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**Science in Aid of Law**

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## Abstract

Crime is a deviant behaviour and to reform the erring citizen through appropriate punishment, all societies have a criminal justice system. Societies regulate the social behavior of their members through Laws, to ensure peace and tranquility in the society so that the citizens can enjoy the fruits of endeavors and their rights and freedom, Law takes every initiative to protect its citizen for that new methods/ modes are need to investigate the cases so that justice is seen to be done. Modern day criminal uses science and technology to his advantage in committing crimes. Consequently investigating officer is required to possess scientific knowledge and skills to investigate and unearth these crimes. Forensic science comes to their rescue. Forensic science is an umbrella term to describe the application of principles of science and technology in investigation of crime to enable the courts to determine the guilt of the accused. Science since long is in aid of Law. The principles of forensic science has enable the law enforcers to solve many seemingly unsolved blind criminal cases and also help the civil courts in determining many intricate and difficult cases. The word *forensic* comes from the Latin *forensic*, meaning "of or before the forum." further to simplify it, it means a criminal charged presenting the case before a group of public individuals in the forum. Both the person accused of the crime and the accuser would give speeches based on their sides of the story. The individual with the best argument and delivery would determine the outcome of the case. This origin is the source of the two modern usages of the word *forensic* – as a form of legal evidence and as a category of public presentation.

In modern use, the term "forensics" in the place of "forensic science" can be considered correct as the term "forensic" is effectively a synonym for "legal" or "related to courts". However the term is now so closely associated with the scientific field that many dictionaries include the meaning that equates the word "forensics" with "forensic science".

Forensic science is a complex amalgam of various scientific disciplines and it is not possible for an investigator to master all of them. Specialized forensic science Laboratories and field units have been established to utilize forensic science in the detection of crime. Since the ordinary policemen or the station house officer is the first responder to the call for help and visits the scene of crime, he should have a basic knowledge of the capabilities of forensic science to take necessary steps to protect and preserve the scene of crime to enable the forensic scientists and technicians to make use of physical evidence present at the scene. Since scientific evidence are devoid of human bias and is based on well tested and accepted scientific principles, conclusions and inferences drawn based on them are accepted by courts. Scientific evidence is based on time tested, demonstrable, replica table and universally accepted principles. Physical evidence or clues are always present at the scene of crime and if these are properly collected and along with relevant samples are submitted for scientific examination, the opinion given by the scientists will be acceptable by the courts and the defense without dispute. As crimes are generally committed

in secrecy, investigator may not be able to secure eye witnesses, confessions and approvers may not be forthcoming. Circumstantial evidence has to be strong enough to bring the guilt to the accused beyond reasonable doubt.

As science is the systemic study of every fact, it has helped the law faculty in various respects. This paper is a serious attempt to study how science comes in aid with law. Whether these aids are sufficient considering the existing frame work of law, or what more can be done in furtherance.

## Full Paper

### Science in Aid of Law

**Introduction: Forensic science** (often shortened to **forensics**) is the application of a broad spectrum of science to answer questions of interest to a legal system. This may be in relation to a crime or a civil action. The word *forensic* comes from the Latin *forēnsis*, meaning "of or before the forum."<sup>1</sup> In Roman times, a criminal charge meant presenting the case before a group of public individuals in the forum. Both the person accused of the crime and the accuser would give speeches based on their sides of the story. The individual with the best argument and delivery would determine the outcome of the case. This origin is the source of the two modern usages of the word *forensic* – as a form of legal evidence and as a category of public presentation.

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The ancient world lacked standardized forensic practices, which aided criminals in escaping punishment. Criminal investigations and trials relied on forced confessions and witness testimony. However ancient sources contain several accounts of techniques that foreshadow the concepts of forensic science that is developed centuries later, such as the "Eureka" legend told of Archimedes (287–212 BC).<sup>2</sup> The account about Archimedes tells of how he invented a method for determining the volume of an object with an irregular shape. According to Vitruvius, a votive crown for a temple had been made for King Hiero II, who had supplied the pure gold to be used, and Archimedes was asked to determine whether some silver had been substituted by the

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<sup>1</sup>*Shorter Oxford English Dictionary* (6th ed.), Oxford University Press, 2007, ISBN978-0-19-920687-2

<sup>2</sup>Schafer, Elizabeth D. (2008). "Ancient science and forensics". In AynEmbar-seddon, Allan D. Pass (eds.). *Forensic Science*. Salem Press. p. 40. ISBN978-1-58765-423-7.

dishonest goldsmith.<sup>3</sup> Archimedes had to solve the problem without damaging the crown, so he could not melt it down into a regularly shaped body in order to calculate its density.

