inquiry is never conducted by the police though in common parlance we talk of police inquiries 100.

Investigation is a true ascertainment of facts to arrive at a correct conclusion if and who committed crime 101. A criminal investigation is a search for the truth. It is the systematic process of identifying, collecting, preserving and evaluating information for purpose of bringing a criminal offender to justice. 102

### 2.3.7. Police Investigation and its Meaning

An investigation refers to the process of collecting information in order to reach some goal; for example, collecting information about the reliability and performance of a vehicle prior to purchase in order to enhance the likelihood of buying a good car. 103 Investigation can be conducted either by any person or police officer who is authorized by a Magistrate. A police officer is empowered to start an investigation in any criminal case either it is cognizable or non-cognizable offence. In

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99 See section 2(g) Criminal Procedure code, 1973
cognizable offences, any police officer can arrest the offender without any warrant. In case of non-cognizable offences, a police officer has no authority to arrest without warrant. Cognizable offence means an offence for which, and cognizable case means a case in which, a police officer may, in accordance with the First Schedule or under any other law for the time being in force, arrest without warrant. ¹⁰⁴

### 2.3.8. Who Can Do the Investigation?

When a crime is committed, it is the bound duty of police to determine who committed the crime and arrest the accused person as soon as and produce him before the court of law. Investigation is not an easy task. In the past, it was very easy to recognize the offender due to fear of police and people were very simple. There were few criminals.

A police officer in the rank of sub-inspector or above the rank of sub-inspector can do the investigation of any offence. Any head constable also who is lower school course pass or above the rank of head constable can do the investigation of any case of non-heinous offences on the behalf of Station House Officer/SHO.

### 2.3.9. Powers & Duties of Police

Powers and duties of police can be understood only after a study of the Criminal Procedure Code, 1973 in detail. This Code is called ‘The Police and Magisterial Code’. It provides the powers to a police officer. Police officers, superior in rank to an officer in charge of a police station may exercise the same powers throughout the local area to which they are appointed, as may

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¹⁰⁴ See sub section (c), Section 2 of the Criminal Procedure Code, 1973
be exercised by such officer within the limits of his station.¹⁰⁵ In cognizable offences, the police can investigate without any direction from a magistrate while in a case of non-cognizable offences the police cannot proceed with investigation without the order of the court. Every information related to the commission of a cognizable offence, if given orally to an officer-in-charge of a police station, shall be reduced to writing by him or under his direction, and be read over to the informant.¹⁰⁶ Further, it is provided that if the information is given by the woman against whom an offence under section 326A, section 326B, section 354, section 354A, section 354B, section 354C, section 354D, section 376, section 376A, section 376B, section 376C, section 376D, section 376E or section 509 of the Indian Penal Code is alleged to have been committed or attempted, then such information shall be reduced, by a woman police officer or any woman officer.¹⁰⁷ On the other hand, when any information is received in the police station as to non-cognizable offence, then the officer-in-charge of the police station shall enter the information in a book called namely daily diary or roznamcha and refer the information to the magistrate.¹⁰⁸

2.3.10. Elements of Investigation

Investigation is the main function of police to find out the truth in a matter of criminal activity. To achieve this goal, an investigating officer has to perform the following steps as under:-

(i) **To Visit the Crime Scene** - As soon as any complaint or

¹⁰⁵ See Section 36 of the Code of Criminal Procedure Code, 1973
¹⁰⁶ See Sub-section (1) of Section 154, the Code of Criminal Procedure, 1973
¹⁰⁷ Inserted by the Criminal Law (Amendment) Act, 2013, Section 13 (w.e.f. 3.2.2013)
¹⁰⁸ See Sub-section (1) of Section 155, the Code of Criminal Procedure, 1973
information is received in the police control room or police station the present Senior Duty Officer (SDO) and Junior Duty Officer (JDO) in the police station is under duty to move the crime scene immediately without any delay.

(ii) **To Hospitalize the Injured** - After visiting the crime scene the I/O should send the injured person/person to the hospital without any delay.

(iii) **To Protect & Preserve the Crime Scene** - It is the bounden duty of the I/O to protect or save the crime scene and inform the senior officers and call the mobile forensic science laboratory unit, photographer, draftsman and dog squad etc. Unnecessary crowd should be kept away from the crime scene.
(iv) **To Record the Statements**- Complaints and statements should be recorded well in time.

(v) **To Arrest the Offenders**- If the accused person is present on the crime scene, he should be arrested immediately.

(vi) **To Search the Crime Scene**- Investigation officer should search the crime scene deeply and each and every physical clue on the spot should be recovered in the presence of scene of crime unit under their supervision.

2.3.11. **Techniques or Methods of Searching the Crime Scene**

The methodology of searching depends on the case and the scene. Manpower problems in police units as well as problems associated with the proffering of evidence in court have developed the single-officer search. Associates of this officer often assist in locating evidence, but they do not disturb it or collect it. The goal is to limit the number of policeman in possession of evidence found at a crime scene to the officer
searching the scene. The examination techniques vary from one scene to another and on personal preferences. The following techniques or methods of searching the crime scene are common.

(i) **Zone Search**- In this method, the area to be searched is divided into unit zones; and each unit is then processed individually as a separate crime scene.

(ii) **Spiral Search**- In a spiral search, a clockwise circle starts at the major impact point of the scene (i.e., the body) and the searcher circles that point at an ever-increasing radius.

(iii) **Strip Search** - This type of search is done when the area of crime scene is located outdoors for example football field. The crime scene is divided into convenient strips and each strip is examined carefully one by one.

![Strip Search Diagram](image)

(iv) **Cross-Hatch Method** - Cross-hatch method is like strip method but here strips is both length and width wise. Thus, the cross-hatch method covers the entire scene twice. The officer moves first in one direction, say, width-wise as in strip method. At the end point he starts moving length-wise, in strips, and completes the entire scene. Every point of the scene is, thus, examined twice.\(^{113}\)

### 2.3.12. Obstacles and Problems Faced by Police during the Investigation

The work of police investigation is not so easy. The National Police Commission has found that an average investigating officer is not able to devote more than 37% of his time to crime investigation work. While the rest of the time is taken by other duties, more particularly law and order work and VIPs security functions.\(^{114}\) There are a number of obstacles and problems which every police officer/official face during the work

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of crime investigation. In short, they may be stated as under:

(i) Every investigating police officer is doing the work of investigation as well as general duty including VIP/VVIP duty and law & order maintenance duty e.g. road crossing, traffic control, election duty, crowd control, session duty etc.

(ii) There is a great political pressure and disturbance in the work of investigation.

(iii) Lack of staff is the main reason of work load on every police officer/official.

(iv) Lack of training.

(v) Insufficient infrastructure.

(vi) Away from home.

(vii) Burden of family.

(viii) Lack of time.

(ix) Lack of education.

(x) Non-cooperation of public.

(xi) Non-cooperation of staff.

(xii) Threats by criminals.

(xiii) Interference of department.

(xiv) Non availability of subordinate staff due to lack of staff.

(xv) Non availability of resources e.g. vehicles, computers, cameras, video cameras and other hi-technique instruments etc.

2.4 Scientific Aids used in Police Investigation

The criminal justice system has learned to rely heavily on the analysis of physical evidence as scientific procedures and methods have become increasingly more reliable and convincing
than eyewitness testimony. The influence of television programs showing the use of highly sophisticated analytical equipment to solve crimes has made the juries to come to expect complex scientific evidence to be presented in all criminal cases. Now-a-days TV channels, like Sony, Life OK and Colors are showing the crimes occurred in the past. Sony TV shows CID, Life OK Savdhaan India and Colors Code Red. The real story makes the viewers much more aware about the crime techniques; on the other hand criminals are learning how to commit the crime intelligently.

Scientific aids in police investigation as the name indicates, is the application of science in police investigation or criminal investigation. The demand for scientific criminal investigations is increasing by the day. The main reasons are:

1. There is a sea change in the social scenario. High connectivity with the higher-ups (leaders, officials), the acceptability of the corrupt and corruption, rapid and mobile communication facilities, extremely rapid mobility, and incognito existence in dense cities have brought in the invisible and no-traceable anonymous criminal in the field.

2. Scientific criminal is abroad.

3. The traditional tools of investigation are becoming non-available, non-reliable, obsolete and ambiguous. The judiciary requires a very high standard of proof.

4. The computer, the internet and cyber space have brought in highly complex crimes. No crime scenes! No crime time frames!! No jurisdictional crimes!!! They are baffling the

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traditional trackers of crime.

5. The scientific methods are efficient, certain, specific, rapid, verifiable and unbiased.

6. The scientific methods are always available, applicable in all situations and investigations.\footnote{B.R. Sharma, \textit{Scientific Criminal Investigation} (2006), p. 7}

Here, we are concerned only with scientific aids. All physical evidences which the investigating officers found on the crime scene are scientific aids. Now, the question is what the scientific aids are?

