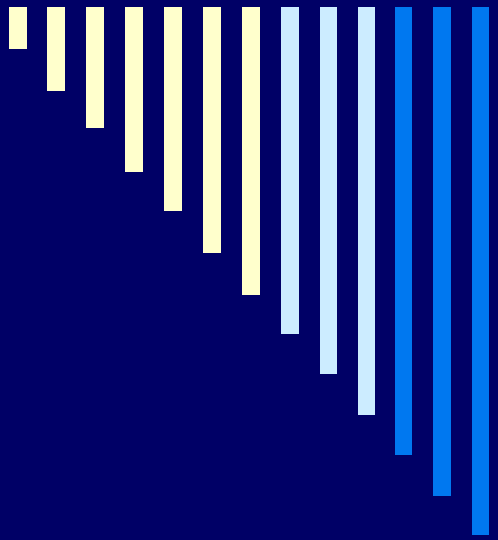

Physical Evidence

Recognition, Collection, Preservation and Packaging for Forensic Analysis

Impression Evidence

- Toolmarks
- Shoe prints
- Fingerprints
- Documents
- Firearms

Documents

- May Bear Several Kinds of Evidence
  - Handwriting (for identification to author)
  - Fingerprints (Latent or Patent)
  - Typescript or computer printing
  - Obscured or damaged printing or writing
  - Indented Writing
  - Impressions – shoes, tools, surfaces
  - Blood and Other Foreign Materials
  - Ink (For dating or comparison to source)

Documents

- May be Subject to Fire Effects:
  - Heat
  - Smoke
  - Condensation
  - Ash
  - Water (from suppression or weather)
  - Mechanical damage (tearing)

Documents

- Recognition
  - Can take any form: notes, business records, calendars, currency, matchbooks
- Documentation
  - Photos in situ
  - Notes of location, condition, and level in debris

Documents

- Heat causes paper to oxidize – turning yellow at low temperatures (100-150F), brown at 200-300F, and charring at temperatures over 300F
- Not all papers will react the same: “cheap” papers like newsprint will react quickly to heat, fine writing and book papers much more slowly. Heavy coated papers (magazines or photos) can be very stable.

Documents

- Collection
  - Charred documents are extremely fragile
  - Recovery should be by sliding sheet metal or a WIDE “mud” knife beneath the debris underneath and picking up the entire mass
  - Place in shallow, rigid plastic box (sandwich box) or cardboard box
  - Charred documents must not be sprayed with lacquer or hairspray

Documents

- Wet Documents are extremely fragile and should be handled as with charred documents
- If possible, they should be allowed to air dry in still warm air before packaging
- Water exposure will compromise:
  - Some ink identification/comparison
  - Latent fingerprints (by ninhydrin method)
  - Indented writing or impressions
    - Even high humidity can cause loss of fingerprint detail or indented writing.

Documents

- Collection
  - Clean, flat, dry documents should be handled only at their edges and with gloved hands. Avoid sharp-edged forceps.
  - Plastic “document” sleeves or clean new paper envelopes (large enough so that folding is not needed) are suggested
  - Crumpled documents should be placed in a rigid box with no attempt to flatten them out in the field

Documents

- Preservation:
  - Collected documents must be protected from excessive heat, moisture or sunlight exposure.
  - They should not be folded or handled repeatedly

Documents

- Fingerprints:
  - Latent: Will require chemical or optical (light source) treatment
    - Ninhydrin (dry documents only)
    - Physical developer (wet documents or dry)
    - MagnaBrush (clean smooth papers only)
  - Patent (blood, ink, etc.) should be photographed with an ABFO scale as found
    - Some may be amenable to enhancement by chemical or optical methods.

Documents

- Indented Writing or Mechanical Impressions:
  - ESDA Electrostatic detection apparatus
  - Optical methods
  - Physical developer

Documents

- Handwriting:
  - Requires suitable exemplars
  - Not a precise science
- Inks:
  - Sample punched from written line (with hollow needle) for chemical analysis
  - Optical analysis (non-destructive) by visual comparator or forensic light source

Shoe Impressions

- Recognition:
  - May be two-dimensional transfers on a flat surface OR three-dimensional reproductions of the surface
    - Transfers can be the result of the shoe REMOVING something from a dirty surface or DEPOSITING a transferable material onto a clean surface
  - Can occur on horizontal or vertical surfaces

Shoe Impressions

- May be Subject to Fire Effects:
  - Heat
  - Smoke
  - Condensation
  - Ash
  - Water (from suppression or weather)
  - Mechanical damage (tearing)
  - Being stepped on by others

