Forensic Sciences

First Stage

First semester

4th Lecture

Physical Evidence and Trace Evidence

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Physical Evidence and Trace Evidence

Trace evidence is any tangible change or residue resulting from an action or event. In the context of crimes, trace evidence is anything that can link the perpetrator to the crime, prove the occurrence of the crime, or help in understanding its circumstances. Physical forensic evidence is that trace evidence that is collected and analyzed for use as evidence in criminal trials.

The relationship between trace evidence and physical evidence:

Trace evidence: is the tangible change or residue resulting from an action (such as breaking glass, leaving a fingerprint, firing a gun).

Physical evidence: is the trace evidence that is collected, documented, and scientifically analyzed to be used as evidence in court.

Types of Physical Traces:

Physical traces can be classified into several main types:

Contact Traces: These are traces that result from direct contact between people or objects. Examples include:

Fingerprints: Result from fingers touching surfaces.

DNA traces: Result from contact with bodily fluids, hair, or skin.

Fibers and textiles: Result from contact with clothing or fabrics.

Footprints: Result from shoes contacting the ground.

Traces of Violence: These are traces that result from the use of violence or force. Examples include:

Bloodstains: Result from injuries or wounds.

Firearm traces: Result from firing a weapon.

Traces of sharp instruments: Result from the use of knives or other sharp tools.

Bruises: Result from blows or impacts.

Material Traces: These are traces that result from the presence of materials at the crime scene. Examples include:

Drugs and chemical substances: May indicate drug use or the use of chemical substances in the crime.

Poisons: May indicate poisoning of the victim.

Explosive materials: May indicate the use of explosives in the crime.

Fire debris: May indicate arson.

Tools and Weapons Traces: These are traces that result from the use of tools and weapons in the crime. Examples include:

Firearms and ammunition: Can be analyzed to determine the type of weapon and match the bullet used to the weapon.

Sharp instruments: Can be analyzed to determine their type and match their traces to the injuries.

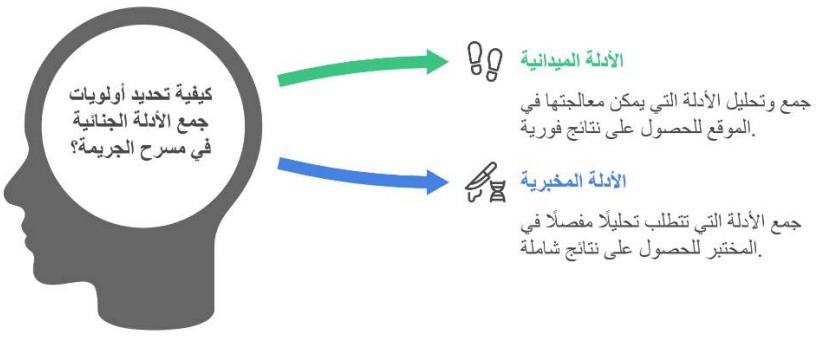
Environmental Traces: These are traces that result from changes in the environment surrounding the crime scene. Examples include:

Soil and rocks: May carry traces indicating the location of the crime or the perpetrator's movements.

Plants: May carry traces indicating the passage of people or vehicles.

Insects: May help determine the time of death.

Classification of Forensic Evidence in Crime Scene Field:



Firstly: Evidence that can be established and its results known in the field (at the crime scene):

This evidence can be collected and initially established at the crime scene using relatively simple equipment, and the initial results may be immediately observable or require simple on-site analysis. Like following:

Footprints and Tire Tracks:

Photography: Comprehensive documentation of footprints and tire tracks using a high-resolution digital camera.

Measurement: Measuring the length, width, and depth of the trace using a measuring tape and ruler.

Lifting: In some cases, footprints can be lifted from wet soil or snow using special adhesive materials or plaster.

Equipment: Digital camera, measuring tape, ruler, adhesive materials or plaster, brush.

