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INSPIRE INTERNSHIP PROGRAMME 2024

Innovation in Science Pursuits for Inspired Research
An Initiative of DST, Govt of India

8-12 JULY 2024

To Catch a Thief

Offered by:
Chemistry Department

Forensics: To Catch a Thief

TYPES OF FINGERPRINTS

Fingerprints are unique patterns formed by ridges and valleys on the tips of human fingers. They are used extensively in forensic science for identification purposes. There are three main types of fingerprints found at crime scenes: latent prints, patent prints, and plastic prints. Additionally, two common methods of recording fingerprints are rolled prints and plain prints.

1. Latent Prints
Definition: Latent prints are invisible to the naked eye and consist of the natural secretions from sweat glands present on the friction ridges of the skin. **Detection**: These prints require enhancement techniques to be visualized. Common methods include:

- **Dusting with fingerprint powder**: Applying fine powder to adhere to the sweat and oils in the print.
- **Chemical development**: Using chemicals like ninhydrin or iodine fuming to react with the amino acids or other components in the print residues.
- **Alternative light sources**: Employing UV or infrared light to make the prints visible.

2. Patent Prints
Definition: Patent prints are visible prints left when fingers coated with a substance such as blood, ink, oil, or dirt touch a surface. **Characteristics**: These prints can be seen without any enhancement and often provide clear ridge patterns. **Examples**:

- **Blood prints**: Fingerprints left in blood at a crime scene.
- **Ink prints**: Fingerprints left after touching an inkpad.
- **Grease prints**: Fingerprints left by greasy fingers.

3. Plastic Prints
Definition: Plastic prints are three-dimensional impressions made when the fingers press into a soft material such as wax, soap, or wet paint. **Characteristics**: These prints create a mold of the fingerprint ridges and valleys and are visible to the naked eye. **Collection**: Plastic prints can be collected by:

- **Photography**: Capturing detailed images of the print.
- **Casting**: Using materials like silicone rubber to make a mold of the print.

Rolled and Plain Prints
Rolled Prints
Definition: Rolled prints are taken by rolling the finger from one side to the other, capturing the entire fingerprint ridge pattern from nail to nail. **Usage**: These prints are typically used for official records such as criminal databases and background checks. **Procedure**:

1. **Preparation**: Clean the finger to remove any dirt or oil.
2. **Inking**: Apply a thin layer of ink or use a live scan device.
3. **Rolling**: Roll the finger from one side to the other on a fingerprint card or scanner to capture the full print.

Plain Prints
Definition: Plain prints, also known as flat or slapped prints, are taken by pressing the finger flat onto a surface without rolling. **Usage**: These prints are often used for quick identification and verification purposes. **Procedure**:

1. **Preparation**: Ensure the finger is clean.

2. **Inking**: Apply ink or use a live scan device.
3. **Pressing**: Press the finger flat onto the fingerprint card or scanner to capture the print.

Summary

Fingerprints are vital tools in forensic investigations, offering unique identification markers. Latent, patent, and plastic prints provide critical evidence from crime scenes, while rolled and plain prints are essential for recording and verifying individual identities. Understanding the different types of prints and their collection methods enhances the accuracy and reliability of fingerprint analysis in forensic science.

TYPES OF FINGERPRINT PATTERNS

Fingerprint patterns are unique to each individual and can be categorized into three primary types: arches, whorls, and loops. Each type has distinct characteristics that make them identifiable.

1. Arches

Definition: Arches are the simplest type of fingerprint pattern, characterized by ridge lines that enter from one side of the fingerprint, rise in the center, and exit on the opposite side.

Characteristics:

- No deltas (triangular regions where ridge lines diverge).
- No core (the central area of a fingerprint).

Frequency: Arches are the least common type of fingerprint pattern, found in about 5% of the population.

2. Whorls

Definition: Whorls are circular or spiral patterns where ridge lines form concentric circles or spirals around a central point.

Characteristics:

- At least one core and two deltas.
- Circular or spiral ridges.

Frequency: Whorls are found in approximately 30-35% of the population.

3. Loops

Definition: Loops are the most common fingerprint pattern, where ridge lines enter from one side, curve around, and exit on the same side.