\textbf{2.4.1. Classification of Physical Evidence under Scientific Aids}

A forensic scientist examines physical evidence for one of two purposes: identification or comparison. Identification is the process of elucidating the physical or chemical identity of a substance with as much certainty as possible. Comparison is the process of subjecting both the evidence (questioned sample) and the reference material (exemplar) to the same tests to prove whether they share a common origin.\footnote{James E. Girard, \textit{Criminalistics Forensic Science and Crime} (2008), preface, p. 38}

\textbf{(1) Abortion as Scientific Aid in Police Investigation}

Abortions are carried out to terminate unwanted pregnancies of unmarried girls, widows, professional prostitutes and of some married women whose family size has become too large to permit more additions. Formerly, all unwanted pregnancies were terminated illegally. In recent years the law has been modified so much that practically any female can get the unwanted pregnancy terminated confidentially in any
government approved hospital in India. Thus the number of criminal abortions had come down drastically. Only illiterate women and their men, who do not know the liberal laws, now go to the quacks. They perform abortions under improper conditions. The result is death or serious injury to the female. Only such abortions have attracted police action.¹¹⁸ Now-a-days female foeticide is a new crime in our country.

**Female Foeticide Goes on Illegally**- The Government of India has taken a serious note on this and has banned such tests and such abortions. The police are under duty to collect evidence and take legal action against such law-breakers. The police can collect oral evidence, medical evidence and physical evidence in such cases.

Statistics of Foeticide in India- Sections 315 and 316 of Indian Penal Code provides punishment for foeticides. The table shows the female foeticides in the different years as under:

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of foeticides</td>
<td>111</td>
<td>132</td>
<td>210</td>
<td>221</td>
<td>107</td>
</tr>
</tbody>
</table>

Source¹¹⁹

A total number of 111 cases of foeticide were reported in the country during the year 2010, 132 in 2011, 210 in 2012, 221 in 2013 and 107 in the year of 2014 respectively.

**Statistics of Abortion in India**- According to National Crime Record Bureau total numbers of abortions is 811 in the year 2009 and 785 in the year 2010. It is also to be notable that total number of cases which came on the record in the year 2009

¹¹⁹ [http://ncrb.nic.in/](http://ncrb.nic.in/)
is 1072 and in 2010 it is 867. In 2010, only 785 female foeticide were recorded.

In such cases, on the one side, oral evidence may be got from the person who took the lady to the abortionist, the female that was carried to the abortionist and the man who performed the abortion.

On the other hand, medical evidence and physical evidence should be collected by the investigation officer from the place where the abortion has been made. Vaginal washes or swabs with the help of doctor, instruments used for the purpose of abortion, any residual fluid used may be collected from the spot for physical evidence. Section 372 of Indian Penal Code provides the punishment for the commission of abortion. According to this section abortion is liable to be punishable for imprisonment of 3 years to 7 years of duration and fine. However, the abortionist or the woman who gives her consent for an act of abortion, both are treated as accused under section 511 of Indian Penal Code. Miscarriage against the will of woman is treated under section 313 of Indian Penal Code with imprisonment up to 10 years who performs medical termination of her pregnancy. If the pregnant woman does not survive after termination of expulsion of product of conception then the abortionist is liable to be punished for 10 years under section 314 IPC, but if the new born baby is born alive and an attempt is made to kill him/her from being born, then the case is treated u/s 315 IPC followed by imprisonment for 10 years along with fine. If the baby has not been still born, an intention and persuasion is being made to abort the baby by giving or injecting abortifacient drugs, then the case is treated under section 316
IPC and 10 years punishment will ensure.120

(2) Alcohol

Test of using alcohol is the important scientific aid in police investigation. Consumption of alcohol to celebrate any occasion is common.121 It is considered a status symbol, a road to social ability, a means to end one’s sorrow and pain from failure or insults, a medium to boost courage to commit crime; murder, rape (and other sexual offences), robberies and the like.122 Many families are destroyed due to this habit of the head of the family. The future of Children is darkened. Thus, the life of whole family goes towards poverty and they indulge in bad habits. The future of the entire family is spoilt.

First of all, it can be easily said that the quantity of alcohol affects upon its consumer, secondly it is absorbed in stomach very soon.

According to section 85 of Indian Penal Code, 1860 it has been provided that act of a person is incapable of judgment by reason of intoxication caused against his will. The fact that a person is drunk when he attacks another in no defence in law. However, if it can be proved that he was so hopelessly drunk that he was incapable of knowing what he was doing, or of forming any specific intention, then, in a case of homicide, it could reduce a charge of murder to one of manslaughter.123 Therefore, section 86 of Indian Penal Code (1860) declares that, “Offence requiring a particular intent or knowledge committed by

120 Quoted in the Indian Police Journal vol.LX.No.2 ISSN 0537-2420 April-June, 2013 p.224
121 Quoted in Ministry of Road Transport & Highways Govt. of India, Sign Language Book on Road Safety Signage and Signs (2012), p.69
123 Brian Lane, The Encyclopedia of Forensic Science (1993), p.28
one who is intoxicated.” In short, a particular intent or knowledge is must to punish the offender.

In Gautam Bhole v. State of Maharashtra, it was held that the benefit under section 86 of Indian Penal Code, (1860) would be available to a person if intoxicating substance was administered to him against his will or without his knowledge.

Increasing demand of alcoholic drinks has increased the manufacturing of illicit liquor. At present, illicit liquors are produced in a very large quantity in the country, which are usually consumed by the poor people. In order to give rapid kick, the illegal manufacturers have started adding harmful chemicals and other adulterants to the illicitly manufactured liquors, which at times result in death of many people.

Road Accidents due to Influence of Alcohol or Drunken Driving

Consumption of alcohol to celebrate any occasion is common in the present scenario. But when mixed with driving it turns celebration into a misfortune. Alcohol reduces concentration. It decreases reaction time of a human body. Limbs take more time to react to the instructions of brain. It hampers vision due to dizziness. Alcohol dampers fear and incite humans to take risks. All these factors while driving cause accidents and many a time it proves fatal. For every increase of 0.05 blood alcohol concentration, the risk of accident doubles. Apart from alcohol many drugs, medicines also affect the skills

124 (2010) IV Cri. L.J. 4073 (Bom.)
125 Dr AK Bapuly, Forensic Science Its Application in Crime Investigation (2006), p.91
and concentration necessary for driving.\textsuperscript{126}

According to National Crime Record Bureau cause wise analysis of road accidents has revealed that driving under influence of drug/alcohol contributed 1.6\% of total road accidents which rendered 7,398 persons injured and 2,591 deaths in the country in 2014.\textsuperscript{127} दुनिया भर में शराब पीकर गाड़ी न चलाने से सम्बंधित कानून को लागू करके इस वजह से होने वाले सड़क हादसों को 20 फीसद काम किया जा सकता है।\textsuperscript{128}

The active ingredient of any alcohol drink is ethyl alcohol in various proportions. Ethyl alcohol is a clear, colorless liquid with characteristic smell and burning taste. It boils at 78.4°C. It mixes with water in all proportions. Alcohol is manufactured from the fermentation of carbohydrates from various cereals and other parts of the plants, sugars and sweet juices. The process is so simple that it is done even in private homes. The following table indicates the percentage of ethyl alcohol as various types of alcoholic beverages.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|}
\hline
\textbf{Type of alcoholic beverage} & \textbf{Percentage of ethyl alcohol} \\
\hline
1. Beer & 4-8 \\
\hline
2. Wine & 10-15 \\
\hline
3. Fortified wine & 15-20 \\
\hline
4. Whisky, gin, brandy & 40-45 \\
\hline
5. Rum & 48-50 \\
\hline
\end{tabular}
\caption{Table\textsuperscript{129}}
\end{table}

\textsuperscript{126} Quoted in Ministry of Road Transport & Highways Govt. of India, \textit{Sign Language Book on Road Safety Signage and Signs} (2012), pp.69-70
\textsuperscript{127} Quoted in NCRB, Accidental Deaths & Suicides in India (2014), p.126.
\textsuperscript{128} Quoted in Dainik Jagran; Mudda @jagran.com.panipat, 30 November, 2014 p.9
\textsuperscript{129} Dr AK Bapuly; \textit{Forensic Science Its Application in Crime Investigation} (2006) p.91
Following cases involving alcohol are handled by the police:

(i) Drunkenness
(ii) Illicit liquors
(iii) Smuggled liquors
(iv) Imitation liquors
(v) Camouflaged liquor

The investigating officer or police officer faces the drunk in the following situations-

(i) Drunken drivers, driving their vehicle dangerously on the roads.
(ii) A drunkard creating nuisance in public places
(iii) A drunkard lying unattended, unable to help himself.
(iv) In road accidents or other accidents where the culprit, the victim or both are drunk.
(v) In unnatural (accidental, suicidal or homicidal) deaths, drunkenness may be the cause of death.
(vi) In case of alcoholic poisoning.
(vii) In case of assault/fighting, to ascertain whether the assailants or the victim(s) were drunk.

