

Michigan State
Police
Forensic Science Division
Bridgeport Regional Laboratory

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Forensic Science

- Application of scientific principles to civil and criminal laws that are enforced by police agencies.

Role of the
Forensic Scientist

- To receive evidence.
- To examine that evidence by applying the principles and techniques of the physical and natural sciences.
- To form a conclusion as to the results of the examination.
- To generate a report.
- To testify to that conclusion and the steps taken to reach that conclusion in a court of law.

Locard Exchange Theory: or Theory of Transfer and Exchange

- The perpetrator will leave traces of him/herself on the victim and/or at the scene.
- A fleeing perpetrator will take away traces from the victim and/or the scene on him/herself.
- The perpetrator, victim and/or scene will retain these traces for a period of time.

Services offered by the Bridgeport Laboratory


- Latent Prints Unit
- Biology Unit
- Micro-trace Unit
- Firearms and Toolmarks Unit
- Narcotics Unit
- Crime Scene Processing and Reconstruction

Bridgeport is part of the Third District.
We process evidence for 14 counties.



The Latent Print Unit

- Processes evidence for latent prints
- Enter prints into the AFIS database
- Compare suspect known prints to evidence prints
- Identify unidentified remains
- Process crime scenes and vehicles for latent prints



AFIS Terminal

What Makes a Latent Print?


The matrix that forms the print is the

- Actual substance deposited by the friction ridges
 - Sebaceous Glands secrete oils
 - Eccrine Glands secrete perspiration
 - Perspiration contains:
 - 98.99% water
 - 2% solids, Sodium chloride (salt), amino acids, lipids, fatty acids, urea, albumin and acetic acids
 - Other contaminants
 - water, blood, paint and oils.

The latent print has three levels of Detail that can be used to identify the print to an individual.

Level 1 Detail

- There are three basic fingerprint patterns.
 - Loops (60-65%)
 - Whorls (30-35%)
 - Arches (5%)



Level 2 Detail

- Variations in ridge path configurations may include:
 - ridge endings
 - bifurcations
 - enclosures
 - short ridges
 - ridge dot



Other Level 2 Details

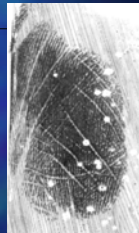
- Other characteristics
 - accidental features



Scars



Incipient Ridges



Flexion Creases

Level 3 Detail

- Ridge shape
- Pore location
- Other minute characteristics



Three Types of Crime Scene Fingerprints

- Visible Prints
 - are made by fingers touching a surface after ridges have been in contact with colored material; such as blood, paint, grease or ink
- Plastic Prints
 - are ridge impressions left on a soft material such as putty, wax, soap or dust
- Latent or Invisible Fingerprints
 - ridge impressions caused by the transfer of perspiration or contaminants, such as oils from the face and hair, to the surface of an object.

Latent Print Unit

- Process evidence for the presence of latent prints using:
 - Powders
 - typically gray and black
 - white powder and magnetic powder
 - sometimes fluorescent powders (Red Wop, Green Wop)
 - Chemicals
 - Ninhydrin
 - Cyanoacrylate Ester
 - Lasers
 - using fluorescent dyes

Super Glue Fuming

- Objects with smooth surfaces like baggies, guns, cans, bottles, knives, etc. they are excellent candidates for this process.
- Super glue is heated and vaporized in the glue chamber. It will adhere to the latent prints on the object.



On objects with dark surfaces the white super glue print may show up well and can be photographed



On light or patterned surfaces the print may need to be processed further with powders or fluorescent dyes to see and photograph.



Super glue print after powdering

Dye stained super glue print fluoresced using the alternate light source





Chemical processing of an apparent bloody print on a branch found near the victim. The print was processed with Amido Black, a chemical process that stains proteins in the bloody print.