Characteristics:

- One core and one delta.
- Ridge lines enter, loop around, and exit on the same side.

Frequency: Loops are the most prevalent type of fingerprint pattern, found in about 60-65% of the population.

VISUALIZATION OF LATENT FINGERPRINTS USING IODINE FUMING METHOD

Introduction

The iodine fuming method is a well-established technique in forensic science for visualizing latent fingerprints on various surfaces. Iodine fumes react with the oils and fats present in fingerprint residues, producing a temporary brownish print that can be photographed or further enhanced. This method is particularly useful for non-porous and semi-porous surfaces, such as paper, cardboard, and certain plastics.

Materials and Equipment

- Iodine crystals
- Glass rod – both ends open
- Cotton wool wads
- Heat source (e.g., hot plate or iodine fuming wand)
- Tweezers or forceps
- Protective gloves
- Face mask
- Camera for documentation
- Starch solution (optional for fixing the prints)

Safety Precautions

- Iodine is a toxic and corrosive substance. Always handle it with care, using protective gloves and a face mask.
- Perform the fuming process in a well-ventilated area or under a fume hood to avoid inhaling iodine vapors.
- Ensure that the fuming chamber (glass rod setup) is securely assembled to prevent the escape of fumes.

- Do not inhale the iodine vapors directly at any point during the procedure.

Procedure

1. **Preparation of the Fuming Chamber**
    - Select a clean and dry glass rod. Place cotton wool wads at both ends of the rod. These wads will act as a barrier to hold the iodine crystals in place and direct the fumes.
    - Place a small amount of iodine crystals in between the cotton wool wad
2. **Placement of Evidence**
    - Carefully place the item to be examined for fingerprints near the other end of the glass rod and ensure the surface with the suspected fingerprints is exposed to the iodine fumes nicely.
    - Avoid touching the surface with bare hands to prevent contamination.
3. **Fuming Process**
    - Blow hot air gently from one end of the glass rod, causing the iodine crystals to sublimate and produce iodine fumes. Ensure the hot air is directed towards the other end of the rod where the item is positioned.
    - Allow the item to be exposed to the iodine fumes for several minutes. The fumes will react with the fingerprint residues, causing the latent prints to become visible as brownish impressions.
4. **Observation and Documentation**
    - Once the fingerprints become visible, carefully remove the item from the vicinity of the glass rod.
    - Immediately photograph the developed fingerprints for documentation, as the iodine-induced prints are temporary and will fade over time.
    - Optionally, the prints can be treated with a starch solution to enhance and fix them. Spray a fine mist of starch solution over the developed prints. The starch reacts with the iodine, forming a more stable blue-black coloration.

Post-Fuming Care

- After completing the fuming process, ventilate the area to disperse any remaining iodine fumes.
- Dispose of any used iodine crystals and contaminated materials according to safety guidelines.
- Store the photographed evidence in a secure and labeled container for further analysis.

Advantages and Limitations

Advantages:

- The iodine fuming method is simple and cost-effective.
- It is a non-destructive technique, preserving the evidence for further analysis.
- Effective on a variety of surfaces, especially paper and cardboard.

Limitations:

- The developed fingerprints are temporary and will fade quickly if not documented or fixed.
- Not suitable for all surfaces, particularly those that are highly porous or wet.
- Requires careful handling and safety precautions due to the toxic nature of iodine.

Conclusion

The iodine fuming method is a valuable tool in the visualization of latent fingerprints, providing a quick and efficient way to reveal evidence that might otherwise remain invisible. By following proper procedures and safety measures, forensic investigators can effectively utilize this technique to enhance the visibility of fingerprints and aid in the identification of suspects.

VISUALIZATION OF LATENT FINGERPRINTS USING CHARCOAL

Aim: To visualize and examine latent fingerprints using charcoal as dusting powder.

Apparatus and Reagents:

- Glass slide
- Camel-hair brush
- Scotch tape
- White or light-coloured paper
- Dusting powder (charcoal or similar)

Theory:

Fingerprint patterns and characteristics are formed before birth and, unless the dermal layer is injured severely enough to produce a scar, remain unchanged until decomposition destroys them after death. Fingerprints are unique to each individual – including identical twins – and have been used for over a century for identification and crime-solving purposes.