In such cases, the subject is the real clue. The stage of drunkenness is determined by:

1. Medical examination. - By medico-legal experts.
2. Physical examination/test- By medico-legal experts.
3. Chemical examination – By medico legal experts.

**Physical Evidence/Chemical Tests**

Chemical tests determine how much alcohol is inside the body of a person at the given time. They can be conducted in the following ways-

- Blood
• Urine
• Breath
• Saliva
• Vitreous fluid
• Blood clots
• Spinal marrow liver

Note- However, the commonly collected fluids are blood, urine and breath.

**Physical Evidences/Scientific Aids/Samples Collections from the Dead**

In case of dead bodies reported and recovered by the police the following steps are to be taken accordingly:

(i) Viscera

(ii) Sample of blood (10 ml)

**Detection of Alcohol**

In many cases, it is the duty of a police officer to take a legal action against the offender. It is very important for a police officer to collect the physical evidence against him. It can be done by analyzing his breath, blood and urine for alcohol test. It is very easy for a police officer by analyzing the breath. It can be performed on the spot. The breath analyzer instrument like Alcometer, Intoxilysyer and G.C. intoximeter, wherein the breath is blown in a balloon, which when passed into the instrument indicates the approximate percentage of alcohol.

(3) **Arson as Scientific Aid in Police Investigation**

According to dictionary meaning arson is willfully burning a house. An arsonist willfully breaks out the fire for the following reasons-

• To take revenge;
• To receive fraudulent insurance claims;
• To loss to property;
• To loss to life/lives, etc.

Generally, arsonists use various kinds of inflammable liquids such as petrol and kerosene to harm and destroy the valuable lives and property.

**Indian Law of Arson Cases**

It is a cognizable offence in the eye of law. Indian Penal code, 1860 provides the mischief under sections 435, 436 and 438 of such cases. Section 435 provides that whoever commits mischief by fire or any explosive substance intending to cause, or knowing it to be likely that he will thereby cause, damage to any property to the amount of one hundred rupees or upwards or (where the property is agricultural produce) ten rupees or upwards, shall be punished with imprisonment of either description for a term which may extend to seven years, and shall also be liable to fine. Section 436 provides that whoever commits mischief by fire or any explosive substance intending to cause, or knowing it to be likely that he will thereby cause, the destruction of any building which is ordinarily used as a place of worship, or as a human dwelling or as a place for the custody of property, shall be punished with imprisonment for life, or with imprisonment of wither description for a term which may extend to ten years, and shall also be liable to fine. Section 438 provides that whoever commits, or attempts to commit, by fire or any explosive substance, such mischief as is described in the last preceding section, shall be punished with imprisonment for life, or with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine.
Physical Evidence to be Collected in Arson Cases

As soon as the police officer receives the information of fire case he would approach the crime scene immediately. First of all, he should try to save the valuable lives and property if any. Secondly, fire brigade should be called to control the fire. Thirdly, he should preserve the crime scene and call the forensic scene of crime experts on the crime scene to detect the reason of fire.

The scene of arson should be examined with special care and consideration. The region of origin of fire should be traced. The investigating officer is under duty to collect the following physical/chemical materials from the crime scene and send them to the forensic science laboratory for examination.

- Flammable fluids and materials
- Ash
- Partially burnt wood fragments
- Fused and short-circuiting of electrical wires
- Smoke
- Partially burnt papers
- Partially burnt clothes
- Suspected failures of appliances, batteries etc.
- Partially burnt matches

Note- All the physical and chemical materials should be sent to forensic science laboratory in air-tight jars for examination by the investigating officer.

The following chart represents the incidences of fire occurred in India as under:
<table>
<thead>
<tr>
<th>Year of incidence</th>
<th>Arson cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>12028</td>
</tr>
<tr>
<td>1996</td>
<td>12425</td>
</tr>
<tr>
<td>1997</td>
<td>12363</td>
</tr>
<tr>
<td>1998</td>
<td>12913</td>
</tr>
<tr>
<td>1999</td>
<td>11218</td>
</tr>
<tr>
<td>2000</td>
<td>10392</td>
</tr>
<tr>
<td>2001</td>
<td>10534</td>
</tr>
<tr>
<td>2002</td>
<td>11820</td>
</tr>
<tr>
<td>2003</td>
<td>9365</td>
</tr>
<tr>
<td>2004</td>
<td>8637</td>
</tr>
<tr>
<td>2005</td>
<td>8451</td>
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<tr>
<td>2006</td>
<td>8480</td>
</tr>
<tr>
<td>2007</td>
<td>9024</td>
</tr>
<tr>
<td>2008</td>
<td>9249</td>
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<tr>
<td>2009</td>
<td>8736</td>
</tr>
<tr>
<td>2010</td>
<td>8508</td>
</tr>
<tr>
<td>2011</td>
<td>9064</td>
</tr>
<tr>
<td>2012</td>
<td>11836</td>
</tr>
<tr>
<td>2013</td>
<td>9357</td>
</tr>
<tr>
<td>2014</td>
<td>9289</td>
</tr>
</tbody>
</table>

Source: NCRB; Crime in India, Compendium

The above chart shows that arson cases are at very high score. These are those cases which are reported to the police, but there may be more cases that are not reported to the police due to several reasons. According to National Crime Record Bureau’s report total 12572 persons were arrested under the
offence of arson during the year 2012. Thus, the number of arrest per case is 1.1.\textsuperscript{130}

\textbf{(4) Blood as Scientific Aid in Police Investigation}

Blood makes a human different from another living being such as animals and plants. Deficiency of blood in a living person causes death. A living person cannot live without the smooth functioning of blood. Blood group is of four kinds, e.g. A, B, O and AB. As it is an important part of human living so it is also found on the crime scenes of criminal activities. In criminal activities it may be found on crime scene, on the body parts of victim and on the suspect. It creates a link between the victim, the accused or the suspect and the crime scene.

\textbf{Parts of Blood}

Blood contains four parts-

1. Red Blood Cells
2. White Blood Cells
3. Platelets &

\textbf{Blood as Physical Evidence on Crime Scene}

Blood is very useful and important physical evidence in criminal investigation. Almost in all criminal activities, such as murders, rapes, assaults, etc. blood is found on the spot.

\textbf{Nature of blood or blood stains}

Blood or blood stains found on the crime scene may be lifted for its examination with due care and consideration. Blood should not be touched with bare hands as it may be hazardous. There are certain precautions which should be used in this

\textsuperscript{130} Quoted in NCRB, \textit{Crime in India} (2012) Compendium p. 143
process.

(i) The investigating officer or scientific expert should allow the blood to dry and then be scraped into a clean container.

(ii) In case of wet blood, it should be soaked in a cotton and dry in shade.

(iii) Blood can be tested on the spot by the forensic experts.

(iv) It should be determined whether the blood is human or non-human e.g. animals etc.

(5) **Bottles of Alcohol or Cold Drinks as Scientific Aid in Police Investigation**

Many times as seen on the crime scenes in thefts or any other criminal activities like murder, rape and house burglary etc. the criminals often drink alcohol or cold drinks and also eat food, fruits and other eatable products on the spot where they commit the crime. The remains of these foods and drinks may be very useful to make the link between the crime scene and criminals.

It is an important clue for the investigating officers. Therefore, crime scene should not be disturbed until the crime scene expert and fingerprint expert visit the spot. Bottles or wrappers of biscuits, snacks and bread etc. may have fingerprints that are called chance prints. They may become the physical evidence and helpful to trace the criminals.

On the other hand, the remains of fruits may be very helpful to identify the criminals by DNA test through saliva observed upon them.

(6) **CCTV Cameras**

A CCTV camera was invented by Marie Van Brittan Brown.
Full name of CCTV camera is Closed-circuit television (CCTV) cameras. It can produce images or recordings for surveillance purposes and can be either video cameras, or digital stills cameras.\(^{131}\) It is very useful and important evidence as scientific aid. It provides all the activities occurred during the crime. A number of times, this evidence prove very useful and it is admissible evidence.

Since the CCTV cameras are very useful to keep watch on the criminal activities, therefore, the clever criminals cut down the wiring of CCTV cameras or damage or smash down these cameras during committing the crime. In this way, they become useless evidence in different cases. For example, in burglary and theft cases, offenders make these cameras useless. ATM machines cameras are moved to the opposite direction that disables the CCTV camera to capture the process.

