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<b>Principal Investigator</b>	<b>Co-Principal Investigator</b>	<b>Co- Principal Investigator (Technical)</b>
<b>Dr. A.K. Gupta</b>  Professor and Head, Department of Forensic Science Sam Higginbottom Institute of Agriculture, Technology & Sciences SHIATS, Allahabad	<b>Dr. G.S. Sodhi</b>  Associate Professor Forensic Science Unit Department of Chemistry SGTB Khalsa College University of Delhi	<b>Dr. (Mrs.) Vimal Rarh</b>  Deputy Director, Centre for e-Learning and Assistant Professor, Department of Chemistry, SGTB Khalsa College, University of Delhi <i>Specialised in : e-Learning and Educational            Technologies</i>
<b>Paper Coordinator</b>	<b>Author</b>	<b>Reviewer</b>
<b>Dr. Mukesh Kumar Thakar</b>  Professor, Department of Forensic Science, Punjabi University, Patiala	<b>Dr. Mukesh Kumar Thakar</b>  Professor, Department of Forensic Science, Punjabi University, Patiala	<b>Dr. G.S. Sodhi</b>  Associate Professor Forensic Science Unit Department of Chemistry SGTB Khalsa College University of Delhi
<b>Anchor Institute : SGTB Khalsa College, University of Delhi</b>		

**FORENSIC SCIENCE**
**PAPER No. 1: General Forensic Science**
**MODULE No. 23: Forensic Significance of Physical Evidences in Crime Scene Investigation**

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**FORENSIC SCIENCE**

**PAPER No. 1: General Forensic Science**

**MODULE No. 23: Forensic Significance of Physical Evidences in Crime Scene Investigation**

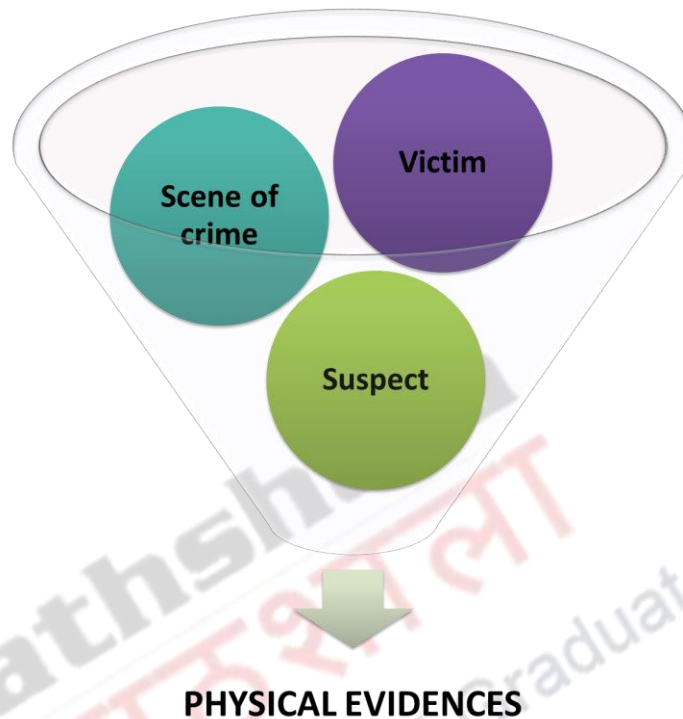
## 1. Learning Outcomes

After studying this module you shall be able to know-

- What are Physical Evidences?
- Their importance in crime investigation, and
- Types of physical evidences

## 2. Introduction

Physical evidences are any objects that can establish that a crime has been committed or can establish a link between a suspect and the victim of the crime with each other and with the scene of crime. As all the crime scenes are unique in nature so almost anything can be treated as physical evidence depending upon the type of crime and the circumstances under which the crime was committed. It may not be possible to enlist a type of objects to be recovered as physical evidences in a particular type of case. Several different types of physical evidences like pieces of glass, paint, soil, semen, saliva, hair, nail clippings, finger and foot prints are very commonly found at a crime scenes related to different types of cases. However, the weight given to each piece of evidence is ultimately decided by the jury. After recognising the physical evidences at the scene needs to be collected and packaged properly. While handling the evidence care must be exercised to avoid contamination as far as possible.



**Fig-1 Showing the Purpose of Forensic Investigation**

### **3. Crime Investigation**

Crime or offence or a criminal offence is any unlawful activity which is punishable by law. Whenever any crime is committed there must be some reasons behind it and are mostly related either to

- Money or
- Revenge or
- Emotions (because of Hate, Anger or Love)

Every crime scene is unique, may be because of any particular reason or because of style to commit crime. At every scene the range of human activity is so diverse that almost anything present can be consider as *Physical evidence* under one circumstance or the other. The physical evidences, if recognized, properly handled at the scene of crime, and proficiently analyzed and interpreted in the laboratory, can contribute significantly in linking the suspect and victim with each other and with the scene of crime.