The first written account of using medicine and entomology to solve (separate) criminal cases is attributed to the book of Xi Yuan Lu (translated as "Washing Away of Wrongs"<sup>4</sup>), written in Song Dynasty China by Song Ci (宋慈, 1186–1249) in 1248. In one of the accounts, the case of a person murdered with a sickle was solved by a death investigator who instructed everyone to bring his sickle to one location. (He realized it was a sickle by testing various blades on an animal carcass and comparing the wound.) Flies, attracted by the smell of blood, eventually gathered on a single sickle. In light of this, the murderer confessed. The book also offered advice on how to distinguish between a drowning (water in the lungs) and strangulation (broken neck cartilage), along with other evidence from examining corpses on determining if a death was caused by murder, suicide or an accident.

Methods from around the world involved saliva and examination of the mouth and tongue to determine innocence or guilt. In ancient Chinese cultures, sometimes suspects were made to fill their mouths with dried rice and spit it back out. In ancient middle-eastern cultures the accused were made to lick hot metal rods briefly. Both of these test had some validity since a guilty person would produce less saliva and thus have a drier mouth. The accused were considered guilty if rice was sticking to their mouth in abundance or if their tongues were severely burned due to lack of shielding from saliva.

## Modern history

In the 16th-century Europe medical practitioners in army and university settings began to gather information on cause and manner of death. AmbroiseParé, a French army surgeon, systematically studied the effects of violent death on internal organs. Two Italian surgeons, Fortunato Fidelis and Paolo Zacchia, laid the foundation of modern pathology by studying changes that occurred in the structure of the body as the result of disease. In the late 18th century, writings on these topics began to appear. These included *A Treatise on Forensic Medicine and Public Health* by the French physician Fodéré and *The Complete System of Police Medicine* by the German medical expert Johann Peter Franck.

In 1773 a Swedish chemist Carl Wilhelm Scheele devised a way of detecting arsenous oxide, simple arsenic, in corpses, although only in large quantities. This investigation was expanded, in 1806, by German chemist Valentin Ross, who learned to detect the poison in the walls of a

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<sup>3</sup>Vitruvius. "*De Architectura*, Book IX, paragraphs 9–12, text in English and Latin". University of Chicago.[http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/9\\*.html](http://penelope.uchicago.edu/Thayer/E/Roman/Texts/Vitruvius/9*.html). Retrieved 2007-08-30.

<sup>4</sup>"Forensics Timeline". Cbsnews.com. <http://www.cbsnews.com/htdocs/forensics/timeline.html>. Retrieved 2011-12-20.

victim's stomach, and by English chemist James Marsh, who used chemical processes to confirm arsenic as the cause of death in an 1836 murder trial.

Two early examples of English forensic science in individual legal proceedings demonstrate the increasing use of logic and procedure in criminal investigations. In 1784, in Lancaster, John Toms was tried and convicted for murdering Edward Culshaw with a pistol. When the dead body of Culshaw was examined, a pistol wad (crushed paper used to secure powder and balls in the muzzle) found in his head wound matched perfectly with a torn newspaper found in Toms' pocket. In Warwick in 1816, a farm labourer was tried and convicted of the murder of a young maidservant. She had been drowned in a shallow pool and bore the marks of violent assault. The police found footprints and an impression from corduroy cloth with a sewn patch in the damp earth near the pool. There were also scattered grains of wheat and chaff. The breeches of a farm labourer who had been threshing wheat nearby were examined and corresponded exactly to the impression in the earth near the pool.<sup>5</sup> Police started using fingerprints for evidence when Juan Vucetich solved a murder case in Argentina by cutting off a piece of door with a bloody fingerprint on it.<sup>6</sup> Later in the 20th century several British pathologists, Bernard Spilsbury, Francis Camps, Sydney Smith and Keith Simpson pioneered new forensic science methods in Britain. In 1909 Rodolphe Archibald Reiss founded the first school of forensic science in the world: the "Institut de police scientifique" at the University of Lausanne (UNIL).

Forensic science has been fostered by a number of national forensic science learned bodies including the American Academy of Forensic Sciences (founded 1948; publishers of the *Journal of Forensic Sciences*), the Canadian Society of Forensic Science (founded 1953; publishers of the *Journal of the Canadian Society of Forensic Science*), The British Academy of Forensic Sciences (founded 1960; publishers of *Medicine, science and the law* (journal)), and the Australian Academy of Forensic Sciences (founded 1967; publishers of the *Australian Journal of Forensic Sciences*).