(7) DNA as a Scientific Aid in Police Investigation

DNA stands for deoxyribonucleic acid. It is a genetic material in the chromosome.\(^{132}\) It is a nucleic acid generally regarded as a blueprint, a recipe or a code of an organism. The blueprint contains instructions which enables development of cells into the body.\(^{133}\) Two kinds of nucleic acids play crucial roles in inheritance: deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). DNA is found primarily in the nucleic of cells; hence it is referred to as nuclear (DNA) (n DNA). RNA is found primarily in the cytoplasm, the part of the cell surrounding the

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The DNA was first identified and isolated by Friedrich Miescher and the double helix structure of DNA was first discovered by James Watson and Francis Crick. In 1869, Swiss Physician Friedrich Miescher discovered a microscopic substance in the pus of discarded surgical bandages. As it resides in the nuclei of cell, it is called “nuclein”. In 1878, Albrecht Kossel isolated the non-protein component of “nuclein”, nucleic acid, and later isolated its five primary nucleobases. In 1919, Phoebus Levene identified the base, sugar and phosphate nucleotide unit. In 1937, William Astbury produced the first x-ray diffraction patterns that showed that DNA had a regular structure. In 1953, James Watson and Fracis Crick suggested what is now accepted as the first correct double-helix model of DNA structure in the journal Nature. The DNA in all of the cells of a single individual is the same throughout the entire body because humans evolve from a single fertilized egg - that is, a single source of DNA. In 1983, Jeffreys found that DNA contained repeated sequences of genetic code within “mini-satellites”, these mini-satellites turn, contained core sequences that all unique to particular individuals. Jeffreys’s discovery was a crucial element in the development of the technology now known as DNA fingerprinting.

DNA is a forensic tool in crime investigation. DNA and RNA are responsible for the storage and transmission of genetic information in all living organism. They hold the key to the

135 En.wikipedia.org/wiki/dna
process how genetic information is transferred from one cell to another and how genetic traits are transmitted, via sperm and eggs from parents to offspring. The major function of DNA and one in which RNA is also involved— is the control and direction of protein synthesis in body cells. Chemical information stored in the DNA of genes specifies the exact nature of the protein to be made and, therefore, dictates the character of the organism.\textsuperscript{137}

Animal and plants also have DNA, like those in humans, but of course, different.\textsuperscript{138}

**The Importance and Utility of DNA can be Established in the Investigations of:**

1. Disputed paternity/maternity
2. Bay sapping
3. Missing identity
4. Murder
5. Rape cases
6. Immigration cases
7. Road accidents, abduction (kidnapping etc.)

**Supreme Court of India and DNA**

The Supreme Court of India acknowledges DNA Test which ascertains paternity fraud in India. While hearing a criminal appeal filed by a husband to challenge the maintenance claimed by his wife u/s 125 Criminal Procedure Code, the Supreme Court acknowledged the need for the new modern age science and its impact on the justice delivery system of India by accepting Paternity DNA Test as the ultimate conclusive proof for ascertaining matters relating to Paternity disputes, which is a

\textsuperscript{137} Ibid., p.342
crucial in deciding appeals relating to maintenance and other relief to a petitioner wife.

The Bench comprising of Justice C.K. Prasad and Justice J.S. Khehar set aside the 142 year old presumption of paternity or legitimacy under section 112 of the India Evidence Act, 1872 by stating that the Evidence Act was enacted at a time when the new age modern science and DNA tests were not available. Though Section 112 of the Evidence Act puts down a presumption for children born out of subsisting marriages, this presumption could be tested and set aside through DNA test in order to ascertain parenthood of children born out of subsisting marriages as the result of such DNA Tests are scientifically accurate. The Court further stated:

When there is a conflict between a conclusive proof envisaged under law and a proof based on scientific advancement accepted by the world community to be correct, the later must prevail over the former.\(^{139}\)

In case of *Nandlal Wasudeo Badwaik v. Lata Nandlal Badwaik & Another,\(^{140}\)* where petitioner happens to be the husband of Lata Nandlal and alleged to be the father of girl child Netra @ Neha. The petitioner husband challenged the paternity of the child and applied for DNA test. FSL, Nagpur submitted the result of DNA test and opined that Nandlal Wasudeo Badwaik is excluded to be the biological father of Netra @ Neha. The respondent, not being satisfied with the aforesaid report, made a request for retest. Further direction to CFSL, Hyderabad was

\(^{139}\) [ireport.cn.com/doc/DOC-1078428](http://www.ireport.com/docs/DOC-1078428)

\(^{140}\) [CRIMINAL APPEAL NO.24 OF 2014 (@SPECIAL LEAVE PETITION (CRL.) No.8852 of 2008)](http://indiankanoon.org/doc/139951018/)
ordered by the Court. CFSL Hyderabad submitted its report on that basis opined that the appellant, Nandlal Wasudeo Badwaik could be excluded from being the biological father of Neha.

The Tribune dated 27th June 2009 published the news under title- “DNA test proves rape charge false.” The material published was thus- “A DNA test report has come to the rescue of a man who was accused of having forcibly entered the house in which his estranged wife lived and committing rape in November last year a charge which he had denied. The police registered the case. The DNA test report received from the FSL, Madhuban, however, absolved the husband and indicated that the complaint was false. The police had cancelled the FIR and filed a report with the court, seeking permission to prosecute the woman under section 182 of Indian Penal Code, 1860. The woman’s complaint was backed by her two young children though. But the DNA report clearly stated accordingly to the police that the sample of the semen did not match with the blood profile of husband, Mukhtiar.”

The Constitution of India, by Article 51 (A) (h) and (j), declares that, it shall be the duty of every citizen of India, “to develop the scientific temper, humanism and spirit of inquiry and reform”, and “to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement.”

Hence, DNA testing of a criminal provides clinching evidence regarding involvement/association of any person in a crime. DNA fingerprinting can be used as a vital input, and sometimes, the only decisive clue in some of the most complex cases, where all other evidence are lost or destroyed. It is now
more than a decade since the first DNA was furnished in any court of law in India. Since the DNA technology has made advancements by leaps and bounds. Some cases which have been in limelight and the court of law has given due weightage to DNA test reports are Madhumita Shukla murder case, Tandoor murder case and Priyadarshini Matoo murder case.\footnote{Quoted in FSL Bulletin, June 2008}

\section{Document as a Scientific Aid and its Examination}

Documents are most required part in the human society. To think of no documentation is a myth. There may be no transactions without document; it may either paper documents or electronic documents. In all spheres such as institutional, professional, educational, commercial or social the need of documents are the most important part of every individual. No man can survive without documents. For example, a student needs educational certificate, birth certificate, caste certificate, domicile or residential proof certificate and character certificate and so more for new admission to any intuition or entry into any organization for service. Crimes related to document are increasing day by day. Therefore, it is not an easy task to detect the forgeries.

\textbf{Examination and Comparison of Disputed Writings with Standard Writings}

Forensic Science Laboratory also has a division for the examination of documents/writings in question with standard writing that is called “Documents Division”. Today, sophisticated photography is widely used to detect the discrepancies in forged
and altered documents.\textsuperscript{142} According to the dictionary meaning "sophisticate" means to mislead, to corrupt, to adulterate or to temper. The experts of the document division deals in the matters related to documents e.g. fake passports, fake signatures, handwritings, printings either of typewriter or computer printers, printings in printing press, typewriters and ribbons, rubber stamps, price markers, cheque writers, inks of fountain or ball pens, papers, pencils, charred and damaged documents including torn documents etc.

It is notable that there may be overwriting, alteration, additions and erasers in the writing of any documents. For instance, when a careful alteration of a 3 made by 8 or 1 made by 7 or 9 by a ball pen or ink. In such cases only an expert can prove that a separate ball or ink pen has been used in such alteration or addition.

Simply the students and officials use rubbers and blades to erase any writing of mistakes. But when such alteration, addition or eraser is made to deceit any other person then it is an offence civil and criminal. Erasers may be of two types, chemical and mechanical. For example, when rubber or blade is used it is mechanical. When fluids are used it is chemically erasures.

An examination under Ultra-Violet rays is the best medium for detecting the erasures whether mechanical or chemical.\textsuperscript{143}

\textbf{Meaning and Definition of Documents and Other Provisions}

Section 3 of the Indian Evidence Act provides that

\textsuperscript{142} Quoted in LNJN National Institute of Criminology and Forensic Science, \textit{Course on Crime Scene and Forensic Evidence Collection} (2009), p.5

\textsuperscript{143} Shiam Narain Sharma, \textit{Identification of Disputed Documents, Fingerprints and Ballistics} (1980), p.62
document means any matter expressed or described upon any substance by means of letter, figures or marks or by more than one of those means intended to be used, or which may be used for the purpose of recording the matter.

In *Velaga Siraramma Krishna v. Velaga Veerbhadra Rao*,\(^1\) the defendant denied that signatures on the promissory note were not made by him nor he issued the same and it became the matter of dispute. The court held that such disputed document should be sent to expert for the comparison of signatures. In another case, the Supreme Court held that when it was finally concluded that the signatures on the cheque was not forged, there was no need for an opinion of handwriting expert.\(^2\)

In *M. K. Usman Koya v. Santha and others*,\(^3\) the Kerla High Court held that the comparison of handwriting was imperfect science and expert would not be able to state with hundred percent certainty that particular signature is that of the person who purportedly signed. An expert could only state that there was high probability and possibility cannot be ruled out.