Firearms and Toolmarks Unit

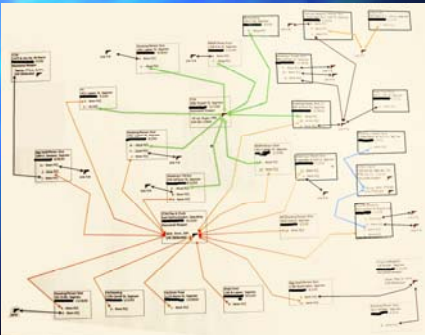
- IBIS Database
- Firearm/Projectile Identification
- Distance Testing
- Serial Number Restoration
- Toolmarks Identification

IBIS / NIBIN

- Integrated Ballistic Identification System (equipment) / National Integrated Ballistic Information Network (database)
- Database of fired bullet and FCC images
- Test fired items entered
- Crime scene evidence entered
- Computer algorithm compares images

IBIS is used to link shooting scenes from fired cartridge case evidence left at the scene



When a firearm is received....

- Firearm to Projectile and Fired Cartridge Case Identifications
- IBIS (International Ballistics Identification)
- Distance Testing and Trajectory Analysis
- Serial Number Restoration

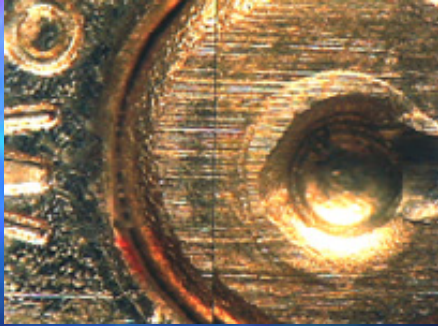


Test firing the suspected gun





The firearms examiner uses a specially designed comparison microscope to compare questioned to known firearms and tool mark evidence.

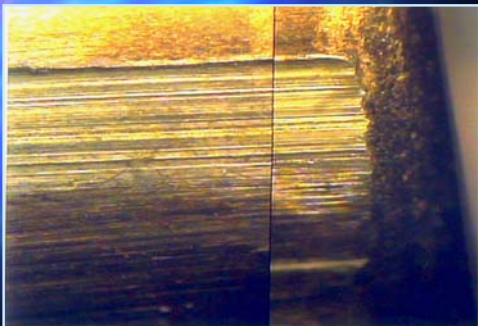


On Fired Cartridge Cases they compare ejector marks, firing pin marks and breach face marks.

Rifling in the barrel



Questioned bullet compared to known bullet



Distance determination is done when the victim's clothing has firearms damage and the firearm used is submitted and same ammunition utilized in the crime

Two chemical tests are used on the clothing to test for a gunshot pattern.

- Sodium Rhodizonate (SORHO) identifies vaporous lead.
- The Greiss test looks at the pattern of nitrites.

The size of the patterns found on the victim's clothing will need to be compared to the gun used.



SORHO pattern


When the gun identified (by fired bullets or fired cartridge cases identified) as the gun that shot the victim is submitted it is test fired at different distances to measure the SORHO and Nitrite patterns at varying distances. Every make and model firearm will vary in the size of the pattern at different distances. The test patterns are compared to the patterns from the evidence

The comparison results will be a range at which the muzzle of the firearm could have been from the victim when shot.





Firearms trajectory is done at the scene to locate where the shooter was. If that location is found there may be other evidence to possibly identify the shooter.





Controlled Substance Unit

- Analysis of Controlled Substances
 - Marijuana
 - Cocaine
 - LSD
 - Heroin
 - Pharmaceuticals

Methods used to identify drugs

- Identification of a controlled substance is done by chemical means
- Two tests (minimum)
 - Infrared Spectroscopy
 - Gas Chromatography
 - Mass Spectrometry
 - Microcrystal Test
 - For prescription tablets or capsules, a published reference identifying substance by markings, size, shapes and colors



Marihuana

- Analyzed differently because the plant is controlled by law
- Microscopic test
- Color test




Analyst examines the suspected plant material
for the identifying features of marijuana





Marijuana plant hairs
Glandular Hairs contain the active ingredient (THC)
Cystolith hairs have calcium carbonate at the base



Cocaine

Erythroxylon coca Plant

The dried leaves are chopped very small, extracted in solvent, filtered and the solvent is evaporated. This results in a coca paste! This paste is then processed into Cocaine.