In India, the middle of the nineteenth century, there was a spurt in the development of sciences. Courts of Law, which were weary of the unreliability of traditional forms of evidence, started looking towards scientists to give them definitive opinion on the matters referred to them. In the initial stages, forensic science was dominated by Pathologist and Toxicologists, who were mostly from medical profession. As a result of this, forensic medicine also developed rapidly along with forensic science and their inter relationship became well established

Societies regulate the social behavior of their members through Laws; to ensure peaceable conditions and tranquility in the society and to enable the citizens to enjoy the fruits of their Endeavours and their basic rights and freedoms. Thus, Laws are the collective wisdom of the

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<sup>5</sup>Kind S, Overman M (1972).*Science Against Crime*. New York: Doubleday. pp. 12–13. [ISBN0-385-09249-0](#).

<sup>6</sup>"Juan Vucetich". Easybuenosairescity.com. 1925-01-25.<http://www.easybuenosairescity.com/biografias/vucetich1.htm>. Retrieved 2010-06-08

society laying down the societal norms in crime. Thus, crime is a deviant behaviour and to reform the erring citizen through appropriate punishment, all societies have a criminal justice system. Modern day criminal uses science and technology to his advantage in committing crimes. Consequently investigating officer is required to possess scientific knowledge and skills to investigate and unearth these crimes. Forensic science comes to their rescue

Forensic science is a complex amalgam of various scientific disciplines and it is not possible for an investigator to master all of them. Specialized forensic science Laboratories and field units have been established to utilize forensic science in the detection of crime. Since the ordinary policemen or the station house officer is the first responder to the call for help and visits the scene of crime, he should have a basic knowledge of the capabilities of forensic science to take necessary steps to protect and preserve the scene of crime to enable the forensic scientists and technicians to make use of physical evidence present at the scene.

Forensic science is an umbrella term to describe the application of principles of science and technology in investigation of crime to enable the courts to determine the guilt of the accused. It is applied in the cases involving both criminal and civil Laws. Since the application of the principles of forensic science has enable the law enforcers to solve many seemingly unsolved blind crimes, people have come to associate forensic science with detection of crime only. Forensic science has also helped the civil courts in solving many intricate and difficult cases. Application of this science and technology assist the courts in determining, whether a crime in fact has been committed the crime. Often the victim is also identified with the help of science. Since scientific evidence are devoid of human bias and is based on well tested and accepted scientific principles, conclusions and inferences drawn based on them are accepted by courts. Scientific evidence is based on time tested, demonstrable, replica table and universally accepted principles. Physical evidence or clues are always present at the scene of crime and if these are properly collected and along with relevant samples are submitted for scientific examination, the opinion given by the scientists will be acceptable by the courts and the defense without dispute. As crimes are generally committed in secrecy, investigator may not be able to secure eye witnesses, confessions and approvers may not be forthcoming. Circumstantial evidence has to be strong enough to bring the guilt to the accused beyond reasonable doubt.

Evidence consists of facts and exhibits which link the citizen with the crime. There are two kinds of evidence, the direct and indirect evidence. Direct evidence establishes a particular point under consideration without reliance on presumptions and inferences. It can be in the form of accounts of eye witnesses who actually witnessed the crime being committed; confessions made voluntarily by the accused persons accepting the guilt; and the statements of an approver that is one of the accused persons, who had actively participated in the crime and willingly to assist the by fully accepting his guilt and giving evidence about the role of others. Direct evidence can become subjective due to errors in observation and infirmities in vision, hearing etc, perceptual

problems, memory lapses, social prejudices, and inability to express without exaggeration, embellishment and value judgments.

Indirect evidence also known as circumstantial evidence tries to establish the fact under examination through a series of related and interconnected facts<sup>7</sup>. It is inferential in nature and could become subject of difference of opinion. Indirect evidence can become objective, if the vital material clues found at the scene of crime, on the suspect or victim etc are subjected to scientific analysis and opinion.