There may be different opinions of experts regarding handwriting. There are a number of cases of such situation. In *Suresh Kumar v. Mewa Ram*,\(^4\) where there were two different opinions of two handwriting experts then the court itself could compare the disputed handwriting with the admitted handwriting.

In *State of U.P. v. Ranjit Singh*,\(^5\) the respondent was a

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1. AIR 2009 AP 47
2. *L.C. Goyal v. Mrs. Suresh Joshi* AIR 1999 SC 2222
3. AIR 2003 Ker 191
4. AIR 1991 Punjab 254
stenographer of a Judge and charged for fabricating a forged bail order for accused Khelawan. It was held by the High Court that since the accused had not signed the bail order, the same could not be said to constitute a document. The bail order in question was written by the accused. The Supreme Court held that in view of the facts and law provisions of IPC, a person is said to make a false document who dishonestly or fraudulently makes, signs, seals or execute a document or part of a document, the reasoning of the High Court that the bail order without the signature cannot be said to be a document attracting the provisions of Section 464 IPC and is wholly unsustainable.

In another case, Kotamraju Venkatarayudu v. Emperor, a candidate for the matriculation examination of the university forwarded a character certificate and a certificate that he had completed is 20th year which purported to be signed by the Headmaster of a recognized school, but the certificate was, in fact, not signed by him but was signed by the candidate in his own handwriting. The certificate was held to be a forged document and the accused was liable for forgery. There are a numerous court decisions on the topic of forgery and alteration the documents.

(9) Drugs

India is a secular state. People of all religions live here together with love and affection. But the population of India is rising day by day. As per record its population has reached over one billion. The culture and the ethics of India are as old as the creation of the World. Therefore, its culture and ethics are ideal

149 (1950) 28 Mad. 90
and supreme. But it is also true that our culture and moral values have changed in the present scenario due to unemployment, overpopulation and poverty. The Western culture has played an important role in this regard. People have become self-centred and busy in their personal gratification or satisfaction of their physical needs. Due to busyness and restless life they indulge in bad habits e.g. alcohol and drugs etc. Consuming of alcohol or drug addiction is not only a major problem of our country but for the whole universe also. In the USA, one gang was smuggling 1000 pounds of charas every month. The police also seized more than one million tablets of LSD from the same gang. The US government spends thousands of crores of rupees every year, for its control. It shows the gravity of the situation.¹⁵⁰

**Law Related to Drugs in India**

In order to meet the growing threat and problems of drugs, the following laws were enacted in India:

1. The Opium Act, 1857;
2. The Opium Act, 1878;
3. The Dangerous Drugs Act, 1930, and

It is notable that prior laws enacted before 1985 were not adequate because of illicit drug abuse and drug trafficking. Therefore, the new and effective law in the form of The Narcotic Drugs and Psychotropic Substance Act was introduced in Lok Sabha on 23rd August, 1985. Further, this Act was passed by both the houses of the Parliament and it was assented by the

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President of India on 16th September, 1985. It came into force on 14th November, 1985 as The Narcotic Drugs and Psychotropic Substance Act, 1985 (61 of 1985). It extends to the whole of India and it applies also to all citizens of India outside India and to all persons on ships and aircrafts registered in India.\textsuperscript{151}

In \textit{Gulam Mohiuddin v. State of Jammu & Kashmir}\textsuperscript{152} it was held that this is a special Act, while adopting the liberal construction of the Act. This Act has been enacted with a view to make stringent provisions for the control and regulation of operations relating to the narcotic drugs and psychotropic substances.

Drugs in bulk form and in blood and/or urine specimens are often involved as physical evidence in a wide variety of criminal cases. These substances are encountered in cases such as traffic accidents, traffic fatalities, driving while under the influence of alcohol or other drugs, public intoxication, possession or sale of controlled substances, and illicit manufacture or controlled substances.\textsuperscript{153}

“Drug is any natural or synthetic substance when administered produces definite physiological or psychological effects in the individual.”\textsuperscript{154} A drug can be defined as a natural or synthetic substance that is used to produce physiological affects in man. But in the modern context, drug means something different to different persons. To some, drugs are a necessity for sustaining and prolonging life; to others, drugs provide an escape from the pressure of life. The law enforcement

\textsuperscript{151} Sub-sections (1), (2), (2) (a) & (b) of Section 1 of NDPS Act, 1985
\textsuperscript{152} (1994) 1 Crimes 204 (J&K).
\textsuperscript{154} Dr AK Bapuly, \textit{Forensic Science} (2006), p. 66
agency is concerned with the latter type of drug which is widely abused. 155

**Narcotic Drug**

“Narcotic drug” means coca leaf, cannabis (hemp), opium, straw and includes all manufactured goods. 156

**Psychotropic Substance**

“Psychotropic substance” means any substance, natural or synthetic, or any natural material or any salt or preparation of such substance or material included in the list of psychotropic substances specified in the Schedule. 157

**Addict**

“Addict” means a person who has dependence on any narcotic drug or psychotropic substances. 158 This Act provides the provisions related to prohibition, control and regulation of narcotic drugs and psychotropic substance under chapter III of the NDPS Act, 1985. Section 8 of the Act provides the prohibition of certain operations as under.

**TABLE**

<table>
<thead>
<tr>
<th>Particulars of narcotic drugs/psychotropic substance</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>(i) Opium</td>
<td>10Kgs.</td>
</tr>
<tr>
<td>(ii) Morphine</td>
<td>1 Kg.</td>
</tr>
<tr>
<td>(iii) Heroin</td>
<td>1 Kg.</td>
</tr>
<tr>
<td>(iv) Codeine</td>
<td>1 Kg.</td>
</tr>
</tbody>
</table>

155 B.S.Nabar, Forensic Science (2010), p.246
156 Sub-section (xiv) of Section 2 of NDPS Act, 1985
157 Sub-section (xxiii) of Section 2 of NDPS Act, 1985
158 Sub-section (i) of Section 2 of NDPS Act, 1985
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(v)</td>
<td>Thebaine</td>
<td>1 Kg.</td>
</tr>
<tr>
<td>(vi)</td>
<td>Cocaine</td>
<td>500 grams.</td>
</tr>
<tr>
<td>(vii)</td>
<td>Hashish</td>
<td>20 Kg.</td>
</tr>
<tr>
<td>(viii)</td>
<td>Any mixture with or without any natural material of any of the above drugs</td>
<td>Lesser of the quantity between the quantities given against the respective narcotic drugs or the psychotropic substances mentioned above forming part of the mixture.</td>
</tr>
<tr>
<td>(ix)</td>
<td>LSD, LSD-25(+)N, N Diethyllysergamdie (d-lysergic acid diethylamide)</td>
<td>500 grams.</td>
</tr>
<tr>
<td>(x)</td>
<td>THC (Tetrahydrocannabinols, the following Isomers: 6-a (10-a), 6a (7) 7, 8, 9, 10, 9 (11) and their stereochemical variants)</td>
<td>500 grams.</td>
</tr>
<tr>
<td>(xi)</td>
<td>Methamphetamine (+)-2-Methylamine-1-Phenylpropane</td>
<td>1,500 grams.</td>
</tr>
<tr>
<td>(xii)</td>
<td>Metha qualone (2-Meth y 1-3-0-tol y 1-4-(3h)-quinazolinone)</td>
<td>1,500 grams.</td>
</tr>
<tr>
<td>(xiii)</td>
<td>Amphetamine (+)-2amino-1-phenylorpane</td>
<td>1,500 grams.</td>
</tr>
<tr>
<td>(xiv)</td>
<td>Salts and preparations of the psychotropic substances mentioned in (ix) to (xii)</td>
<td>1,500 grams.</td>
</tr>
</tbody>
</table>
Where any person is convicted by a competent court of criminal jurisdiction outside India under any law corresponding to the provisions of section 19, section 24 or section 27 A and for offences involving commercial quantity of any narcotic drug or psychotropic substance, such person, in respect of such conviction, shall be dealt with for the purposes of sub section (1) as if he had been convicted by a court of India.

Generally, there are no sound and effective parameters to recognize the addict of drugs. But there are some symptoms which provide help to an investigating officer. There may be some guidelines or symptoms which aid an investigating officer as under:-

1. Any drug addict may have the drugs which are banned under the NDPS Act or any other law of the country.
2. Abnormal behavior shown by a person like borrowing money again and again. Sometimes such persons indulge in criminal activities e.g. stealing money from his own house or from any other house, trespassing and breaking the other houses and do the heinous offence like murder. There are numerous examples in the society that we read in the newspapers daily.
3. Every drug addict usually hides or conceals the drugs and tries to keep them away from his family members and known/unknown persons who do not use drugs.
4. Every drug addict may have different tools and devices for smoking, injecting and inhaling various drugs. Many times, they use the same needle to inject the drugs in their bodies through injections.
5. If the drug addict takes the drug through injection, then
needle marks may easily be seen in their forearms, lower parts of legs etc. These scar marks may be in the form of black or blue colored like tattoo.