Infrared Spectroscopy

- The infrared spectrum is unique for each substance
- This makes IR a **CONFIRMATORY** test for a pure substance such as a drug



Crystal test used for cocaine and heroin



Gas Chromatography/Mass Spectrometry

Gas Chromatography:

- Separation technique
- Separates mixtures based on chemical properties
 - Acid/base
 - Size
 - Polarity

Mass Spectrometry

- Mass spectrometer bombards molecules with beam of electrons
- Molecule breaks apart into stable, reproducible fragment ions
- Pattern of fragments is unique and can ID the molecule



Micro-Trace Unit

- Trace Analysis Done at the Bridgeport Lab
 - Footwear and Tire Track Evidence
 - Ignitable Liquid Residue
 - Physical Match
 - Miscellaneous Trace
- Trace analysis transferred to other MSP Labs
 - Fibers
 - Paint
 - Glass
 - Explosive Residue
 - Light Bulb On/Off Determination

Footwear and Tire Track Evidence



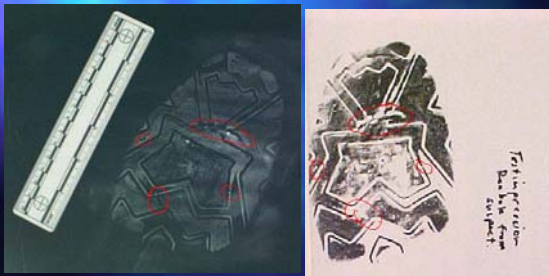
Footwear and Tire Track analysis

- Footwear and tire track impressions can be identified back to a shoe/boot or tire that made the impression.



Footwear and Tire Track analysis

- The accidentals identify the shoe to the impression

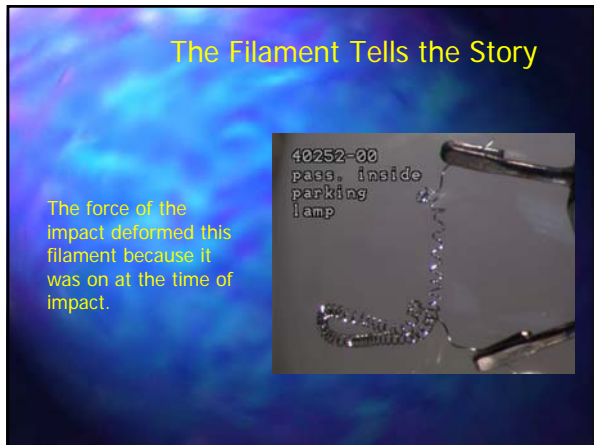


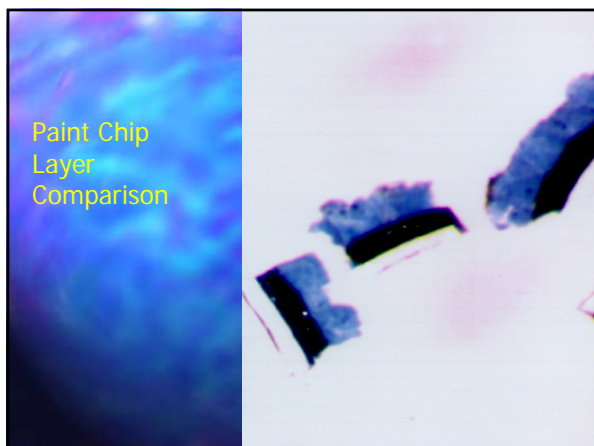






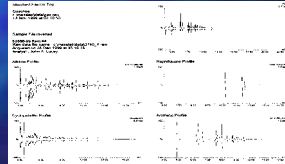






Ignitable Liquid Residue

After the fire is put out investigators bring in samples they think may have ignitable liquids in. Using a GC/MS the vapor from the sample is analyzed. Then the analyst will report if an ignitable liquid was present in the sample.



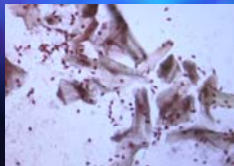
Biology Unit

- Test for Presence of Serological Fluids
 - Blood
 - Semen
 - Saliva
 - Hair for DNA suitability
- Blood Stain Pattern Recognition
- DNA testing is done at the Lansing Regional Laboratory

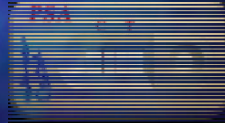
Criminal Sexual Assault Cases

- The CSC Kit is submitted by agency to find biological evidence of the suspect.
- The CSC Kit contains possibly the most intimate transfer and can help prove penetration
- Looking for semen, saliva, blood and hairs
- Clothing and bedding are processed only if no evidence is found in the CSC kit.