The skin found on the fingers, palms and soles of the feet of humans (and some primates) is known as friction skin. This skin is unique because it does not have hair follicles or oil glands, and is composed of ridges that are believed to be adapted for increased friction to help when handling various objects and walking. These 'friction ridges' are composed of rows of sweat pores, or eccrine glands, that constantly secrete perspiration. This perspiration – along with grease and oil transferred from other parts of the body – adheres to the friction skin, and is transferred from the skin to other surfaces when contact is made with objects. The transferred outline of the friction ridges is what is known as a latent print.

Latent prints are not readily visible to the naked eye. As a result, these 'hidden' prints must be 'developed' in some way to increase their visibility and contrast. The most common method of developing latent prints on nonporous objects is to physically enhance them by applying fingerprint powder. Fingerprint powder is composed of many different ingredients that can vary greatly depending on the formula used:

White Fingerprint Powder:

- **Purpose**: Used on dark-colored surfaces to create a contrast with the latent fingerprints.
- **Common Compositions:**
    - **Haddonite White**: Made from titanium dioxide, kaolin, and French chalk, or from titanium dioxide, purified talc, and kadin lenis.
    - **Lanconide**: Made from zinc sulfide, zinc oxide, barium sulfate, titanium dioxide, bismuth oxychloride, and calcium carbonate.
    - **Other White Powders**: Titanium dioxide, white tempura or chalk.

Discontinued: Mercury chalk, due to serious health risks associated with mercury.
Makeshift: Talcum powder can be used as an alternative.

Black Fingerprint Powder:

- **Purpose**: Used on light-colored surfaces.
- **Common Ingredients:**
    - Graphite
    - Charcoal
    - Lampblack
    - Photocopier toners
- **Specific Powders**:
    - **Dactyl Black**: Made from graphite, lampblack, and gum acacia.
    - **Haddonite Black**: Similar to Dactyl Black but uses powdered acacia instead of gum acacia.
    - **Dragon's Blood**: Uses powdered resin of the Daemonorops draco plant.

Makeshift: Cocoa powder can be used as an alternative.

Bichromatic Fingerprint Powder:

- **Purpose**: Used on surfaces of variable color; appears grey to silver on a light-colored surface and white on a dark-colored surface.

Fluorescent Fingerprint Powder:

- **Purpose**: Used on wooden surfaces, such as rifle stocks and wood paneling. Effective when used with filters and UV lights.

Magnetic Fingerprint Powder:

- **Purpose**: Used on surfaces with variable shape or texture, such as plastic films and bags, paper and cardboard, textured surfaces like painted rough lumber, textured or brushed metal, and raw wood.

Usage Tips

- **Application**: Apply the powder using a soft brush in a circular motion to ensure even coverage and adherence to the fingerprint residues.
- **Safety**: Always use appropriate personal protective equipment (gloves, mask) to avoid inhaling fine powder particles and contaminating the crime scene.
- **Documentation**: Photograph developed fingerprints immediately as some powders may cause temporary visibility of prints.

Conclusion

Different types of fingerprint powders are used based on the surface and color contrast required. Understanding the composition and specific use cases helps forensic investigators choose the right powder for effective fingerprint visualization and evidence collection.

Precautions:

- Brushing of any powder and transfer of fingerprints should be done carefully to prevent smudging.
- Excess of powder should be blown gently off the slide.
- Any powder used for developing the fingerprints should not be inhaled.
- Gloves should be worn while collecting fingerprints to prevent contamination of existing prints.

EVIDENCE COLLECTION PROCEDURE AT A CRIME SCENE

Aim: To study and practice standard evidence collection procedure at a simulated crime scene.

Apparatus:

- Gloves
- Forceps
- Ziplock bags of different sizes
- Earbuds
- Sticky Labels
- Mailing envelopes A4 and A5
- Pens/markers
- A4 Sheets
- Plastic containers (approx. 10”X5”)
- Newspaper/ tissues – to be used a packing material

Materials:

- Red color ~ for blood stains
- Hair sample
- Threads and fibres of different clothes
- Drinking glasses / cups
- Buttons

Theory:

Forensic evidence consists of all the physical objects that can be observed by the five human senses and analyzed regarding their relevance to the events that occurred at a crime scene. Any physical item can be a source of information that assists the investigator in reconstructing the sequence of events, and thus discovering the identity of the criminal.