6. Often the collection of pus around the vein of such persons may be seen due to use of unsafe needles or using the same needle by many drug addicts.

7. It is notable that these drug addicts usually wears the full sleeves and long cloths even in the months of summer and hot days to disguise the marks of needles.

8. As a person who takes liquor, the smell of alcohol can be felt by breath, but in case of drug addiction, there is no smell of drugs.

9. Non availability of drugs to the addict may cause the following symptoms like, high blood pressure, high temperature of body, taking breath speedily, excessive sweating, running nose regularly, nervousness, restlessness, sleeplessness, constricting pupils, straight eyes, anxiety and there may be other symptoms also.

10. The nature of the addict may be of moody, impaired speech and over excited.

11. Drug addicts usually seen to indulge in quarrel with his own family members such as parents, brothers, sisters, wife, and children if any. Such addict person is beaten or he beats his family members or vice versa.

12. As already stated that they can do the heinous crime e.g. burglary, murder or dacaioty etc.

13. There are some spot examinations or tests which are reliable and sure which helps to identify the drug addicts.

14. In addition, forensic science laboratory’s NDPS Division
provides the scientific aids to detect the drugs and substances under the NDPS Act and other existing law of our country. This division provides the exact nature and evidence in the examination and laboratory test report to conclude the crime.

(10) Dust

According to Mahamaya Advanced Perfect Dictionary, the meaning of dust is fine particles of matter, powder, the grave. It is a common thing that can be seen on every place whether it is a home, shop, vehicle and every place. Therefore, it can also be traced on the crime scene where the crime has occurred. Every person/culprit or his shoes, soles of shoes, cloths, his hairs, on the face and vehicles carry the dust from the place of occurrence. It is also important to say that the nature of dust of every place is so different that can be use for comparison.

Kinds of dust

Dusty may be of many kinds such as road dust, footpath dust, air dust, industrial dust, home dust, professional dust and occupational dust.

Importance of Dust in Crime Scene

It is fact that dust is unique in place to place. The collection of dust from the crime scene, vehicle used in crime, soles of shoes, skins etc. may be used for comparison and identification. It can help the investigating officer to correlate the criminal and crime. Dust as a physical evidence can play an important role in criminal cases but the use of such evidences are very rare in our country.

(11) Dyes

According to dictionary meaning, dye means colour. It may
be colour on walls of any house, shop, complex or building. When a criminal enters in a place with the intent of making a crime such as burglary or theft and otherwise, then the dye can transfer to his clothes. The sample of dye lifted from crime scene can be matched with the dye recovered on the clothing of the suspected. In this way this scientific aid can help to trace the criminal case. It is an important scientific aid and very easy to match with the help of forensic experts or forensic laboratories.

**12) Explosives**

In cases of violent burst, debris are collected on the crime scenes to detect explosive residues. A number of cases have been traced with the help of scientific teams. It determines the how strong materials and chemicals have been used to blast.

**13) Fingerprints**

Fingerprints also play an important role in providing identification of an individual. The identity of finger impressions has now been accepted by all courts of law. In 1902, Henery Jackson was the first man convicted in England, solely on fingerprint evidence. A fingerprint in fresh paint was left on the window frame of a house that had been burgled. This print was tallied with the print on one of the fingers of Henery Jackson, an old criminal, in the records of Scotland Yard. Since then, all over the world, fingerprints have been classed as one of the strongest forms of evidence, as to the identity or non-identity of a person. The Science of fingerprints identification is an exact science and the opinion of the fingerprint expert is acceptable under section 45 of Indian Evidence Act, 1872. The evidence

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given by a fingerprint expert need not necessarily be corroborated; but the court must satisfy itself as to the value of the evidence of the expert in the same way as it must satisfy itself of the value of other evidence. Fingerprint expert need not necessarily be corroborated; but the court must satisfy itself as to the value of the evidence of the expert in the same way as it must satisfy itself of the value of other evidence. Fingerprint science is based on two principles, viz, (i) that these patterns remain permanent throughout from birth till decomposition sets in after death, and (ii) no two fingerprints are ever identically alike. The Great Architect of the universe never made two things exactly alike. It is true that a man can disguise himself but a chance print reveals his true identity. Fingerprints are of four types—Arch, Loop, Whorl and Composite. The first recorded case in which fingerprints were utilized as a scientific aid was a case of double murder. A widow in order to marry another person had killed her children. But she claimed that some unknown person had killed them. There were no eye witnesses. While examining the scene of occurrence, the investigating officer observed two faint fingerprints in blood on one of the door leaves where the children had been killed. A comparison of the fingerprints on the door with those of the mother indicated that the prints were of her fingers. She confessed to the crime. Fingerprints as scientific aids to criminal investigation have been discussed comprehensively in the next chapter.

(14) Footprints

As fingerprints and DNA are the most reliable and unique

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scientific and physical evidence but on the other hand, footprints are not so reliable and unique. As it is right that footprints also may be of unique but all culprits wears footwear e.g. shoes, chapels or sandle. The pattern and make of footwear helps the investigating officer to trace out the culprit. But there may be a number of same size and made footwear, then it is impossible to trace out the case. Therefore, this physical evidence is not much reliable.

In the past when there was not so much transportation, sniffer dog succeeded in catching the culprits. In that time, offenders used to go on feet to the crime scene and back also on feet. The sniffer was very successful in tracing a number of cases.

(15) Fibre and Fabrics

Fibre is a thread-like animal or vegetable tissue. Fabric is a woven material or structure or tissue. In criminal and hit and run cases fibre and fabrics play an important role as scientific aid and physical evidence. For example, a fibre piece recovered from the place of occurrence matched with the fibre of suspected clothing proves that the suspected is related with the crime scene. On the other hand, if any clothing piece of the driver of a two wheeler found on the other accidental vehicle in hit and run case then it settle the case.

(16) Firearms and Ammunition

When any crime occurs crime scene defines or tells everything and situation. For example, in a firing case there shall be found bullets, cartridge case, injured, deceased, hole marks on wall, window panes, doors and entry or exist gate etc. Mostly firing arms and ammunition are often used in criminal
cases such as murders, dacoities, police encounters, family disputes, gang wars and suicidal cases etc. Mainly firearms are of two types, namely Smooth Bore and Rifled. Any firearm, discharged ammunition such as bullets, shells, wads and pellets or even intact ammunition suspected of being involved in a criminal offence may enable the expert to identify the weapon and the ammunition with the offence.\textsuperscript{161}

Therefore, these arms and ammunitions are very important evidence/clues or physical evidence in criminal cases. These physical evidences are submitted to the forensic science laboratory. Ballistic division of forensic science laboratory deals with such matters related to firearms and ammunition. Ballistic expert of forensic science laboratory examines the following things as under:

(a) Firearms  
(b) Ammunition  
(c) Bullets- fired or live  
(d) Cartridge case  
(e) Pellets  
(f) Wads etc.

Firearms identification is actually a form of tool mark identification where the firearm, because it is made of a material harder than the ammunition components, acts as a tool to leave impressed or striated marks on the various ammunition components that come into contract with the firearm.\textsuperscript{162} Thus every bullet used in firing is important evidence for the linkage the bullet with the firearm.

\textsuperscript{161} B.S. Nabar, \textit{Forensic Science in Crime Investigation} (2010), p.31  
\textsuperscript{162} Dr AK Bapuly, \textit{Forensic Science} (2006), p. 97
**Importance and Significance of Expert’s Opinion**

The expert of forensic science is called ballistic expert. His opinion in the firing and ammunition case is of much importance. There may be the following reasons for his opinion.

(i) The expert’s opinion or evidence justifies the linkage between the crime, crime scene and criminal/criminals. This is done with the help of firearms used and bullets or cartridge recovered on the spot.

(ii) The expert justifies the direction of the fire, distance of firing, entry and exists with the approved formulas.

(iii) The expert justifies whether the sample arm sent in laboratory is actually used in firing or otherwise.

(iv) Sometimes fake firearms are submitted to the laboratory for examination and comparison. The expert is able to justify that the bullet recovered from crime scene is fired from sample gun or not.

(17) **Glass**

According to the dictionary meaning, glass is a hard brittle usually transparent substance, a vessel of glass, a mirror. Glass is the important physical evidence found on any crime scene. Glass may be of window pane of ay building such as house, office, factory etc. It may be of any vehicles as well. Generally, glass pieces or fragments are found in house burglary, theft, homicidal and accidental cases etc.

In a case, a factory manager was fatally hammered in his car by a worker while breaking of the car window, a few fragments of glass lodged in the hammer neck. The accused was linked to the crime by the matching of glass fragments from the hammer recovered from him, with the glass of the broken
A hair is common physical evidence. Hairs may be of human beings, animals and cloth and articles made from wools, skins and furs. Hair is also important physical evidence that helps the investigating officer to correlate the crime and criminals. Microscopic examination of hair can prove the age, sex, and race of a criminal. Generally, in rape and struggle cases hair found at the crime scene is of much importance. It proves the link of criminal with the crime.