### **India's development in relation to forensic science:**

Keeping pace with the development in Western world, India had developed scientific institutions assisting crime investigation. Chemical Examiner's Laboratories were established in Madras, Calcutta, Agra and Bombay in the second half of the 19<sup>th</sup> century. These Laboratories took up chemical analysis and toxicology work. In 1897, the first finger print Bureau was established in Calcutta based on the recommendations of the Police Commission of 1902. After this Commission finger print bureau were established in all the state by 1910. Most of the Criminal Investigation Departments in country set up modest facilities to scientifically examine the crime materials/ clue in their offices. A crime scene photographer and a finger print and foot print developer became the standard staff of many District Crime Bureau throughout the country. Government of India provides fund to state to purchase equipments in forensic science Laboratories under the Police Modernization scheme. As forensic science has become integral part of the curriculum of all police training programme. Government is taking efforts to establish various institutions to educate and spread awareness in society, such as National and state Police Academies, Central Detective Training Schools, National institute of forensic science and Criminology. Apart from, all these specialist Labs and Organisations run short term courses in forensic science for Police personnel of different ranks. Some of the universities in India are offering forensic science either independently or part of their Criminology courses.

What care should be taken for making investigation?

### **Evidence collection**

Strictly speaking, a crime scene is a location wherein evidence of a crime may be found. It is not necessarily where the crime was committed. Indeed, there are primary, secondary and often tertiary crime scenes. For instance, the police may use a warrant to search a suspect's home. Even though the suspect did not commit the crime at that location, evidence of the crime may be found

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<sup>7</sup>*Trace Evidence-The Invisible Witness*, by Petraco, Nicholas, Journal of Forensic Sciences, Volume 31, Jan. 1986, pp. 321–28.

there. In another instance, an offender might kidnap at one location (primary crime scene), transport the victim (the car being a secondary crime scene), commit another crime at a distant location (murder, for instance) and then dispose of the body at a fourth scene.

All locations where there is the potential for the recovery of evidence must be handled in the same manner. They must be protected from interference of any kind so as to preserve any trace evidence. It is usually achieved by taping a wide area around the crime was committed to prevent access by any person other than the investigators. The conditions at the crime scene must be carefully recorded in great detail, as well as conserved. Only when recording has taken place can items be removed for laboratory analysis.

Legal concepts impacting the usefulness of evidence in court (Daubert, chain of custody, etc.) apply to the recovery of evidence whether or not a crime actually occurred at that location. Forensic science is need for successful investigation of crime. Forensic science can help the investigator to solve the crimes, if he understands clearly the principles of forensic and applies them to his investigative methods. While inspecting the scene of crime, he should keep in mind, Prof. Locard's principle of exchange. **1)** He should inspect the scene of crime minutely and look for traces of physical evidence left behind by the criminal. This would apply to all material objects like weapons and tools used in the crime, cloths of the victim, articles handled by the suspect etc. when a suspect has been apprehended, he should look for the traces and evidence of his presence at the scene of crime.**2)** Careful inspection of the scene of crime and collection of physical evidence will enable the forensic scientist to analyze them to provide clues, leads, and missing links in the chain of evidence etc., which in turn would help the investigating officer to verify the correctness of the statements made by the suspect and witnesses and assist in the proper investigation of the crime.**3)** while collecting physical evidence, the investigator should follow the principle of evidence recovery. He should be careful not to add, damage or obliterate any evidence in the recovery process and also ensure that there is no contamination of the physical evidence by outside factors.**4)** keeping in mind the principle of comparison, he should obtain and provide adequate and appropriate samples for comparison by the forensic scientist with the physical evidence sent to him for examination and opinion.**5)** understanding the principle of progressive change, and the likelihood of physical evidence deteriorate due to external and inherent factors, he should forward the physical evidence to the forensic science Laboratory without delay and properly packed to ensure that no physical damage takes place while in transit.

All this is essential to ensure that there is no miscarriage of justice and innocent person are not punished, the courts insist that the evidence produced by law enforcers should prove the guilt of the person who is accused beyond reasonable doubt. The benefit of doubt, if any, should go to the person accused of crime. The philosophy is not to punish even by mistake an innocent person even if many guilty persons escape punishment.

How forensic science helps in protection and preservation of evidences:



The scene of crime is the place from where the investigation process begins. It is the place, where the crime has been reportedly committed or the result or the crime has been first noticed. It may not be the only place where the crime has been committed. Often, perpetrators commit the crime in one place, remove the victim or the dead body to an isolated place, like jungle, river or sea and abandon or throw it there. All these places including the transport used will become part of the scene of crime as the commission of crime continued in all these places. Scene of crime will contain traces of physical evidences which, when properly searched, located, collected and send to the forensic scientist for examination, will give vital clues and leads about the crime, the victim, the perpetrator and the modus operandi (method adopted for commission of crime )<sup>8</sup>

