

FRSC1011HB

Physical Evidence

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CHAPTER 5

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Lecture overview

Physical evidence

- Attributes and use

Case example

Examining physical evidence

Classifying characteristics

Forensic Databases

Branches of Forensic Science

Kinds of Evidence

Physical evidence

- Real evidence, generated as a result of a crime committed

Demonstrated evidence

- Fabricated evidence often used to explain physical evidence
 - E.g. a demonstration of blood spatter characteristics

Using Physical Evidence

Physical evidence is circumstantial

- Inference of contact, but not knowledge or observation

Physical Evidence

- Aids in linking a perpetrator or victim to the scene of a crime
- Is often the deciding factor in determining guilt or innocence of suspect(s)

Using Physical Evidence

- As the number of different objects linking an individual to a crime scene increases, so does the likelihood of that individual's involvement with the crime.
- Just as important, a person may be exonerated or excluded from suspicion if physical evidence collected at a crime scene is found to be different from standard/reference samples collected from that subject.
- Inculpatory evidence vs Exculpatory evidence

What Can Physical Evidence Tell Us

Modus Operandi

- Method by which the crime was committed
- Criminals' signature

Links suspects/victims to primary/secondary scenes

- Locard's Exchange Principle

Support / refute witness statements

Case Study Example

Forensic Science: An Introduction to Scientific and Investigative Techniques - James and Nordby

In April 2005, a body was discovered in a bedroom

The man was dressed only in a towel and was shot twice at close range with a shotgun

No sign of forced entry

Witnesses

Two teenaged girls, acquainted with the 50 y.o. victim

- One girl visited and drank with the man periodically during the previous 3y
- The other girl had been romantically involved with the lead suspect in the case

Both denied knowledge of the death

- However, when they became the focus of the investigation, they both provided detailed statements of what happened

Witness' Statement

According to the girl who drank with the victim, she was an eye witness to the shooting

- Suspect hid behind the door to the bedroom and emerged to face the victim who entered the bedroom from the hallway
- First shot was in the hallway near the door
- Second shot was fired as the victim stumbled forward into the bedroom

Witness' Statement

- The suspect held a pillow in front of the shotgun
- Shots were fired while the suspect was partially hidden behind the bedroom door

The Physical Evidence Tells a Different Story

No Shotgun pellets were found in the hallway

- Shotgun was fired from the hallway into the bedroom

Blood spatter on the wall next to the doorway is consistent with an arterial gush

- Indicating the victim was facing the hallway just inside the doorway when shot

Pillowcase had several small tears in the upper portion

- Consistent with a glancing blast or discharge from a shotgun muzzle

Case Conclusion

The physical evidence collected together with crime scene documentation, investigators were able to reconstruct the scene of events refuting the eyewitness' account of what happened

Examining Physical Evidence

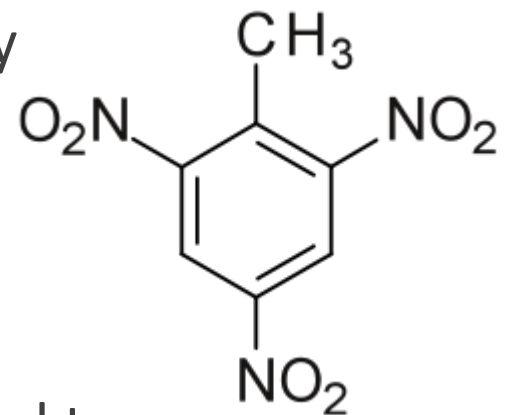
- Identification has, as its purpose, the determination of the physical or chemical identity of a substance (with as near absolute certainty as existing analytical techniques will permit).
- A comparison analysis subjects a suspect specimen and a standard/reference specimen to the same tests and examinations for the ultimate purpose of determining whether or not they have a common origin.

Identification

- The process of identification first requires the adoption of testing procedures that give characteristic results for specific standard materials.
- Once these test results have been established, they may be permanently recorded and used repeatedly to prove the identity of suspect materials.
- Second, identification requires that the number and type of tests needed to identify a substance be sufficient to exclude all other substances.

Common Types of Identification

- The crime laboratory is frequently requested to identify the chemical composition of an illicit drug.
- It may be asked to identify gasoline in residues recovered from the debris of a fire, or it may have to identify the nature of explosive residues—for example, dynamite or Trinitrotoluene.
- The identification of blood, semen, hair, or wood are also very common and, can be used to determine species origin.



Role of Probability

- To comprehend the evidential value of a comparison, one must appreciate the role that probability has in ascertaining the origins of two or more specimens.
- Simply defined, *probability* is the frequency of occurrence of an event.
- In flipping a coin, probability is easy to establish.
- With many analytical processes exact probability is impossible to define.

Classifying Characteristics

Individual Characteristics

- Evidence that can be associated to a common source with an extremely high degree of probability is said to possess individual characteristics.

Class Characteristics

- Evidence associated only with a group is said to have class characteristics.

Individual Characteristics

- Matching ridge characteristics of two fingerprints
- Random striation markings on bullets, or tool marks
- Irregular and random wear patterns in tire or footwear impressions
- Handwriting characteristics
- Piecing together irregular edges of broken objects

Individual Characteristics

- In all cases, it is not possible to state with mathematical exactness the probability that the specimens are of common origin.
- It can only be concluded that this probability is so high that the specimens cannot be excluded from being of a common origin.