Shoe Impressions

- Document via notes and sketches to show:
  - Location
  - Orientation
  - Direction
  - Type of shoe
  - Type of surface (soil type, moisture)
  - If multiple impressions measure heel-to-heel stride length and note slope

Shoe Impressions

- Document
  - By Photography AS SOON AS POSSIBLE
    - Use right angle scale (or ruler or tape measure) alongside and parallel to the long axis of the impression NOT ACROSS THE MIDDLE!
    - Scale should be in the same plane as the center of the print or as close to possible to avoid depth of field issues
    - Two-dimensional (transfer) prints can be photographed in ambient light or with normal flash

Shoe Impressions

- Document
  - Three-dimensional impressions need to be photographed first in normal illumination for reference purposes and then again using oblique illumination to cause shadows to highlight the 3-D features
  - Normal room light, sunlight, or fixed (on-camera) flash will not create the shadows
  - A remote (hand-held) flash or light source, early morning or late afternoon sun will do

Shoe Impressions

- Document
  - Two-dimensional transfer prints may be found and photographed using forensic light sources (white and various wavelengths)
  - Transfer prints in dust should be photographed using oblique illumination before any attempt is made to lift them or recover the surface itself

Shoe Impressions

- Collection
  - Transfer prints in dust can be lifted (after photography) using electrostatic lifting apparatus even from carpet and fabric surfaces
  - IF at all possible, collect the actual item or surface on which the 2-D print was left.
    - Do not cover with fingerprint tape
    - A clean sheet of paper can be taped over the print to protect it
    - The object should then be placed face up in a clean, rigid box for transport

Shoe Impressions

- Collection:
  - All impressions must be protected from water, wind, equipment, and foot and vehicle traffic until they can be recovered
  - This can be accomplished by covering with boxes, marking areas with cones or crime scene banner tape, or even posting a guard
  - Next to fingerprints, shoe prints are the best way of linking a person to a scene or developing investigative leads

Shoe Impressions

- Collection
  - Except in very unusual cases where heavy clay soil clumps may be recovered intact, 3-D impressions will have to be cast for best preservation and comparison
  - Casting can preserve features of the shoe surface that do not show up in photographs
  - Casting yields a 3-D replica of the surface making better comparisons possible

Shoe Impressions

- Collection by Casting
  - PHOTOGRAPH First!
  - Commercial casting products (Armor Forensics or Sirchie) are the best solution (considering availability and suitability) but are expensive
  - Dental stone is ideal because it shrinks very little as it cures
  - Plaster of Paris is OK because it is cheap and readily available but it is much more fragile than dental stone and it shrinks as it cures

Shoe Impressions

- The casting material should be mixed to a pancake batter consistency
- A dam erected around the impression from soil, a flexible metal Venetian blind strip fixed with a clothes pin, or a commercially sold casting frame minimizes spillage and keeps the casting material in the impression
- Loose debris (leaves, twigs) that has fallen into the impression should be carefully removed with tweezers

Shoe Impressions

- A mixing spoon or spatula is held just above the lowest part of the impression and the material is poured slowly into it so loose material is not moved possibly destroying features
- Total depth should be about one-half inch at the thinnest portion
- When about half the depth is achieved, some reinforcing material (Wire screen, or lengths of wire) should be dropped into the cast (may not be needed if using dental stone), then pour the rest of the material

Shoe Impressions

- Allow to cure until hard and warm to the touch
- Remove gently with adhering soil and place in rigid box
- Do NOT attempt to remove adhering soil until the cast is fully cured (in hours to days)
- Adhering soil can then be collected as a reference sample for soil comparisons

Shoe Impressions

- Impressions in snow can be cast using “Sno-Print” wax to fix the details and then cast with casting stone made with ice water (plaster and similar materials generate heat as they cure)
- Standing water in an impression in soils can be removed with an eyedropper
- Impressions in deeper standing water can be cast by sifting dry casting material into the water and allowing it to accumulate in the impression

Shoe Impressions

- Transport and storage:
  - Recovered impressions should be kept flat and protected from mechanical damage
  - Castings should be allowed to air dry thoroughly in dry room air before storage to minimize mold growth or damage to other stored materials

Shoe Impressions

- Examination:
  - Evidence impressions can be visually examined for:
    - Shoe type
    - Manufacturer identification
    - Size
    - Unusual wear features
    - Trace evidence