When evidence is collected at crime scenes, preservation is of the utmost importance. To that end, here are guidelines for the collection of various types of evidence:

Bloodstains

Blood that is in liquid pools should be picked up on a cotton ear bud/ gauze pad or other clean sterile cotton cloth and allowed to air dry thoroughly, at room temperature. It should be refrigerated or frozen as soon as possible and brought to the laboratory as quickly as possible.

If close to the laboratory, deliver stained object immediately. If unable to deliver to the laboratory, or if the object must be mailed, allow the stain to air dry completely before packaging.

If not completely dry, label and roll in paper or place in a brown paper bag or box and seal and label container. Place only one item in each container. Do not use plastic containers.

Dried Bloodstains

On clothing, if possible, wrap the item in clean paper, place the article in a brown paper bag or box and seal and label container. Do not attempt to remove stains from the cloth.

On large solid objects, scrape the stain onto a clean piece of paper, which can be folded and placed in an envelope. Do not scrape directly into evidence envelope. Seal and mark the envelope.
Do not mix dried stains. Place each stain in a separate envelope.
Never attempt to wipe dried stains from an object using a moistened cloth or paper.

Hair
An examination of human hair can reveal from whom it came and the part of the body from which it originated. Human hair can be compared to determine whether or not two samples could have had a common origin. The value of the laboratory examinations of such specimens will depend upon the amount of hair recovered and the characteristics found in the examinations.
Recover all hair present. If possible, use the fingers or tweezers to pick up hair, place in paper bindles or coin envelopes which should then be folded and sealed in larger envelopes. Label the outer sealed envelope.
If hair is attached, such as in dry blood, or caught in metal or a crack of glass, do not attempt to remove it but rather leave hair intact on the object. If the object is small, mark it, wrap it, and seal it in an envelope. If the object is large, wrap the area containing the hair in paper to prevent loss of hairs during shipment.

Fibers and Threads
Such evidence is often found in fabric abrasions or caught in torn materials or other areas on hit-and-run vehicles. In some burglary cases, it may be found caught in torn screens, broken glass, or other locations.
Examination of fibres can normally be conducted to determine the type or color of fibre. Such examinations will sometimes indicate the type of garment or fabric from which they originated.
Fibres and threads can also be compared with suspects' clothing to determine whether or not they could have come from this clothing.
If threads or large fibres are found, they can often be picked up with the fingers and placed in a paper bindle, then in a coin envelope, which can be sealed and marked. Never place loose fibres directly into a mailing envelope since they can be lost from this type of envelope.

Glass
Windows are frequently broken in burglaries, headlights in hit-and-run cases, and bottles or other objects may break or leave fragments on personal belongings of suspects involved in various types of crimes.
Place small glass fragments in paper bindles, then in coin envelopes, or film cans which can be marked and completely sealed.
Place large glass fragments in boxes. Separate individual pieces with cotton or tissue to prevent breakage and damaged edges during shipment. Seal and mark the box containing them.

Paint
Paint evidence is frequently encountered in hit-and run cases, on tools used by burglars, and occasionally in other types of cases.
Keep all samples collected in separate containers.
Small paper bindles can be used to collect and hold many paint samples. It can be placed in a coin or mailing envelope, which can be marked and sealed. Such containers should never be stapled.
Never place paint directly into envelopes unless large pieces are enclosed. Most envelopes have unsealed cracks in the corners and loss or contamination can occur.

Tool Marks
Tool marks are encountered most frequently in burglary cases but may also be found in other types of crimes. The evidence consists of striations or impressions left by tools on objects at the crime scene and

various types of tools found in the possession of suspects. In other cases, it is possible by means of physical and other comparisons to prove that parts of tools left at crime scenes were broken from damaged tools found in the possession of suspects. In many cases, it is possible to identify the specific tool which made the questioned marks by means of a Laboratory comparison of tools and marked objects. In some instances, it is also possible to prove that marks of various types on tools were produced by objects which they contacted at crime scene.
Pack the object containing tool marks so that no alteration or damage will occur during shipment. Small objects should be wrapped with clean paper and placed in envelopes or boxes, while important areas on larger objects can be protected with paper. Whole, large objects can be packed in cartons or crates, if not delivered in person.