**Lie Detection**

Before the existence of Human Right Commission, and Supreme Court’s guidelines in the case of *D. K. Basu v. State of West Bengal* regarding the arrest of any suspect or accused, the police used the third degree torture to reveal the truth in criminal cases. The Supreme Court observed in the case of D. K. Basu that law does not permit the use of third degree methods on an accused. Therefore, some directions and guidelines for police have been issued by the Supreme Court. They are as under:

1. The police personnel carrying out the arrest and handling the interrogation of the arrestee should bear accurate, visible and clear identification and name tags with their designations.
2. Particulars of all personnel handling interrogation of an arrested person must be recorded in a register.

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163 Quoted in LNJN National Institute of Criminology and Forensic Science, *Course on Crime Scene and Forensic Evidence Collection* (2009), p.6
164 AIR 1997 SC 610
3. A memo of arrest stating time and place of arrest must be prepared by the investigating police officer.

4. It is the right of an arrested person that his close friend or family member may be informed accordingly. Time, place of arrest and venue of custody of the arrested person must be notified to the next friend or relative of the accused.

5. The arrested person may be allowed to meet his/her lawyer during interrogation but not throughout the interrogation.

6. An entry must be made in daily diary at the place of detention in regard to the arrest. The name of friend/relative of the arrested person who has been informed and the names of the police personnel in whose custody, the arrested person is being kept should be entered in the register.

7. The arrested person should be examined by a doctor/medical practitioner at the time of arrest if he/she so requests. All bodily injuries on the arrested person should be recorded in the ‘inspection memo’ which should be signed by both the arrested person and the police officer making the arrest. A copy of the memo should be provided to the arrested person.

8. The arrested person should be subject to a medical examination every 48 hours by a trained doctor who has been approved by the State Health Department.

9. Copies of all documents related to the arrest including the memo of arrest should be sent to the Area Magistrate for his/her record.

10. A police control room should be provided at all district and State Headquarters where information regarding arrests
should be prominent.

11. Departmental action and contempt of court proceedings should be initiated against those who fail to follow above mentioned directives.

As the guidelines given by the Supreme Court are clear, so no police officer shall use third degree method during the conducting any investigation. Now the question is what the method or technique is left for a police officer to conclude the criminal case. In such situations, scientific aids play an important role in deciding the puzzle cases.

In ancient times, the Chinese used to make a suspect chew dried rice powder and then spit it out. If the powder was still dry, the individual was considered guilty. Other ancient civilizations reportedly took the more drastic step of touching the suspect’s tongue with a hot sword. If the sword sizzled from the presence of saliva, the person was thought to be telling the truth. If the sword burned the tongue, the person was thought to be lying. In the modern times, lie detection, polygraph and psychological stress evaluator methods are based on the old age methods because of every person who is telling a lie reacts in such way that his face shows the fear, guilt and anxiety or stress.

(20) Metals

According to dictionary meaning, 'metal' is a substance as gold, silver, copper & rails of a railway line etc. They may be the important physical evidence in criminal cases. As it is known that every appliances such as refrigerator, washing machine,
standard guns, bullets and vehicles has a serial number on it. Sometimes, in criminal cases like theft of vehicles these numbers have been erased and new one is made that cannot be seen by naked eyes. Scientific expert is able to trace out these cases.

(21) Mobile Phones

Before the invention of telephone, people mostly send their messages through telegram and letters. As it is right that necessity is the mother of invention, so in the beginning of 21st century the mobile phone took over the landline facility. Every person has at least one mobile phone. There are a number of advantages of mobile phones. On the other hand, its use has vastly increased in the crime rate. It is also true that call details and tower location helps the investigating officer to trace the various criminal cases. Location of mobile phones has helped the police on many occasions. It is a true and definite scientific aid which helps the investigating officer.

(22) Nails and Nail Marks

According to dictionary meaning 'nail' is horny covering on the ends of human fingers and toes, a claw, a small pointed iron spike. Nails and nail marks are very useful in cases of theft, burglary, assault, rape, kidnapping, murder and dacoity etc. While committing these crimes nail can be break down on the spot. For instance, when an offender commits burglary and tries to open any object with the help of nail then his nail piece can be break or cut on the crime scene. This piece of nail or nail marks on the body of injured or deceased can become the important physical evidence.
(23) **Oil and Grease**

Oil and grease can become important physical evidence in cases of arson and fire. In arson cases the smell and the debris of partly burnt materials should be sent to forensic science laboratory for examination and comparison.

(24) **Paint**

According to dictionary meaning 'paint' is a solid colouring matter. It can be the useful physical evidence in many cases such as hit and run cases, theft, burglary, rape and murder etc.

(25) **Petroleum Products**

Like oil and grease petroleum products like diesel, petrol and kerosene are the main physical evidence for deciding the criminal cases.

(26) **Piece of Cigarette/Bidi**

Pieces of cigarette and bidi are used by a number of citizens not of our country but also in foreign countries. Sometimes, the addict of smoking criminals left bidi or cigarette on the crime scene by chance. They become the important physical evidence because of saliva test.

(27) **Poisons and Poisoning**

Any substance can act as poison when taken in excess. However, a poison is defined as a substance which, when taken in small doses, injures health or destroys life. In case of poisoning the vomiting should be sent to the forensic science laboratory in air tight container. In addition, if the person dies, his viscera also sent to laboratory for further examination.

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Photography as Scientific Aid

In olden days, artists used to make the picture of any individual. He had to sit for a long time for this task. After some time, black and white cameras were used for photography. In the middle of 20th century color photography took over the black and white photography. Photography is an important task to be done by the police at the crime scene. The aim of a crime scene search is to collect physical evidence. On the basis of these physical evidences (collected from crime scene) it is tried to link the crime with the crime scene and criminals. Every crime scene should be photographed before any disturb is made.

Every clever and intelligent police officer is unable to keep every moment of crime scene. Therefore, photography is the main and very useful source which is safe and forever a record of the crime scene which enables every police officer to refresh his memory in regard to crime scene. The court trusts on such photography. This is the solid evidence of crime scene. It is rightly said, “One photograph is worth a thousand words”.

Importance and Significance of Crime Scene Photography

The need of crime scene photography is proved by the following reasons:

(1) It proves the occurrence of crime.
(2) It is a permanent record.
(3) A witness can hostile but photograph is the real evidence.
(4) It is an acceptable evidence in the eye of law.
(5) It captures all the crime scene, hence unseen and invisible evidence by the investigating officer can be seen during the further investigation while refreshing the memory.
(6) First of all, photography of crime scene should be made
before disturbing the things and evidences on the crime scene so that their real position should be recorded.

(7) It helps to find out the untouched or remaining clues by naked eyes of the investigating officer in further studies of the case.

(8) Series of photographs can easily prove the crime scene instead of oral testimony of eye witness.

(9) On many times, the courts asks to the police to reconstruct the crime scene in highlight cases such as Aarushi murder case etc., then the photography is the main evidence of such reconstruction of crime scenes.

In *State of Madhya Pradesh v. Chamru @ Bhagwandas etc.*\(^{167}\) where the photographs of the accused were shown to two of the child witnesses before the Test Identification Parade, that took away the effect of the Test Identification Parade.\(^{168}\)

Now-a-days android mobile phones are being used by the people. Even a laborer, rickshaw puller and even small children are using these phones. Sometimes by chance they see the live original crime and do capture the photo of same in their mobiles etc. This evidence is admissible in the court of law also.

**29) Rubber**

According to dictionary meaning rubber is an implement thing used for rubbing, or it may be elastic substance such as rubber chapels, rubber hair ring, rubber made key rings etc. Thus, rubber is a common thing that can be found on everywhere. In this way, it can also be found on the crime scene. Such physical evidence leave by criminals on the crime scene

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167 AIR 2007 SC 2004
can make link between the crime and criminals.

(30) **Restoration of Obliterated Numbers**

Every valuable product such as car, motorcycle, cycle, television, mobile phone, computer, laptop etc. has a serial number for its identification. Every particular product has a unique number. Such valuable products can be stolen or moved away by unknown culprits. They do so by erasing these numbers. But, it is possible for the forensic science laboratory to restore the true identity. As it is said that a man can disguise himself but his fingerprints reveal his true identity. In the same way forensic experts are able to restore these altered or changed numbers. Restoration of obliterated marks is possible in the forensic laboratory. In theft cases such as vehicles and other movable property which contains serial numbers etc. can be restored by the forensic experts. For instance, original engine numbers and chassis number of stolen vehicles were restored. Whereas field off numbers could not be restored on stolen cycles, machines, transistors, chassis etc.169

(31) **Saliva**

Saliva as a body fluid also plays an important role as a scientific aid. It is colourless liquid secreted by certain glands in the mouth. Its identification may be important in the investigation of criminal cases. For instance, used pieces of a cigarette/beedi, throwing chewing tobacco or handkerchief left by chance at a crime scene may have saliva stains on it.