#### 4. Purpose

In any crime case, the following three entities are very important from where a useful information in the form of physical evidences can be obtained:

- 1) Suspect
- 2) Victim
- 3) Crime Scene

Main purpose of forensic investigation of crime is to provide useful information about linking the suspect and victim with each other and with the scene of crime through scientific analysis of physical evidence present with/at any of three entities mentioned above. In majority of crime cases, two of the above entities are known and the third is missing (mostly suspected person). Link needs to be established by scientifically analysis of physical evidences recovered either from the crime scene or from victim. This analysis not only helps in establishing a common origin of samples of evidence, but also provides a number of different types of information about the crime.

As already said that every crime scene is unique, so there is no single ‘accurate way’ to process the crime scene. Therefore, each scene must be evaluated individually on its merit.

If appreciated and employed properly at the crime scene, this science might act as a powerful and effective tool to investigate the crime and prosecute criminal. It can help to reveal the facts in any type of case or situation involving physical evidences, provided the crime scene is protected. Safeguarding and preservation of evidences are fundamental to the successful solution of a crime.

## 5. Evidentiary Clues

The evidences which are present physically at the crime scene are called Physical-evidence. After recognized correctly at crime scene, there is a need to collect, packed and send them to forensic science laboratory properly along with the list of required analysis. It is mainly concerned with the identification and individualization of traces of evidence and establishing a common origin of samples of evidence to finally reconstruct the event.

Kirk Paul described the physical evidences in United Nations Office on Drugs and Crime (UNODC) manual as:

*Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as silent evidence against him. Not only his fingerprints or his footprints, but his hair, the fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects - all these and more bear mute witness against him. This is evidence that does not forget. It is not confused by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong; it cannot perjure itself; it cannot be wholly absent. Only its interpretation can err. Only human failure to find it, study and understand it, can diminish its value.*

The role of forensic scientist starts from the crime scene with the recognition and recovery of physical evidence. It proceeds further with its analysis and the evaluation of the results in a Forensic Science laboratory, and the presentation of the findings in the form report to judges, prosecutors and lawyers. From the first responders to the end-users of the information, all personnel involved should have an adequate understanding of the forensic process, the scientific disciplines and the specialized services provided by forensic laboratories.

Besides other, the physical evidences contribute significantly in:

- Placing the perpetrator at a scene
- Linking a suspect with a weapon
- establishing the scope of the crime scene
- distinguishing between primary and secondary crime scene
- Linking crime scene areas in cases of abduction, vehicle used and dump site
- Supporting or refuting witness statements

There are different types of evidences found at the crime scene. These evidences individually or collectively can play a significant role in providing an investigative lead by answering the following questions:

- What took place at a crime scene?
- The number of people involved?
- The sequence of events i.e. reconstruction of crime?



The significance of each evidence is often unknown at the time of collection from scene of crime but as the investigation proceeds further seemingly important evidence at the time of collection may not be able to contribute much and vice -versa. For these reasons, the forensic scientist needs to cover every corner of the crime scene and treat each and every piece of evidence as vital. So every little object at a crime scene must be considered to be significant until thoroughly examined in the laboratory or investigation reached to the fruitful conclusion.

More often than not, the forensic scientists only obtain usable evidence form a small percentage of the objects collected at a crime scene. It seems that much of the examination of evidence is not very fruitful, but the discovery of unexpected evidence such as a finger print or hair, can break investigation wide open.

## 6. Types of Physical Evidence

There are legal distinctions among different types or categories of evidences that help to determine its admissibility in court of law. Evidence have been categorized differently by different scientist, but the most convenient categorization which cover most type of evidences are as follows:

- a. **Physical Evidence**
- b. **Testimonial or Personal Evidence**
- c. **Miscellaneous Evidence**
- d. **Corpus Delicti Evidence**

### a. **Physical Evidence:**

The evidences in this category are also called the real evidences and are *Indirect* type of evidences, which consists of tangible articles such as hairs, fibers, latent finger and foot prints and other biological & chemical materials, they are discussed in detail in the later part of this module.



### **b. Testimonial or Personal Evidence:**

This category of evidence is related to direct evidence and includes either of the followings:

- a) In the form of testimony or statement given by any person at the crime scene otherwise.
- b) Can be subjective and colored by a person's attitude or
- c) An eyewitness, confession, hearsay (not usable in court).

