

The image shows a spiral-bound notebook with a light brown, textured cover. The spiral binding is on the left side. The text is centered on the cover.

# Practical Crime Scene Processing and Investigation

## Chapter 2 - Understanding the Nature of Physical Evidence

# Learning Objectives

---

- Describe the interrelationship and interdependency of the scene and crime lab examination.
- Describe the difference between a class and individual characteristic.
- Describe a mechanical fit.
- Identify and discuss the general categories of evidence.

## Interdependency of the Scene and Lab Examination

---

- ❑ Without the lab, specific details about the evidence cannot be identified.
- ❑ Without good scene work, the lab has nothing to work with.
- ❑ The two are interdependent for a successful investigation.
- ❑ Crime scene technicians must recognize and know how to recover the evidence in an appropriate fashion.

# The Nature of Evidence

---

- The physical evidence recovered from any scene will, based on its nature, provide:
  - Class Characteristics
  - or
  - Individual Characteristics

# Class Characteristics

---

- A trait or characteristic that allows the item to be compared with another group of items and included or excluded in the group.
- Example: Hair - can typically identify general body part, color or race.

# Individual Characteristics

---

- A trait or characteristic that allows the item to be compared to an individual item or person.
- Example: Fingerprint - can identify the specific individual who deposited the print.



# Mechanical Fit

---

- Mechanical Fit is an individualization by fitting two or more pieces of something together:
  - Paint flakes
  - Broken reflector lens
  - Broken metal
  - Matches/Match Books



# General Categories of Evidence

---

- ❑ Fingerprint Evidence
- ❑ Serology/Biological Evidence
- ❑ Trace Evidence
- ❑ Ballistic/Firearms Evidence
- ❑ Impression Evidence
- ❑ Document Evidence
- ❑ Computer Evidence
- ❑ General Chemical Evidence



# Fingerprint Evidence

---

- Nature - Individual Characteristics
- Most recognized evidence, found on any number of articles - porous and non-porous.
- Fingerprints are made up of 98% water. The remaining 2% is a combination of grease, oil, salts and amino acids.

# Fingerprint Evidence

---

- ❑ Fingerprints from two different people have ever been found to match.
- ❑ Identification is based on both ridge details and minutia in the print.
- ❑ These minutia include: ridge endings, bifurcation's, short ridges, enclosures, ridge dots, deltas, overlap, spurs and bridges.

# Fingerprinting Methods

---

- Typical crime scene methods include:
  - standard or magnetic brush with powder
  - super-glue fuming
  
- Alternative scene methods include:
  - Fluorescent powders - for contrasting surfaces
  - Various chemical enhancements

# Serological/Biological Evidence

---

- Nature - *Class and Individual Characteristics*
- Exists in the form of blood or body fluids found in the scene, including:
  - spittle
  - semen
  - bone/tissue
  - vaginal secretions

# Biological Evidence

---

## □ Collection:

- Collect entire item if possible, particularly clothing.
- Air dry thoroughly, before final packaging.
- Once dry - refrigerate.
- Package clothing by folding inside butcher or wrapping paper, ensure no part of item overlaps onto another part. **Where** the stain is found, may be of importance!

# DNA Evaluations

---

- DNA - deoxyribonucleic acid
- Building block of life, present in every cell nucleus. No two DNA samples are the same (except identical twins).
- DNA first utilized in forensic work in 1987.
- Subsequent development and advances have made it a more effective forensic discriminator.

# DNA Analysis

---

- RFLP - Restrictive Fragment Length Polymorphism
  - Large samples required but produced very high discrimination. (High statistics)
- PCR - Polymerase Chain Reaction
  - Mid-1990s technology, reduced discrimination; but smaller samples were needed.
- STR - Short Tandem Repeats
  - Combines best of both RFLP and PCR.
  - Works on small stains, but creates high statistics.



# Mitochondrial DNA (mDNA)

---

- mDNA is a recent forensic advancement.
- Mitochondria are present in greater number in every cell.
- mDNA however is not individual. It is shared in a family and follows the matriarchal line.
- It is an effective means of examining hair, bone and degraded biological samples.

# Trace Evidence

---

- Nature - Primarily Class and occasionally Individual Characteristics
- Trace evidence includes:
  - hairs and fibers
  - glass
  - paints
  - soils
  - gunshot residues

# Trace Evidence

---

- Trace evidence is analyzed at the crime laboratory through a variety of mechanisms, such as:
  - microscopic ( both light and electron microscope)
  - infrared spectrometry
  - automated refractive index systems (glass)

# Trace - Hairs

## □ Determinations:

- Species.
- Race
- Body area.
- Pulled, plucked or cut.