Shoe Impressions

- Exemplars may be collected from shoe stores to aid in identification
- Identification to a particular shoe depends on the number and character of points of individuality (holes, chips, cuts, etc. resulting from wear. These features may change if the shoe is worn frequently over a period of time, possibly to the point of preventing identification
- Shoe prints can also reveal where a perpetrator walked during the crime

Toolmarks

- Impressions of a hard object deforming a softer material

Toolmarks

- Can be affected by:
  - Heat (deforming the material)
  - Water (rusting the “tool” or the surface)
  - Ash (corrosion or physical obscuration)
  - Mechanical damage (collapse or removal)
  - Fire (destruction)

Toolmarks

- Recognition
  - Can be on any surface: wood (door or window frames), aluminum (door or window frames), brass (lock plates), pot metal (door locks, door knobs), soil
  - May be hidden: cans (containers for ignitable liquids)

Toolmarks

- Most likely around entry points
- Can be impressed (stamped) or striated (scraped) or both

Toolmarks

- Documentation
  - Photos (photos alone are rarely adequate to allow identification of specific tool responsible)
  - Overall location
  - Orientation
  - Close-up with ABFO scale
  - Notes/sketch – with location, orientation/ direction

Toolmarks

- Documentation
  - Notes/sketch – with location, orientation/ direction
  - Height above floor or ground should also be documented
  - Look for and document any possible trace (transfer) evidence (paint, mortar, etc.)

Toolmarks

- Recovery
  - If at all possible, the object bearing the impression should be recovered
  - If not recoverable, or likely to be damaged by recovery or transport, the impression should be cast in a suitable medium

Toolmarks

- Recovery
  - Best materials
    - 2 part forensic casting silicone rubber (such as Mikrosil)
    - Dental impression rubber
    - Silicone rubber sealant – modeling clay
  - Rigid materials (plaster/wax) not recommended

Toolmarks

- Recovery
  - Mix according to directions – avoid bubbles
  - Place “dam” of clay around impression
  - Pour or spoon
  - Allow to dry or cure thoroughly
- Label orientation (North)
- Prepare envelope, tag, or box
- Collect comparison sample of paint or other substrate for comparison to tool

Toolmarks

- Be aware that the tool responsible MAY be still at the scene so collect and preserve tools having the approximate class characteristics – pliers, wrench, hammer, screwdriver, etc.
- Comparisons may be on the basis of class characteristics (type, width, shape) or individual characteristics (features acquired through use and damage)

Toolmarks

- Packaging
  - Suitable sturdy container
  - Tape paper over impression
  - If tool recovered, protect ends with envelope or folded paper taped to tool
  - Label
  - Keep dry

Fingerprints (Palm prints)

- Most likely evidence to link a specific person with a scene or artifact
- More likely to be left behind (and found) than DNA materials
- Extensive databases in existence for decades and computer searchable now

Fingerprints

- Can be affected by:
  - Heat – evaporating “oils,” degrading substrate
  - Moisture – compromising chemical treatment
  - Water
  - Ash – obscuring
  - Soot – coating and obscuring
  - Fire – destroying substrate
  - Physical damage during suppression

Fingerprints

- Recognition
  - May be:
    - Latent – transfer of ridge detail via normal skin “oils” (water, salts, proteins, oils, cosmetics)
    - Patent – visible without any special treatment – colored transfer medium, blood, paint, grease
    - Plastic – 3D impression molded into soft material
  - May be left on any smooth surface or some textured surfaces

Fingerprints

- Recognition
  - Search using oblique illumination
  - Search using soft “direct” illumination
  - Susceptible or likely surfaces should be recovered for lab exam even if no prints “visible”

Fingerprints

- Documentation
  - Photography – location and close-up with ABFO scale
  - Sketch – location and orientation (if known)
  - All patent prints found at the scene should be photographed before collection (in case they are damaged during collection or transport

Fingerprints

- Techniques today allow recovery of prints from many surfaces once thought to be useless – wet, soot-covered, rough, textured – if an object could possibly have been the focus of the person – take it!