Physical evidence present at the scene can be disturbed and obliterated as a matter of course by people due to lack of awareness of its value in solving the crime. For example, in rural areas, if a dead body is found in a dwelling place, it is promptly removed outside the premises and it is the normal practice to immediately wash the area where the body was found with lots of water (in many cases mixed with cow dung) and light strong smelling incense sticks. This action removes all the traces of body fluids like blood, semen, saliva etc. and also traces of smell of poison /chemicals, if any, found in the scene. Curious on lookers and relatives may unknowingly trample on the clues available. The person who had committed the offence might try to tamper with the solid evidences and might try to remove the physical traces which show his involvement in the offence. We could see this in Aarushi's murder case where the evidences against the accused are been systematically tackled. The clues were washed, it is said that she was killed by slitting her throat, but no sign of bloodshed was found. She was sexually assaulted but her clothes were changed and prima-facie no stain of semen was found on the clothes etc... Eventually when investigation was made by forensic expert, the fact came to existence that the place was washed before investigation started. With the help of some chemical it was clear that the act was committed by such a person who was present in the house and he had tried to tamper the evidence. And therefore her parents are accused of offence as they, were the one who were present in the house.

Police officers deputed to the scene on receipt of information about the crime in the police station or the first responding police personnel like those in police control room vans, should, therefore, on arrival at the scene of crime, take immediate steps to clear the area of all people and take steps to protect and preserve the scene of crime, till the investigating officer arrives. As soon as the crime is reported, if the investigating officer is not readily available at the police station, intimation about occurrence should be send to him by quickest means possible and available police personal should be sent to the scene with instruction (a) to protect scene by cordoning off

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<sup>8</sup>*Mute Witnesses: Trace evidence analysis*, by Houck, Max M (Ed), Academic Press (2001).

the area. (b) Detain the complainant and eye witnesses at the spot for interview with the investigating officer, and (c) send the critically injured person, if any, to hospital for medical attention. Before removing such injured person, they should carefully mark and note the places and positions in which they were found. In cities and towns, where the system of flying squads or emergency response teams operates, the personnel of such teams should be trained in protecting the scene of crime. If the crime scene is indoor, it will be easy to isolate the area. However, if its outdoors, like high-way or railway track or an open public place, it will pose serious problems to cordon off the area, as public will have continuous access to the same. Here, in addition to cordoning off the area, special steps are to be taken for diversion of traffic and regulating the mob. Immediate action is required to collect physical evidence before it is lost.

### **Some of the instances where science come in aid of Law**

#### 1) Science helps to catch hold of corruption

Corruption among Public servant is rampant in the country and bribe is demanded at every stage by the public servants to perform their assigned duties. Failure to pay the bribe creates many problems for the citizen, who has to depend on the corrupt public servant to get his work done. Corruption is corroding the basic fabric of our Democracy.

To deal with this menace, a special Law 'Prevention of Corruption Act of 1988 has been enacted. Under this Act, demanding and accepting a bribe by public servant, is a serious offence. Since demand and acceptance of bribe takes place secretly, it is very difficult to catch the public servant while actually accepting the bribe. Science comes to help the investigating officers to catch the corrupt public servants, it is to highlight the importance of science and how it is useful to the investigation of a crime. Aggravated by the demand of bribe by public servant, the affected person approaches the CBI, Anti-corruption Bureau of the state or the local Police with the complaint against the person who demands bribe. The complaint is taken by the concerned Authority in writing and is verified, if it has any substance then the complainant is advised to inform the corrupt official that he is ready and willing to give him the demanded amount on specified date and time. On the day and time fixed two respectable witnesses are summoned and the complainant repeats his complaint to them and also produces the amount demanded in suitable denomination currency notes. A panchnama is prepared indicating the identifying particulars of the currency like serial numbers etc... then the notes are dusted with Phenolphthalein powder, this powder is a light white powder which when exposed to alkaline medium changes its color to pink. A trap is led down, the complainant along with one of the witness go to the corrupt public servant. The witness hears the conversation of both once the public servant demanded the complainant hands over the currency notes treated with phenolphthalein powder and gives pre-

arranged signal. The investigating officials raid the crime scene and arrest the public servant red handed. The public servant who had demanded the bribe and who had touched the notes is asked to dip his hands in alkaline solution the color of hands of the accused person changes to pink if he had touched the powder on the notes this is to witness by the panch-witness. The pink solution is seized under a mahazar and placed in the sealed bottle. The treated currency notes, pink solution etc... is sent through court to the forensic science lab for analysis and report. Instead of phenolphthalein powder Anthracene can also be used to trap corrupt public servants. This powder emits light blue fluorescent light under the influence of ultra violet rays.