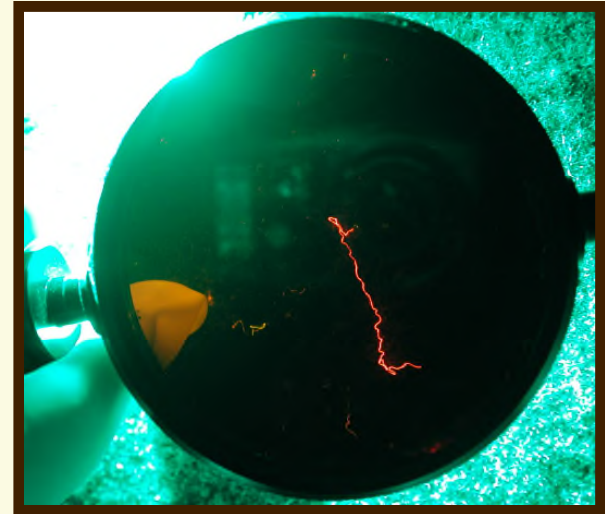


- In odd circumstances, processes applied to the hair may allow individualization.
- DNA from the follicle or mtDNA may allow a more defined analysis.

# Trace - Fibers

## □ Determinations:

- Type (e.g. cotton, nylon)
- Dye peculiarities
- Generally class comparisons



## □ 90% of fiber transfers lost in first 8 hours.

## □ Beware of and eliminate cross contamination by investigators.

# Trace - Hairs and Fibers

---

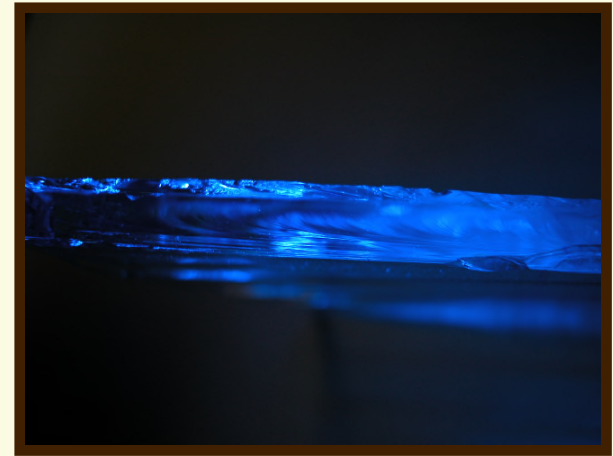
## □ Collection:

- Visible - collect immediately. Seal in paper container. It won't be there later!
- General Collection - adhesive tape, 8-10 inch strips applied to item or area repeatedly.
  - Don't over use tape on multiple objects or areas.
  - Use an ALS when searching for fibers.
  - Place tape onto transparent surface (document protector) and seal in envelope.

# Trace - Glass

## □ Determinations:

- Type
- Direction of Force



## □ Collection for “Type” Examinations:

- Collect samples of fragments and possible sources.
- Clearly mark all.
- Package securely. Mark as “Fragile” and “Sharp”



# Trace - Glass

---

## □ Collection:

- Take hair combings of individuals believed to be exposed to glass breakage. Collect in clean paper. Seal and secure all edges.
- Take any clothing exposed to possible glass breakage. Seal and secure all edges.
- Handle carefully, so as not to dislodge small fragments.

# Trace - Paints

---

## □ Determinations:

- Class characteristics such as layering, color.
- Chemical characteristic comparison.
- Possibility for “mechanical fit”

# Trace - Paints

---

## □ Paint Chips and Transfer Collection:

- Visible - collect immediately. Seal in container.
- General collection - lift full thickness of the paint transfer.
- Cut, dislodge, or pry with a clean knife.
- Package in small pills bottles or druggists fold, unless mechanical fit is possible.
- Mechanical fit - wrap in cotton, place in box or pill bottle.

# Trace - Soils

---

## □ Soil Determinations:

- Primarily class characteristics such as type and content.
- Greater individualization may be possible due to contaminants or unique environmental characteristics.
  - Primary environmental unique characteristic is plant pollen.

# Trace - Soils

---

## □ Soil Collection:

### – Visible Questioned

- Dry before packaging.
- Collect all evident soil present.
- Seal in pill bottle or pharmacist fold.

### – Standards

- Collect samples from multiple locations believed involved. Minimum of six from general area.
- Each standard should be about 1/2 cup.