Fingerprints

- Collection
  - Objects suspected of bearing latent prints can be collected at the scene for lab processing or
  - Some processing techniques can be used at the scene

Fingerprints

- Collection
  - Smooth, clean, dry surfaces suspected of bearing latent prints can be dusted at the scene using a fiberglass (Zephyr) brush and black dusting powder or MagnaBrush
  - All other surfaces should await lab processing

Fingerprints

- Surfaces that are (or have been) wet can still yield prints
  - Non-porous metal items like guns or tools should be kept WET until processed to avoid rusting (use a snap lid plastic food container)
  - Such items are processed with Small Particle Reagent (a slurry of molybdenum disulfide in a water/detergent suspension)
  - SPR can be applied at the scene to large fixed items that are wet (swimming pool ladders, boats)

Fingerprints

- Wet Items:
  - Paper/cardboard: Can be rinsed and treated with a process called Physical Developer that reacts with the fats and oils
  - The resulting prints are then photographed

Fingerprints

- Faint or partial fingerprints in blood can be enhanced with washing with:
  - Ninhydrin solution
  - Amido black solution
  - Leuco crystal violet (LCV) solution

  These are toxic and are best used in the lab but wall and cabinet surfaces can be processed at the scene with appropriate PPE. When applied to soot-covered surfaces they wash the soot off, further enhancing the print

Fingerprints

- High intensity forensic light sources such as the PoliLight or Luma-Light can enhance latent or faint patent impressions for photography without chemical treatment (and thereby eliminate the risk of damaging the print)
- They work by causing the latent residues to fluoresce against a darker background or cause the latent residue to absorb (darken) against a fluorescing background

Fingerprints

- To work effectively they require:
  - A fully darkened room (not like on CSI!)
  - Adjustable wavelength sources (not the flashlights on CSI!)
  - Suitable barrier filters (to match the wavelengths being used from the light source)
  - Suitable photographic equipment and expertise

Firearms Evidence

- Consists of three basic elements:
  - Weapon
  - Projectile
  - Casing

  With today's powerful computer databases, fired projectiles and casings are much more likely to be linked to a weapon than in past years.

  Linkages are made through microscopic toolmarks made by the weapon on the casings or projectiles

Firearms Evidence

- Firearms evidence is subject to damage in a fire from:
  - Heat/ flames – melting or distortion
  - Smoke - contamination or corrosion
  - Water – corrosion
  - Mechanical damage from the fire, suppression or overhaul

Firearms Evidence

- Projectiles
  - Made from:
    - Lead (alloy)
    - Lead in a copper or steel jacket

    (So they can MELT at relatively low temperatures)
    - Steel (that can corrode)
- Also shotgun wads: fiber or plastic and plastic sabots (from specialty weapons)
  - That can melt or combust

Firearms Evidence

- Casings”
  - Brass
  - Nickel plated brass or steel
  - Plastic (shot shells)
  - Paper/cardboard (shot shells)

  All of which are soft (easily crushed or markings obliterated)

  Some are combustible

Firearms Evidence

- Weapons:
  - Steel with various finishes
  - Steel alloys
  - Zinc alloys
  - Carbon fiber
  - Plastics

  The effects of fire can vary widely to nearly complete destruction or obliteration

  The critical surfaces are the interior of the barrel, the firing pin, any ejector or extractor mechanisms, and magazine (edges)

Firearms Evidence

- Documentation (Before Handling):
  - Notes:
    - Cocked or uncocked
    - Location
    - Debris below or on top
  - Sketches:
    - Location/ distances to fixed reference points
    - Location of bullet holes (include height above floor)
  - Photograph in place:
    - Orientation/location
    - Close-up

Firearms Evidence

- Recovery:
  - Weapons: ENSURE SAFETY FIRST – ASSUME EVERY WEAPON IS LOADED (UNTIL PROVEN OTHERWISE)
  - Position of the cylinder and its loads must be documented
  - Sequence of loads in magazine may be important
  - Removing the magazine from a semi-auto or automatic weapon MAY leave a round in the chamber. Always work the action and inspect the chamber

Firearms Evidence

- Projectiles (bullets)
  - Are generally SOFT and easily damaged
  - Recover with fingers or rubber-covered forceps ONLY
  - DO NOT use steel tools (like pocket knife)
  - If the projectile is embedded, recover the substrate by cutting a portion out well away from the hole and submitting that
  - Do not mark the projectile except with a SOFT felt tip pen (Sharpie)
  - Allow to air dry before packaging in paper or plastic envelope

Firearms Evidence

- Casings:
  - Recover with fingers or rubber-coated forceps (some surfaces are soft and easily damaged)
  - Do not mark except with a SOFT felt-tip pen (Sharpie)
  - If wet allow to air dry before packaging
  - Place in dry clean container (plastic bag, or vial, paper envelope, or box.

Firearms Evidence

- Weapons should be hand-carried to the lab
- Many agencies have special cases with steel end plates for transporting weapons
- Be sure to submit all recoverable components – even if fire-damaged (magazine, stock, grips, forearm, etc.)

Firearms Evidence

- Be sure to consult your local crime lab for special guidance or policies and what services they provide
- Ask about any training materials or advisory bulletins.