## 2) Scientific methods to detect lies

While investigating, often it is necessary to determine whether a person is telling truth or not. The ancient methods of detection of lie were crueler. Many innocent people, in order to avoid the ordeals had pleaded guilty and were punished. In modern days technique are more advanced, to detect a lie, Polygraph test are conducted. The term polygraph literally means "writing much". Polygraph measures and records changes in cardiovascular patterns and sweat gland activities during interrogation. The original polygraph was invented by psychiatrist John Larson in 1921. He built a machine that simultaneously measured pulse rate, blood pressure, and respiratory changes while series of questions were asked. Most often lying is the defense mechanism adopted by the person to avoid trouble with Law, bosses or authority figures. When a person lies, there are significant changes in his physiological condition. Polygraph commonly known as 'lie detector' is an instrument that monitors a person's physiological reaction to questions/statements. The instrument in true sense do not detect a lie, but the physiological changes of the body is monitored by the instrument as compared to that when the person is normal, when no questions are been asked to the person. If there are more fluctuations seen in physiological aspect, then these fluctuations may indicate that the person is being deceptive. Care should be taken that these test should be conducted by an expert or could led to mis-carriage of justice.

Apart from these test there are various methods to detect lies and those are 1) Hypnosis 2) Truth serum 3) Psychological stress evaluation 4) Brain mapping / fingerprinting etc... Courts in India are accepting lie detector and brain fingerprinting as scientific evidences.

## 3) Voice identification of person:

Criminals now a day's extensively use modern communication tools to commit crime. They often use land lines, cellular or satellite phones to send anonymously Bomb threats, Ransom message etc... to create psychological pressure on their victim. They also use tape recorded messages for this purpose (VirrappanChandantaskar commonly used this technique). So to prevent crime and for investigative purposes, police make use of the voice identification technique to trace the criminals. The identification of individuals through their voice is a

comparative science. Firstly a recording of voice is listened by witness, victim or experts and an effort is made out to fix identity. Second mechanical patterns of voice, known as voice prints are created on the machine-sound Spectrograph and the same is compared with speaker recognition, thirdly computers are used for automatic speaker recognition. If on comparison, if 20 similarities are noticed, the identity of person is conclusively asserted.

Voice identification is useful in profiling criminals, eliminating innocents and fixing the identity of the criminal. To make use of this science, investigating officers should know the basics how this science works. In the first place, when they make efforts to tap the phone or record a conversation, they should take steps to get top quality of recording. Defects in the quality of recording will create problems for the experts to analyse the voice. Secondly all the legal formalities to authenticate the recording and proof of custody etc are to be faithfully followed like all other physical evidence. There are three methods to identify a person from voice. 1) Speaker Recognition by listening, 2) Visual evaluation of voice Spectrogram for speaker recognition (SRS) and 3) Automatic Speaker recognition (ASR)

#### 4) Science in solving cases of poisoning

Poison is a substance, which on being absorbed into the body injures health or destroys life. Poison can be introduced into the body through food, drink, injection, and inhalation<sup>9</sup>. Forensic toxicology is the science, which deals with characteristics and properties of the poison and the methodology of extraction and identification of poisons from the samples submitted for examination. Forensic science laboratory conducts many tests to extract and identify the poison from various samples submitted for examination. As these are highly technical procedure, they are not being discussed in detail. The forensic lab studies with the help of microscope the crystal structure and conducts Reinsch's, Ditchizon test, Mayer's reagent test, Wagner's reagent test etc... to identify the poison

Poisons can be classified on the basis of their action on the body. It can be Corrosive, Chemical irritation, poisons affecting Nervous system, or Spinal Nervous system, Poisons affecting Cardiac system, or to say Poisons affecting respiratory system. Science comes in aid to resolve all the cases of poison whether based on Homicidal aspect, suicides or accidents. In addition, there are cases of criminals administering stupefying poisons to make their victims unconscious before robbing them. In cases of illegal organ transplant of body, there are many reported cases that the victims are unaware of the fact that their body parts are been removed and then sold at high price. The over dose of this stupefying substance acts as poison for the body, it may kill a person. In rural areas poison are used as Abortifacients that is to terminate pregnancy, and this often results in death of the pregnant women.

#### 5) DNA Profiling :

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<sup>9</sup> HWV Cox, 'medical Jurisprudence and Toxicology (VII Edition)(edDr.P.CDikshit), Lexis NexisButterworths Publication,ISBN-81-87162-59-7.