Test Used to Identify Semen



- Acid Phosphate Spot Test indicates the possible presence of seminal fluid
- Smears in the kit or a stain from clothing or bedding is used to look for actual sperm cells
- If no sperm is found we use an immunological test to further show the possible presence of seminal fluid.



Blood Evidence

- Homicide cases may have blood from the victim and/or the suspect.
- CSC and Assault cases
- Robberies and breaking and entries
- Blood Pattern evidence may be left at the scene which can help explain the circumstances of the crime.

We use a spot test to indicate the possible presence of blood (Phenolphthalein, or Hemastix).



We then use an immunological test for human hemoglobin which indicates the presence of human blood.



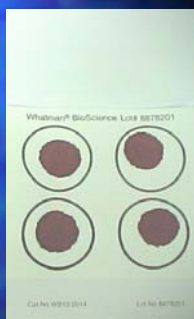
Known DNA samples

☑ With the change to PCR DNA analysis, a less invasive method called buccal swabs has been developed to collect DNA samples from suspects and victims

☑ The person's cheek inside their mouth is swabbed and the swab dried and submitted to the laboratory.



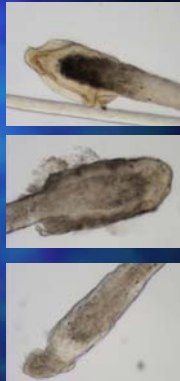
Known blood samples received are dropped on a DNA card and dried. A portion of the dried blood is cut and sent as the DNA known. Most liquid blood known samples come from autopsies.



Hair Examinations

- The questioned hairs are evaluated for DNA suitability.
- Hairs submitted in the CSC Kits - we do a gross visual examination between the victim's known hairs and the combings.
- If there is a hair that appears to be different from the victim's and it is suitable for DNA, It could be sent for analysis if no other biological evidence is identified
- Microscopic comparisons are no longer done in the MSP Laboratories.

The only Microscopic Examination done on hairs is to evaluate the suitability of a hair for DNA analysis. We will mount the hair and using low power microscopy we examine the root for a root tag, root sheath or germinal nipple



Clothing/Bedding

- If no biological evidence is located in the CSC Kit then clothing, bedding or other evidence may be submitted.
- In cases where the kit was collected two or more days after the assault the clothing/bedding may contain the evidence needed to prove the assault occurred.
- Examine the clothing/bedding for trace evidence (hairs, fibers, other)
 - Macroscopic
 - Lint tapes
 - Scraping with Spatula
 - Alternate Light Source for fibers
- Examine the clothing/bedding for stains (semen, blood, saliva, sweat, nasal secretions, etc.)
 - Macroscopic and bright light for blood
 - Laser or UV light other biological stains

Using an Alternate Light Source to Locate Body Fluid Stains

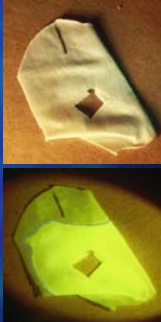
Semen and other body fluids fluoresce when illuminated with ALS (Alternate Light Source) or UV (Ultra Violet) light. Blood does not fluoresce, however it absorbs the light and will show as a dark stain on the fabric.



A portion of a sock supporting a semen stain

Top is normal light. Stain is not visible


Using the Alternate light source, the stain fluoresces and can be easily marked for testing.



Tape Lifts

•3M Book tape is used. It is 3 inches wide, and with the tape rolled back around the roll a garment can be quickly rolled to pick up hairs and fibers.

•Before putting tape lift on a clear protector sheet the hairs are removed and placed in a paper packet.



Other Types of Evidence

- Fingernail Scrapings/Cuttings
- "Date Rape Drugs"
 - Alcohol, GHB, Ketamine, many others
 - Many disappear quickly from the body (GHB only found in blood up to 6 hours, 12 hours in urine)
- Bitemarks
 - Swab for DNA
 - Photography by forensic odontologist

Crime Scene Processing and Reconstruction

- Securing the scene is very important to protect evidence.
- A crime scene crew is assembled with personnel needed for the type of crime committed.
- Documentation i.e. Photographs, notes, sketches and/or video.
- Document and collect physical evidence and package to bring to the crime lab for analysis.

Contact Information



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