Field Result: The type of shoe or tire can be determined, and its size and depth estimated. The trace may be initially matched with a suspected shoe or tire.

Visible Fingerprints:

Photography: Documenting visible fingerprints using a digital camera with appropriate lighting.

Lifting: Visible fingerprints can be lifted from smooth surfaces using transparent adhesive materials.

Equipment: Digital camera, transparent adhesive materials, soft brush.

Field Result: The shape of the fingerprint can be seen, and whether it is complete or partial can be determined. It may be visually matched with known fingerprints (if available).

Sharp Instruments (Preliminary Examination):

Photography: Documenting the shape and location of the instrument at the crime scene.

Visual Inspection: Examining the instrument for traces of blood, hair, or fibers, and documenting them.

Equipment: Digital camera, gloves, storage containers.

Field Result: The type of instrument (knife, axe, etc.) can be determined, and its visual condition described. The presence of blood or fibers visible to the naked eye may be determined.

Firearms (Preliminary Examination):

Photography: Documenting the weapon and its location at the crime scene.

Visual Inspection: Examining the weapon for traces of fingerprints or blood.

Equipment: Digital camera, gloves, storage containers, warning tape.

Field Result: The type of weapon (pistol, rifle, etc.) can be determined and its visual condition described. The presence of fingerprints or blood visible to the naked eye may be determined.

Personal Belongings (Initial Documentation):

Photography: Documenting personal belongings and their location at the crime scene.

Inventory: Making a list of the items found.

Equipment: Digital camera, notebook, pens.

Field Result: The personal belongings present at the crime scene can be identified and initially documented.

Secondly: Evidence that requires laboratory analysis (results not possible in the field):

This evidence requires precise analysis in the forensic laboratory using specialized equipment, and the results are often not immediately available.

Biological Evidence:

DNA Analysis: DNA is extracted from samples and analyzed using PCR (Polymerase Chain Reaction) and gene sequencing devices.

Blood Type Analysis: The blood type is determined using chemical reactions.

Biological Fluid Analysis: Fluids such as saliva and semen are analyzed for DNA or other substances.

Laboratory Equipment: PCR machines, gene sequencing devices, centrifuges, chemical analysis devices, microscopes.

Laboratory Result: Identifying a person through DNA, determining blood type, and detecting the presence of other substances such as drugs or toxins.

Non-Visible (Latent) Fingerprints:

Developing Fingerprints: Latent fingerprints are developed using chemicals such as fingerprint powder, iodine fuming, or ninhydrin.

Comparison: The lifted fingerprints are compared with known fingerprints using computers and specialized software.

Laboratory Equipment: Chemicals for developing fingerprints, fingerprint brush, adhesive materials, computers and fingerprint comparison software.

Laboratory Result: Matching lifted fingerprints with known fingerprints to identify a person.

Fibers and Textiles:

Microscopy: Fibers are examined using microscopes to determine their type and characteristics.

Chemical Analysis: Fibers are analyzed to determine their chemical composition.

Laboratory Equipment: Microscopes, chemical analysis devices.

Laboratory Result: Determining the type and source of the fibers (clothing, furniture, etc.).

Chemical Substances (Such as Drugs, Toxins, and Explosives):

Chromatographic Analysis: Chemical components are separated using gas and liquid chromatography devices.

Spectroscopic Analysis: Chemical components are identified using spectroscopic analysis devices.

Laboratory Equipment: Gas and liquid chromatography devices, spectroscopic analysis devices (such as infrared and ultraviolet), mass spectrometer.

Laboratory Result: Determining the type and concentration of the chemical substance.

Documents (Detailed Analysis):

Handwriting Analysis: Handwriting is analyzed to verify the identity of the writer.

Ink Analysis: Ink is analyzed to determine the date of writing.

Document Examination: Documents are examined to detect forgery and manipulation.

Laboratory Equipment: Microscopes, handwriting analysis devices, ink analysis devices, document examination devices.