### **c. Miscellaneous Evidence:**

This category of evidences includes items which do not fall into any of the two previous categories which can be either subjective or objective and may not always be admissible in the court of Law. Example can be

- Polygraph (may not be admissible),
- Voice analysis (depends) and
- Psychological examination (may be admissible in the court)

### **d. Corpus Delicti Evidence:**

This category of evidences includes evidences which can prove that a crime has been committed. Before actual investigation can be initiated there must be sufficient proof that a crime has taken place. Examples include dead body, broken window at the point of entry, stolen or broken items like safe, etc.



*Crime Scene showing Various Types of Physical Evidences*

At first instance, one feel surprised Is there is any need to categorize evidences in so many different ways?, but to ascertain the value of any evidence, way of collection and material in the form of control to be collected for respective evidences it is required and also the most important is what sort of examination can be conducted and type of conclusions can be drawn from the analysis of these evidences.

As the evidences reach the Forensic Science laboratory, they are subjected to several different kinds of analysis as per the requirements mentioned by the Investigating officer for each and every item sent. Some of the evidences have to pass through more than one division for analysis. Each department analyse the evidence to report results to the court of law.

## 7. Common Types of Physical Evidence

The following Indirect types of evidences which can be scientifically examined in the laboratory can be divided in to two following category:

- **Non-Living**
- **Living**

### Non-Living Physical Evidences

#### 1. Glass Pieces:

Window or ventilator glass panes, particles, or fragments that are found or transferred to a person or object involved in a crime may be substantial evidence. Such evidence, whether broken by a bullet or other means, may help in linking a suspect or piece of evidence to a crime scene, and be used to deduce cause of breakage, direction and angle of penetration. Additionally, it is commonly available substrate for fingerprints and/or blood to be present on broken glass.

#### 2. Soils and Natural resources:

Any items (clothes or footwear) containing soil, wood, natural resources like minerals or other vegetative matter could help in linking a person or object to a particular location (for example, soil imbedded in shoes and vault insulation found on garments). Most samples of such are unable to prove make match, but may with the presence of a rare material. Often such types of evidence are considered circumstantial, but are useful in supporting other evidence in a case.

#### 3. Paint:

Paint evidences in the form of smear, chip or dry, may be transferred from the surface of one object to another during the perpetration of a crime. Most paint evidence originates from crimes involving hit-and-runs cases. With a control sample to compare a suspected sample, paint can be matched to a vehicle with near 100% certainty.

#### **4. Questioned Documents:**

Any questioned document, whether hand- or type written, submitted to laboratory so that authenticity and source of it can be determined. These types of analysis are utilized mainly with ransom notes, suicide notes, death threats, and forgeries. When typewriters were used, it was quite simple to match a machine to its productions. With the development of inkjets and laser printers, matching printed documents have become nearly impossible. The exception would be if a document were to be printed with an uncommon font or with a rare type of ink. Since the reduced use of typewriters, document analysis is now primarily concentrated on handwritten documents. Although each person's handwriting is original, no one reproduces writings in the same way twice. Forgers are resourceful and inventive during their attempts to reproduce signatures. For these reasons, handwriting analyses rarely provide a 100% match.

To sum up the other type of activity in document division includes detection of forgery and alterations; comparisons of handwriting; reconstruction of destroyed documents; identify and compares printers, typewriters or copiers which have been used to produce a document.

#### **5. Firearms and Ammunition:**

Firearms, as well as discharged or intact ammunition, are often important evidence in any firing investigation. In fact, it is almost impossible to get a conviction in shooting cases without the discovery of such evidences. When anybody accompanied by a suspected weapon, a fired bullet or spent cartridge case may be matched to a weapon as well as a fingerprint is matched to a finger.

#### **6. Powder Residue:**

A person or item may be suspected of containing Gunshot residue or residue discharge from firearm. The presence and disbursement of powder residue indicate if, when, and where a firearm may have been used to fire. It is almost impossible to fire a weapon and avoid depositing such evidence on your person or surroundings. As these substances are quite difficult to remove from skin, clothing, and inanimate objects, they can be used to determine range of fire and the person who fired it.



## 7. Explosives and Petroleum Products:

The explosive and petroleum products are devices containing an explosive charge, as well as all objects removed from the scene of an explosion or arson that are suspected to contain the residues of an explosive petroleum material. The presence of these items becomes significant in determining from where a fire or explosion originated and advanced.

Another aspect of petroleum product is related to adulteration.

For which proper collection and analysis helps in determining the chemical composition of such materials which may be helpful in identifying the origin as well as users of the substances.