# Gunshot Residues

---

## □ Determinations

- Presence of residues associated with GSR (unique particles containing Barium, Antimony, Lead)
  - Determination is extremely limited.
  - Positive is not proof of firing.
  - Negative is not proof of firing.
- Range determinations - GSR on clothing.
- Range determinations - GSR on wounds.

# Ballistic/Firearms Evidence

---

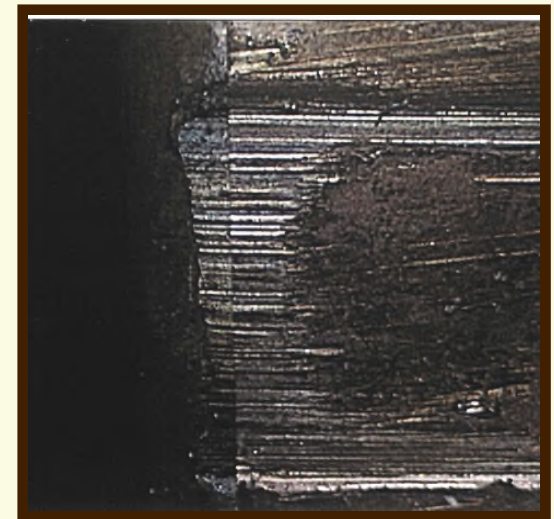
- Nature - *Class and Individual Characteristics*
- Identification of weapons, casings, bullets.
- Trajectory Analysis
- Serial Number Restoration



# Weapons, casings, bullets.

## □ Determinations

- Class characteristics based on lands/grooves, ejectors, caliber.
- Individualization based on marks associated with mechanical operation:
  - Barrel striations
  - Firing pin markings
  - Ejector markings



# Weapons, casings, bullets

---

## □ Collection:

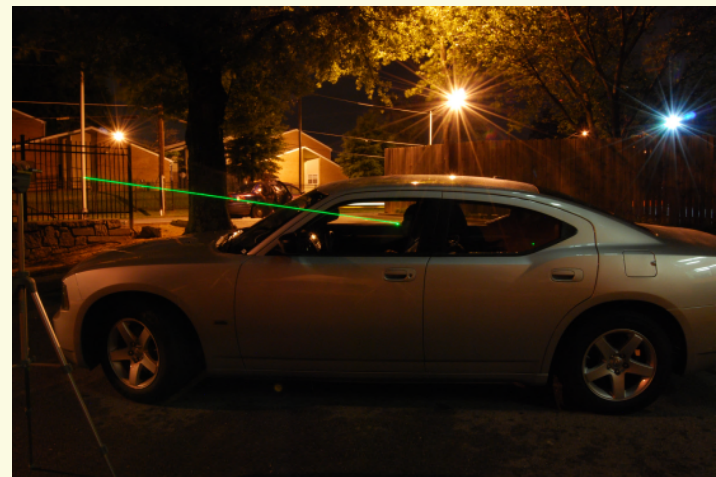
- Do not mark or engrave bullet or casing itself.
- Individually package to preclude causing additional marks.
- Place in a container and mark the container. Empty film containers are good.
- Do not use metal collection tools (forceps, knives, screwdrivers)
- Collect all shotgun wads and pellets.

# Trajectory Analysis

---

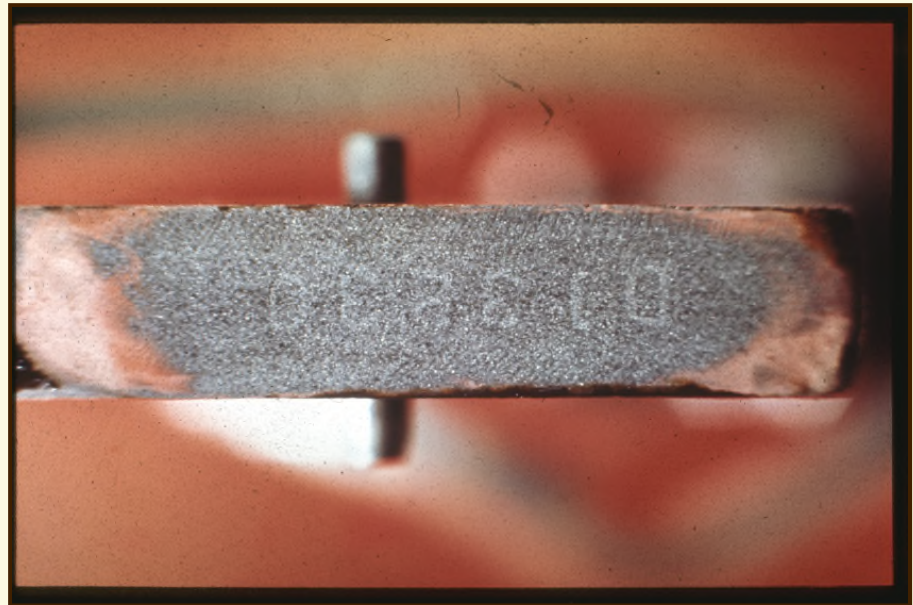
## □ Determinations:

- Defines the parameters of possible and impossible flight paths for a projectile.  
(Discussed in depth in Chapter 10)



# Serial Number Restoration

- Determinations:
  - Recover obliterated or damaged serial numbers on metal objects.



# Impression Evidence

---

- Nature - *Class and Individual Characteristics*
- Types of Impressions
  - Footwear (Impressions and Dust marks)
  - Bite marks
  - Tool marks
  - Fingerprints (plastic impressions)

# Tool Mark Evidence

---

## □ Determinations:

- Each tool is manufactured similarly - resulting in class characteristics (e.g. size, shape, nature of the tool)
- But the process of machining or the subsequent use of the tool may leave unique accidental marks.
- These unique marks can be as individual as fingerprints.



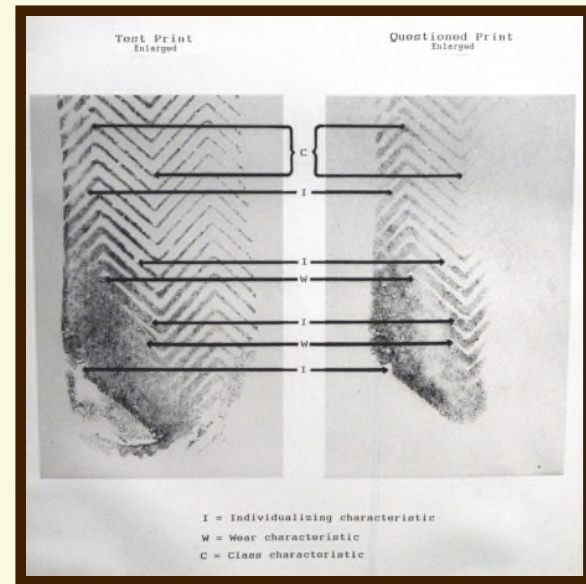
# Footwear Impression Evidence

## □ Determinations

- Brand or style
- A range of size

## – Individualization

- Each style of shoe manufactured similarly
- Once worn, accidental marks are unique.
- Can be as individual as fingerprints.





# Impression Evidence

---

## □ Collection

- Photograph, then cast or lift.
  - Cast with dental stone or silicone.
  - Lift with gel lifters or footprint lifters
- Dust prints use an Electro-static lifting device (ESLD).
- Microsil or Durocast for tool marks and plastic prints.

# Document Evidence

---

- Nature - *Class and Individual Characteristics*
- Determinations
  - Forgery - writer identification/elimination.
  - Tracings - over writing an original signature.
  - Altered writings - changes to original writings.
  - Indented writings

# Document Evidence

---

## □ Collection

- Collect all questioned writings, package in paper.
- Collect writing instruments if known.
- Protect for fingerprint analysis as well.
- Indented writings
  - Protect from further indentations.
  - Collect entire tablet, if available.

# Computer Evidence

---

- ❑ Another form of “document” evidence.
- ❑ Easily manipulated, easily damaged.
- ❑ Requires specialized skills beyond the capability of most crime scene technicians.
- ❑ Consult with a computer crime team.

# Computer Evidence

---

## □ Determinations and Examinations:

- Recovery of encrypted files.
- Recovery of “deleted” files.
- Analysis of time/date of creation.
- Slack file analysis.

# General Chemical Evidence

---

- Nature - *Class and Individual characteristics*
- Determinations
  - Identify chemical composition (e.g. drug identification, presence of accelerants)
  - Comparison to known standards.
  - Extremely accurate based on lab techniques such as GCM, ESM, IR Fluoroscopy

# General Chemical Evidence

---

## □ Collection

- Collect all questioned matter, unless excessive.
- Package in paper bindle, pill bottle or similar container.
- Fire Debris
  - Collect in sealed new paint cans.
  - Once collected do not re-open.
  - Don't use plastic bags. Use “arson” bags as a temporary container.