Questioned Documents
All questioned documents involved in a particular investigation should be submitted to the Laboratory for examination. This is important since questioned documents are identified by a comparison of similarities, plus an absence of divergences or dissimilarities. In order to make an identification, sufficient handwriting, typewriting, or other evidence must be available on which to base an opinion. This means that all questioned material is needed, as well as sufficient exemplars or known specimens.
Under no circumstances should either the questioned document or the exemplars be marked, defaced, or altered. No new folds should be made, nor should marks or notes be placed on such material. Personal marks for identification purposes should be made as small as possible on the back or other area of the document where no handwriting or typewriting is present.
Whenever possible, all documents should be protected by placing them in cellophane or plastic envelopes.

Charred Documents
Where examination and decipherment of charred paper is involved, great care must be taken to prevent any additional crumbling or breaking apart of the burned material. Normally it should be placed on top of loose cotton in a box and delivered in person to the Laboratory. No matter how it is packaged, such material will be damaged if attempts are made to ship it by mail.

Latent Fingerprints
All such evidence should be marked in some distinctive manner, such as is the case with any other type of physical evidence. Precautions should be taken, when marking evidence, not to damage or destroy potential latent fingerprints.
Lifted, developed latent prints should also be marked or sealed in marked envelopes.

Procedure:
- The guidelines given above are followed for the collection of any evidence located at the simulated crime scene.
- Individual pieces of evidence, once located, are picked up using forceps and placed in sealing pouches, which are then labeled carefully for further submission.

Observations/Result:
_____ pieces of evidence were collected and submitted, including _____

_____ (list the

items collected and submitted by you).

Precautions:

- Gloves must be worn while collecting evidence so as not to contaminate the crime scene with dirt and/or fingerprints.
- Evidence must be collected and packaged (and, in case of an actual crime scene, submitted to the concerned laboratory) with the utmost care, following the guidelines precisely to avoid destruction or contamination.
- Neat and correct labels must be affixed to each sealing pouch containing evidence.

Food for thought:

1. Why is preservation and labeling of evidence of such great importance?

2. Which types of evidence are likely to be found useful in which types of cases? (eg. blood samples in murder cases, tool marks in cases of theft etc.)

OBTAINING FOOTPRINTS FROM A CRIME SCENE

Aim: To obtain footprints from a crime scene.

Apparatus and Reagents:

- 500mL beaker
- Stirrer
- Paper plates
- High-strength dental stone
- Water

Theory:

The number of individuals present at a crime scene is often difficult to determine, unless separate footwear impressions allow their number to be counted. The direction in which an individual was moving, the speed at which they were moving, and whether they were carrying anything heavy can be learned from analyzing footwear patterns. Evidence of scuffs or dragging of feet can tell an alert investigator about the activities of individuals at the crime scene, even unique habitual or temporary patterns of the gait at that time.
Analysis of footwear impressions can reveal much about the timing of activities of an individual at a crime scene, as well as the individual's level of involvement.

Footprints can be obtained from a crime scene using dental stone. This is a fine powdered stone, ideal for all-round laboratory use as well as base/study model stone.

Procedure:

- Two cups of dental stone are mixed with one and a quarter cups water in a 500 mL beaker and stirred. The mixture should be as thick as soup so that it can be casted without air bubbles.
- One inch of plaster mix is poured into a paper plate.
- A foot is gently pressed into the plaster, held for one to two minutes and removed.
- The imprint is allowed to sit overnight, and then the plate is peeled from the print.

Precautions:

The imprint of the foot should not go to the bottom of the plate.

Food for thought:

Can you think of an alternative to dental stone for this experiment? Note its formula, advantage(s) and disadvantage(s).

Identify the prints and write the pattern below each of the print

_____ _____ _____ _____

_____ _____ _____

_____ _____ _____