## 8. Marks:

### Tool, Foot and Tire Marks:

Impressions which are 3D in nature include tool marks, tire markings, shoe or foot prints, depressions in loose or soft soils, and all other forms of tracks impressions, and bite marks in skin or various types of foodstuffs. The different types of tool marks present on any object made by another object will serve as a tool in a crime. The examination of the suspect tool, matches may be made to near certainty. This type of evidence is approached in a similar way as is the impressions present on a bullet for analysis. Continuous efforts are on to generate and compile large databases of different types of impressions. In such cases, evidence may provide very important and useful information to the investigators, so that analysis can be conducted even in the absence of a control.

## 9. Drugs:

Drugs are substances which violate the laws regulating the sale, manufacture, distribution, and use of drugs or chemicals and necessitate to be seized. A large number of perpetrators committing other types of crimes are involved with drugs also. The production of drugs is a big business. With increasing advancements in technology and easy availability of chemicals, it has become much easier to manufacture illicit drugs and more difficult to apprehend suspects.

Upon recovery of suspected drugs at a scene or on a body, samples are packaged and sent to the forensic science lab for analysis. Preliminary or spot tests are to discover the identity of a drug. Further confirmatory tests will identify the strength of the drug and its components. The identification of drugs has been perfected by the application of different instruments. Although such equipment are expensive and requires constant maintenance, the results from such tests are indispensable.

### **Living Physical Evidences: Human Body Materials**

#### **1. Blood, Organs, and other Physiological Fluids:**

The blood and body fluids (semen and saliva) will be subjected to biochemical and other analysis to determine the identity and origin and then individuality. By examining the amount, color, and distribution of such fluids, an investigator may be able to make several predictions about what took place at a scene. A smear may indicate an attempted clean up or dragging of a body. At left, each blood spatter is characteristic of different circumstances:

<b>Blood Spattering Pattern</b>		
<b>1</b>	One-foot	Vertical drop
<b>2</b>	Three feet	Vertical drop
<b>3</b>	Six Feet	Vertical drop
<b>4</b>	More than six feet	Splashes

Splashes occur when blood flies through the air at an angle and hits on object. The characteristic 'exclamation mark' shape points in the direction of movement.

After careful collection, nearly every type of organ or organic fluid will be subjected to blood typing and DNA analysis.

Toxicology tests may also detect the possible existence of drugs, alcohol, or poison.

Blood typing, used to exclude the innocent and pin point the possible suspects or victims, is still a useful tool. However, recent advancements in technique, equipment, and collection procedures have elevated DNA testing to the most common types of biological materials.

## **2. Fingerprints:**

It is generally known to almost everyone that when a person touches an article with their bare hands (according to Locard's principle of exchange) that a finger prints is left behind. Such prints are called latent prints as they are not visible to naked eye. The challenge for the forensic scientist is to develop to make it visible, these latent prints so as to identify their owners. In the past matching these prints required a narrowed field of suspects, but with the utilization of computers and large databases, identifying a suspect's prints have become routine.

## **3. Hair and Fibers:**

Hair is most often found at a crime scene and is fairly easy to compare and identify with the use of a microscope. Any animal or human hair present at the scene could be linked a person or animal to a crime. With a number of samples to compare, hairs from a crime scene may be matched with a suspect with a high degree of certainty. Upon the discovery of a root along with follicle tissue, DNA analysis can provide exact genetic information, which is helpful in matching the questioned sample with specimen.

Similarly the fibres which are either natural or synthetic are easily transferred from objects to persons or from person to person. If collected and examined properly can establish a relationship between objects and/or persons. With the exception of DNA analysis, fibers are examined in almost in the same manner as hairs. When control fibers are available for comparison, a match is often made with a high degree of certainty. In the absence of control fibers an experienced observer can provide valuable insight on the origin of a fiber. They may be able to predict if such a fibre originated from clothes, towels, carpet, or other sources.



*Bones* and bone fragments are found at the crime scene, the analysis will answer the following questions:

- Are they animal or human?
- If human to which part it belong?
- Whether of right or left side?
- Whether the reconstruction is possible from bone fragments or not?
- Whether the bone or bone fragments can be individualized?

In case to identify the original ivory from duplicate cross section can help.

*Diatom test* can help in confirming the cause of death and possible site of drowning and also help in deciding anti and post- mortem drowning i.e. person was alive on entering the water.

## 8. Summary

- 1) At every scene the range of human activity is so diverse that almost anything present can be consider as *Physical evidence* under one circumstance or the other.
- 2) The role of forensic scientist starts from the crime scene with the recognition and recovery of physical evidence.
- 3) As the evidences reach the Forensic Science laboratory, they are subjected to several different kinds of analysis as per the requirements mentioned by the Investigating officer for each and every item sent.
- 4) Most paint evidence originates from crimes involving hit-and-runs cases.
- 5) The blood and body fluids (semen and saliva) will be subjected to biochemical and other analysis to determine the identity and origin and then individuality.