It is one of the scientific method to identify an individual through genetic codes. Every nucleated cell in living organism carries genetic code which is unique for each individual. So we can say blood, hair, semen, saliva and any other bodily fluids with biological markers are tools for successful investigation of crimes. Establishing the correct identity of an accused, victim or an unknown dead body, determining parentage of a child etc... are very important for solving crimes. Biological means like blood group identification, analysis and comparison of others body fluids like semen, saliva etc with the help of biological markers, were helpful to some extent but they could not establish individual identity to the exclusion of others. The discovery of DNA and the perfection of the procedure for DNA profiling as a tool for establishing individual identity, has come as a boon to crime investigator. By comparing this genetic code (DNA Profiling) of two different samples it is possible to establish whether they are from the same source or from different sources. In sexual crimes like Rape, indecent assault, sodomy, bestiality etc... evidence in the form of seminal stains play an important role in connecting the perpetrator to the offence. Seminal stains found on the clothing and private parts of the victim, on the accused, and at the scene of crime etc offers important physical evidence to prove sexual contact and also to determine some of genetic characteristics of the offender. It is said that the characteristic of one's blood cannot be found in any others sample except that of an identical twin in rare cases<sup>10</sup>. Thus, its uniqueness has great evidentiary value in fixing the identity of an individual<sup>11</sup> or other material objects used in the crime and linking them to crime.

#### 6) Identification of weapon used in crime:

Weapons are being increasingly used by criminals and political violent groups like terrorist and extremists to commit crimes. Vary rarely; the perpetrators will leave behind their weapons to enable the investigator to identify the criminal. At the scene of crime generally, the spent cartridge, bullets and other paraphernalia associate with weapon, will be available as physical evidence. These will be carrying the impressions of special characteristics or the weapon used in crime. Unless the investigation is able to connect the physical evidence found at the crime scene with the weapon and later the weapon with the criminal, we cannot bring the criminal to justice. Forensic science uses the method of comparison of the physical evidence found on the scene, with tests of the suspected weapon<sup>12</sup>. Each weapon has its own characteristics in the shape, size; barrel, firing pin, breech blocks etc and these are unique for each weapon<sup>13</sup>. No two weapons can cause same wound, the direction, the intensity with which the blow is given may vary and

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<sup>10</sup>Dr.Karl Landsteiner in 1901 discovered that human blood can be divided in four distinct groups, namely A, B, AB, &O.

<sup>11</sup> Dr. Leon Latte (Prof. Institute of forensic medicine, University of Turin, Italy) in 1915 felt this discovery could help in crime detection.

<sup>12</sup>( Capter VII) Of HWV Cox, 'medical Jurisprudence and Toxicology (VII Edition)(edDr.P.CDikshit), Lexis NexisButterworths Publication,ISBN-81-87162-59-7

<sup>13</sup>Col. Calvin Goddard (1891-1955) first time used comparison microscope to determine, particular bullet is fired from suspect's gun.

therefore comparative and scientific study of crime is a must. It is necessary on part of all police officers to possess a sound knowledge about various types of weapon commonly used in crimes.

In cases of explosive like land mined, granites, bombs etc scientific techniques had helped a lot to defuse the components. With rapid industrialization and widespread constructive activities, use of explosive for legitimate purposes has not only increased manifold but has made explosives available virtually all over the country. Spread of scientific knowledge has made known how to manufacture explosive chemical mixtures from common chemical. Manufacture of pyrotechnic products on large scale has made low grade explosive available easily. Explosive investigation mainly centers round identifying the kind of explosives used and link them to the perpetrators. Trained personnel should deal with, neutralizing the explosive, untrained police should not attempt to deal with, as it could be dangerous to others life along with them.

#### 7) Cyber forensics and computer crimes:

There is hardly any enterprise, where computers are not used for storage of information and data on business dealings and details of processes and technical details. Use of computers as a management tool has become universal. With computers becoming portable and miniature in size and development of technologies to store, copy and transfer information from computers, criminals have started indulging in computer related crimes. Where a crime is committed with computer as target of the crime, or the means adopted to commit a crime, it is classified as computer crime. A computer can be the target of crime, when a person intends to steal information from a computer network. This can be entirely virtual that is the information only exists in digital form and the damage, while real, has no physical consequences other than that the computer ceases to perform its expected functions. Increasingly, computer systems control access to goods and services. If a criminal manipulates the system into realizing the goods or authorizing the services, he uses deception to defraud, no matter how it is committed. Other types of computer crimes are Hacking, copyright infringement, child pornography, pedophilia, and obscene graffiti appearing on websites and 'cyber stalking' or harassment that can affect everyday life. There are also problems of privacy when confidential information is lost, say, when an e-mail is intercepted. A computer can be the tool used to plan or commit an offence. Computer crimes can be broadly classified into 1) physical or hard ware crime and 2) Data and systems related or software crime.