Saliva contains an enzyme 'amylase' which when added to starch, hydrolyses it. Saliva extract to which starch is added will

prevent formation of blue colour with iodine. The test for amylase is quite reliable test for saliva.\textsuperscript{170}

\textbf{(32) Semen}

Semen is also very important scientific aid in police investigation. Semen or seminal fluid consists of a highly proteinaceous serum containing normally a very large number of spermatozoa, or male germ cells\textsuperscript{171}. Mostly it is found in the cases of rape, murders, homicides, unnatural offences etc. There are a number of cases where the identification of criminals is led by the semen as scientific aid. Semen stains can be found on the following as under:-

1. On the personal parts of body and clothing particularly on the undergarments of the victim. Vaginal swab should be obtained through the medical examiner in case of female victim.
2. On the clothing particularly on the undergarments and personal body parts of the accused.
3. On the bed sheet, carpet, mattresses, vehicle seats and floor etc.

\textbf{Importance of Identification, Collection, Preservation and Examination of Semen Stains}

It is very important to identify the stains of semen. Generally, white of the egg and gum appears like semen stains. It is, therefore, necessary to see under the ultraviolet light. It enables the examiner to make the difference.

Articles such as cloths, undergarments and other articles

\textsuperscript{170} B.S. Nabar, \textit{Forensic Science in Crime Investigation}(2010), p.126

\textsuperscript{171} Paul L. Kirk, \textit{Crime Investigation Physical Evidence and he Police Laboratory}(1960), p.206
having stains of semen should be collected separately. In case of wet stains of semen it should be dried under the shade. Wet clothing having stain should never be packed. It is also important that two samples should not be packed together. They should be placed in different envelops. And they should not be placed in air tight packing such as polythene etc.

The only really sure proof that a substance is semen is the presence of spermatozoa. Because the structure of the sperm cells varies from species to species, it is possible to differentiate the semen of different animals by microscopic examination.  

(33) **Skeletal Remains**

According to dictionary meaning 'skeleton' is the bony framework of the body, a general outline, and the framework or essential part of anything, abstract. Skeletal remains means pertaining to skeleton. Many a time police has found the skeleton or skeletal remains that are free of blood and muscles. In such situations, on the name of identification there are only some bones and sometimes few hairs. After examination of bones and hairs in the laboratory the expert’s opinion is absolutely admissible or right.

(34) **Skid Marks**

According to dictionary meaning 'skid' means a contrivance for locking the revolution of a wheel. Thus, skid marks are the stopping wheels marks on the road. When the brakes of a speeding vehicle (car, scooter, motor cycle, truck, any other vehicle that runs with the power of engine and having the wheels covered with rubber tires) is applied suddenly to save himself or

other, the friction between the tire and road heats the rubber, depositing a thin layer of rubber, depositing a thin layer of rubber particles. This mark is called skid-mark\textsuperscript{173}.

In cases of road accidents scaled skid marks of tires on the road should be captured in camera so that scientific expert is able to do the comparison and fix the responsibility of the wrongdoer.

\textbf{(35) Soil and Minerals}

Soil is a complex mixture of inorganic and organic materials.\textsuperscript{174} Organic refers to vital, constitutional, systematic and pertaining to organs. On the other hand, inorganic means having no organic structure. Inorganic materials in soil come from the rock fragments and organic material derives from the plants.

Soil can be useful in establishing the link between the place of occurrence, victim, suspected criminal and any vehicle used in the act of crime. It is important that soil of every area differs from the other areas. While committing a crime the suspect can carry the soil of a particular place to the scene of crime or vice versa.

In criminal cases sample of soil should be taken from the crime scene, vehicle’s mattress, footrest, sole of shoes, clothing and on victim clothing if any.

\textbf{(36) Videography}

Like photography, videography is also an important scientific aid in police investigation. Now-a-days android mobile phones are being used by the people. The qualities of these

\textsuperscript{173} B.S. Nabar, \textit{Forensic Science in Crime Investigation}(2010), p.135
\textsuperscript{174} James E. Girard, \textit{Criminalistics Forensic Science and Crime} (2008), p.69
phones are of high degree. Even a laborer, rickshaw puller and even small children are using these phones. Sometimes by chance they see the live original crime and do capture the photo of the same in their mobiles etc. This evidence is admissible in the court of law also. The following are the uses and importance of videography.

(1) Every crime scene should be photographed and videographed for the purpose of sound evidence.

(2) The investigating officer can leave the valuable evidence at the crime scene during the investigation of his visit at crime scene but if videography is done in series he can cover his overcomes.

(3) In the reconstruction of crime scene, photography and videography are must.

(4) It can be produced in the court of law as proof and evidence.

(5) It is a better presentation of crime scene and in further reconstruction of crime scene.

(6) It is indispensable for live scene coverage and expansive scenes.\textsuperscript{175}

(7) Every police officer who conducts the investigation can re-examine the crime scene through videography recordings.

(8) It can be shown in the courtrooms also.

\textbf{(37) Viscera}

Viscera is very useful and important scientific aid in police investigation in cases of poisoning etc. It forms the contents of the abdomen. In case of poisoning and suspected murder case

\textsuperscript{175} B. R. Sharma, \textit{Scientific Criminal Investigation} (2006) p.121
the medical practitioner sends the viscera to the forensic science laboratory for examinations.

(38) **Voice Prints**

In many criminal cases, we can find the physical evidences as scientific aids. But there are numerous cases where there is no physical evidence. Now what should be done? The cases where threats are given to the government or police through telephone or mobile, kidnapper’s demands ransom etc. In these cases telephonic call is the crime itself and the voice is the only evidence that is unseen and unknown.

The only one scientific technique called *voice prints* or *sound spectrograph* is used for recording the voice of criminals. In many cases tape recorded voice is admissible in Courts of Law in India also.

In short, there may be a number of scientific aids in police investigation. As we are concerned with only DNA and Fingerprinting, so the preceding chapters will cover the discussion on these points in detail.

2.5 **Sum up**

When a crime is committed, it is the duty of the police officer to trace out the criminals and send them behind the bars. It is a very difficult task for an investigating officer to find out the culprit. The work of police investigation is not so easy. The police officers of the last century dealing with the investigation of crimes was in a fortunate position in the sense that he did not have to handle so many types of crimes as the police officer of today has to. The National Police Commission has found that an average investigating officer is not able to devote more than 37 percent of his time to crime investigation work. While the
rest of the time was taken by other duties, more particularly law and order work and VIPs security functions. In such conditions, it is very difficult task for the police officers to trace out the culprits in criminal cases. Moreover, no eye-witness available, if available they can be hostile. Only the scientific aids are the main source which can help the investigating officer to conclude an investigation. A scientific aid is useful to the investigating officer in order to utilize the science which assists him in solving the criminal case in scientific way. There are a number of scientific aids which are utilized by the police or forensic scene of crime team experts in criminal investigation. They may be alcohol, arson, blood, bottles of alcohol or cold drinks, CCTV cameras, DNA, documents, drugs, dust, dyes, explosives, fingerprints, footprints, fibre and fabrics, firearm and ammunition, glass, hairs, lie detection, metals, mobile phones, nails and nail marks, oil and greaves, paint, petroleum products, piece of cigarette/bidi, poisons, photography, rubber, restoration of obliterated numbers, saliva, semen, skeletal remains, skid marks, soil and minerals, videography, viscera, voice prints etc.

As far as evidentiary value is concerned, physical evidence is more acceptable when compared to human testimony. With the passage of time the witnesses change their stand whereas physical evidence does not. Physical evidence can take any form. It can be as large as a residence or as small as a fibre, as fleeting as an odor or as obvious as the scene of an explosion. Indeed, the variety of physical evidence that may be encountered by a police officer is enormous. Physical evidence must be handled carefully to prevent its contamination, alteration, or destruction. Forensic Science is science in the service of crime
detection. Its practice includes scientists of various disciplines, physicists, biologists, ecologists, firearm experts, chemists, toxicologists, document experts and others. Despite a wide overlap in the field of forensic medicines it is basically a vital part of the forensic science.

The methodology of searching depends on the case and the scene. Manpower problems in police units as well as problems associated with the proffering of evidence in court have developed the single-officer search. Associates of this officer often assist in locating evidence, but they do not disturb it or collect it. The goal is to limit the number of policeman in possession of evidence found at a crime scene to the officer searching the scene. The examination techniques vary from one scene to another and on personal preferences. There are the following techniques or methods of searching the crime scene are common. They are zone search, spiral search, strip search and cross-hatch method. In zone search the area to be searched is divided into unit zones, in spiral search a clockwise circle is begun, in strip search outdoor area is searched and in cross hatch method crime scene area is covered twice.