Vermont Forensic Laboratory
Physical Comparison Unit

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Locard’s Exchange Principle

“It was Locard’s belief that when a criminal came into contact with an object or person, a cross-transfer of evidence occurs.”

- Richard Saferstein

1
Locard’s Exchange Principle

“Wherever he steps, whatever he touches, whatever he leaves -- even unconsciously-- will serve as silent evidence against him. Not only his fingerprints or his shoeprints, but also his hair, the fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen that 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 wholly be absent. Only in its interpretation can their be error. Only human failure to find, study, and understand it can diminish its value.”

- Paul L. Kirk
What is Forensic Science?

- Forensic Science is the application of science to law.

- “Forensic science is the application of science to those criminal and civil laws that are enforced by police agencies in a criminal justice system”¹

- “Criminalistics is concerned with the recognition, identification, individualization and evaluation of physical evidence using the methods of the natural sciences in matters of legal significance”²
What is a Forensic Scientist?

- “...one who performs investigatory examinations and laboratory tests to reach a conclusion”
  - Crime Scene Investigation
  - Lab Analysis

- “…a communicator and interpreter of those finding... he must be able to explain the methods used to reach those conclusion in a court of law…”
  - Report Results (oral and/or written)
  - Court Testimony
What is considered evidence?

- Bite Marks
- Blood and Body Fluids
- Bones
- Broken Fingernails (striations)
- Drugs
- Explosives
- Fiber
- Fingerprint
- Firearm Powder Residues
- Firearms and Tool Marks

- Glass
- Hair
- Ink
- Paint
- Petroleum Products
- Questioned Documents
- Shoeprints and Tire Tracks
- Soil and minerals
- Teeth
- Toxicology
What is NOT forensic evidence?

- ?
- ?
- ?
- ?
The value of evidence

- **Class Characteristics**
  - Properties of evidence that can be only associated with a group and never with a single source

- **Individual Characteristics**
  - Properties of evidence that can be attributed to a common source within an extremely high degree of certainty
Physical Comparison Unit

- Latent Print Processing
- Fingerprint Comparisons
- Indented Writing
- Firearms/Toolmarks
- Shoewear and Tire Tread Impressions
- Physical Match
- Forensic Photography
Fingerprints
What is a Fingerprint?

- Friction skin located on the fingers of the palm side of the hand from the first joint to the nail bed
  - Areas of skin bearing ridges and furrows
  - Corrugated skin on the volar areas of the skin

- Specialized for traction
Other types of friction skin...

- Palm
- Fingers – area between first joint and the palm
- Feet – soles of feet
- Toes
Loops

- One or more ridges entering from one side of the print, recurving, and exiting from the same side
  - Ulnar – opens towards the little finger
  - Radial – opens towards the thumb
Whorls

- Enters from both sides and ridge flow that is circular in nature
  - Divided into four distinct groups
Arches

- Ridges that enter on one side and flow or tend to flow out the other with a rise in the center
  - Divided into two distinct groups
Fingerprint Individual Characteristics

- Details within the ridge flow that represent a unique occurrence (type, relative location, orientation and number)
  - Ending ridge
  - Bifurcation
  - Dot

- Also known as
  - Galton Details
  - Minutiae
  - Points of Comparison

- Random genetic expression
Ending Ridge

A ridge that follows a distinct path and ends abruptly
Bifurcation

Ridge that follows a distinct path and divides into two ridges
Dot

A ridge unit that is as long as it is wide
Scientific Basis

- Fingerprints can be used for individualization because they are
  - Unique
  - Permanent
Uniqueness

- No two individuals or two fingers from the same hand share the exact friction ridge detail
  - In over 100 years of billions of friction ridge comparisons, no one has yet to find two areas of friction skin from different sources with the same ridge configuration

- Identical twins
  - Same genetic make-up
  - How would this manifest itself in fingerprints?
Permanence

- During fetal development, friction ridges are formed and are permanent throughout life until death and decomposition.

- Except in instances of permanent scarring or amputation.
  - Are these unique characteristics?
Latent Prints

- Generic term used to describe **ANY** evidentiary print recovered from a crime scene
- The *unintentional* recording of friction ridge skin
- A reproduction of the friction ridge skin information left on an object when touched
- The transfer of material from a surface to the friction ridge skin
Evidentiary Prints

- **Latent / Invisible**
  - Ridge impressions caused by the transfer of body perspiration or oils to the surface of an object requiring development or enhancement for their visualization

- **Patent / Visible**
  - Ridge detail transferred to a surface after the ridges have been in contact with a colored material such as blood, paint, grease, or ink

- **Plastic / Impression**
  - Ridge impressions left on a soft material such as putty, wax, soap or dust
Exemplar Prints

- The **intentional** recording of friction ridge skin from a known individual in a controlled environment for documentation, classification, or comparison

- **Form of collection**
  - Ten print card
  - Major case records
  - Post-mortem prints

- Examples of collection
  - Arrest
  - Military record
  - Job requirement
  - Subpoena
  - Driver’s license
  - Birth
Friction Ridge Comparison

- Identifications are affected by viewing these ridge characteristics taking into consideration their similarity, their number and their unit relationship to each other

- NO UNEXPLAINABLE DIFFERENCES
LATENT PRINT
(Source of print)
(Exhibit No.)

KNOWN PRINT
(Name of individual)
(Exhibit No.)
LATENT PRINT
(Source of print)
(Exhibit No.)

KNOWN PRINT
(Name of individual)
(Exhibit No.)
LATENT PRINT
(Source of print)
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(Exhibit No.)
LATENT PRINT
(Source of print)
(Exhibit No.)

KNOWN PRINT
(Name of individual)
(Exhibit No.)
Recording Exemplars
Recording Exemplars
Indented Writing

1qt milk
Loaf of Bread
Chips
Dip
Six Pack Schitz
Obliterated Writing

Original

Viewing with IR Filter
Firearms and Toolmarks
Firearms

Firearms Examinations

- Fired Bullets
  - general characteristics such as caliber
  - physical features of rifling impressions
  - manufacturer of bullets

- Cartridge Cases or Shotshell Casings
  - caliber or gauge
  - manufacturer
  - presence of marks for comparison

- Shot Pellets, Buckshot, Slugs
  - size of shot
  - gauge of slug
  - manufacturer

- Wadding
  - components can determine gauge and manufacturer
Firearms

- **Firearms Examinations, cont.**
  - **Gunshot Residue**
    - indication of holding/firing weapon
    - chemical components
  - **Shot Pattern**
    - type of gun
    - distance from muzzle
  - **Bullet and Casing**
    - matched back to gun (ejector, firing pin, breechblock, and extractor marks)
    - matched back to same lot of ammunition found in suspect's possession
Firearms

- A bullet is impressed with the rifling markings of the barrel when it emerges from the weapon.
Firearms Examination

- Photomicrograph of two bullets through a comparison microscope. The test bullet is on the right; the questioned bullet is on the left.
Physical Matching
Crime Scene Search
References