Cyber forensics: the science of investigating computer crimes is known as Cyber Forensics. It is discovery, analysis, and reconstruction of evidences extracted from any element of computer systems, computer networks, computer media and computer peripherals that enables the investigator to solve the crime. Cyber forensics works at two levels. The first, deals with gathering evidence from computer media seized at the crime scene like imaging storage media, recovering deleted files, searching slack and free space and preserving the collected information for legal purposes. Several computer forensic tools are available to investigators in this aspect of work. The second is Network forensics, which gathers digital evidence that is distributed across

large-scale, complex networks. Often this evidence is transient in nature and is not preserved within permanent storage media. Network forensics deals primarily with in-depth analysis of computer network intrusion evidence.

Cyber forensic comes in role after the crime has been committed. In a networked, distributed environment, it is imperative to perform forensic-like examinations of victim's information systems on an almost continuous basis in addition to traditional postmortem forensic analysis. This is essential to continued functioning of critical information systems and infrastructures. Few, if any, forensic tools are available to assist in preempting the attacks or locating the perpetrators. In the battle against malicious hackers, investigators must perform cyber forensic functions in support of various objectives, including timely cyber-attack containment, perpetrator location and identification, damage mitigation, and recovery initiate in the case of a crippled, yet still functioning, network. Standard intrusion analysis includes examination of many sources of data evidence (e.g., intrusion detection system logs, firewall logs, audit trails, and network management information). Cyber forensics adds inspection of transient and other frequently overlooked elements such as contents or state of memory registers, basic input/output system, input/output buffers, serial receiver buffers and others. The key object of forensic include rapid discovery of evidence, estimate of potential impact of malicious activity on the victim, and assessment of the intent and identity of perpetrator. Real-time tracking of potentially malicious activity is especially difficult when the pertinent information has been intentionally or maliciously hidden, destroyed or modified in order to elude discovery. Etc.....

The above enumerated instances of use of science in legal aspect show out that today we cannot imagine legal process in absence of science and technology.

### **Suggestions and recommendations:**

- State machinery should be made equipped. With advent of new –new technologies criminals are becoming more high–tec. State is under obligation to improve itself so that these criminals could be brought to justice. And therefore state should run frequent training sessions for their official, so they get equipped with the advanced technologies.
- Law is not consonant with the technologies, so more enactments should be made on those lines. Advance techniques can crack the crime in better ways.
- Government need to make more forensic laboratories to deal with crime investigation.
- Government should provide more grant in aids to the agencies who work hand in hand to investigate the crimes in different fields.
- Development of algorithms and software to assist forensic examination is must, as it could be easy to transmit and handle the data,
- The investigating machineries should react to the crime as early as possible, so that the physical evidences might be collected before they are lost. The sampling must be done at

the earliest, and should be preserved with correct method; try to preserve vulnerable traces like finger prints, semen, saliva, blood stains etc...in the best possible way, the loopholes can be a boon for the criminals.

- There is a need that the investigating machinery should be provided with an assistance of the technicians who could help them to resolve the cases scientifically.
- There is need to offer courses related to forensics in more and more of the Universities and institutions.
- There is need for launching an awareness Champaign to educate people about what are technicalities of crimes and how to tackle them especially the cyber-crimes.
- There is a need that the investigating machinery should be provided with an assistance of the technicians who could help them to resolve the cases scientifically.

**Conclusion:**The subject Forensic science which is concerned with the application of scientific knowledge and expertise to various legal issues, is not only restricted to criminal matters, but is also concerned with ethical values related to Law, medicine, civil action and other related topics. Like all other branches of learning, forensic science has undergone many changes over the years and hence, it becomes very important to incorporate recent advances, not only for the sake of academic interest, but also to avoid the miscarriage of justice.

## **METHODOLOGY:**

Keeping the above trends in view, this present research seeks to proceed through sound doctrinal legal research method, Carried on a legal prepositions or prepositions by way of analyzing existing statutory provisions and cases by applying reasoning power to it. This is achieved by various sources of law that are Acts passed by the legislature and case laws decided by Supreme Court and high court which are binding on the lower court as a precedents .

The researcher also intends to use secondary sources like text books on law, commentaries which do not possess as much authority as that of the primary source, law reports, articles from law journals, law digest, magazines , newspaper, current reports, web-sites and public view calculated through various media such as newspaper, news-channels or referendum made by these channels.