Class Characteristics

- A crime scene laboratory may be unable to relate physical evidence to a common origin with a high degree of certainty.
- Evidence is said to possess class characteristics when it can be associated only with a group and never with a single source.
- Probability is a determining factor.
- The high diversity of class evidence in our environment makes their comparison very significant in the context of a criminal investigation.

Class Characteristics

- The value of class physical evidence lies in its ability to provide corroboration of events
- When dealing with more than one type of class evidence, their collective presence may lead to an extremely high certainty that they originated from the same source

Crossing Over

Crossing over the line from class to individual does not end the discussions.

Questions like the following, defy simple answers and are the basis of arguments.

- How many striations are necessary to individualize a mark to a single tool and no other?
- How many color layers individualize a paint chip to a single car?
- How many ridge characteristics individualize a fingerprint?
- How many handwriting characteristics tie a person to a signature?

Natural vs. Evidential Limits

There are practical limits to the properties and characteristics the forensic scientist can select for comparison.

- Modern analytical techniques have become so sophisticated and sensitive that natural variations in objects become almost infinite.
- Carrying natural variations to the extreme, no two things in this world are alike in every detail.
- Evidential variations are not the same as natural variations.
- Distinguishing variations of evidential use from natural variations is not always an easy task.

Databases

Forensic Databases - USA

- The Integrated Automated Fingerprint Identification System (IAFIS)
 - Fingerprint and criminal history system maintained by the FBI
- The Combined DNA Index System (CODIS)
 - Electronically exchange and compare DNA profiles
- The National Integrated Ballistics Information Network (NIBIN)
 - Compare markings made by a firearm on bullets and cartridge casings
- SICAR (shoeprint image capture and retrieval)
 - Shoeprint database

Canadian Forensic Databases

Canadian Criminal Real Time Identification Services (CCRTIS)

- National repository of fingerprint and criminal record information
- Provides direct operational support to the Canadian law enforcement, criminal justice and public security communities
- International partners including the FBI and Interpol (i.e. AFIS)

Canadian Forensic Databases

The Canadian Integrated Ballistics Identification Network (CIBIN)

- A national network of Integrated Ballistics Identification System (IBIS) instruments that collect, analyse and correlate fired bullets and cartridge cases in a central database to generate investigative leads for police

Canadian Forensic Databases

National DNA Data Bank is responsible for two principal indices:

- The **Convicted Offender Index** (COI) is the electronic index that has been developed from DNA profiles collected from offenders convicted of designated primary and secondary offences identified in section 487.04 of the Criminal Code (DNA Designated Offences, <http://www.rcmp-grc.gc.ca/nddb-bndg/form/ddo-did-eng.htm>)
- The **Crime Scene Index** (CSI) is a separate electronic index composed of DNA profiles obtained from crime scene investigations of the same designated offences addressed in the Act.

Canadian Forensic Databases

The Canadian Bomb Data Centre (CBDC)

- National repository for data relating to the criminal use of explosives
- Responsible for holding information concerning the components and use of real or hoax improvised explosive and incendiary (inflammatory) devices (IEDs), thefts and recoveries of explosives, and suspects in reported explosives incidents

Canadian Forensic Databases

The National Sex Offender Registry

- A national registration system for sex offenders who have been convicted of designated sex offences and ordered by the courts to report annually to police
- Not available to the public

International Forensic Database

The International Forensic Automotive Paint Data Query (PDQ)

- Chemical and color information pertaining to original automotive paints
- Including the make, model, year and assembly plant of the vehicle
- Hosted by Canada, Contributors include
 - RCMP
 - Provincial Forensic Laboratories in Ontario and Quebec
 - 40 American Forensic Laboratories
 - Police Agencies in 21 other countries

Branches of Forensic Science

COLLECTING OTHER FORMS OF PHYSICAL
EVIDENCE

Forensic Pathology

Forensic Pathology involves the investigation of unnatural, unexplained, or violent deaths.

- Forensic pathologists in their role as medical examiners or coroners are charged with determining cause of death.
- The forensic pathologist may conduct an autopsy which is the medical dissection and examination of a body in order to determine the cause of death.

Forensic Pathology

After a human body expires there are several stages of death.

- Rigor mortis results in the shortening of muscle tissue and the stiffening of body parts in the position at death (occurs within the first 24 hrs. and disappears within 36 hrs.).
- Livor mortis results in the settling of blood in areas of the body closest to the ground (begins immediately on death and continues up to 12 hrs.).
- Algor mortis results in the loss of heat by a body (a general rule, beginning about an hour after death, the body loses heat by 1 to 1 1/2 degrees Fahrenheit per hour until the body reaches the environmental temperature).

Beyond the Crime Scene

- The search for physical evidence must extend beyond the crime scene to the autopsy room of a deceased victim.
- Here, the medical examiner or coroner will carefully examine the victim to establish a cause and manner of death.
- As a matter of routine, tissues and organs will be retained for pathological and toxicological examination.
- At the same time, arrangements must be made between the examiner and investigator to secure a variety of items that may be obtainable from the body for laboratory examination.

Beyond The Crime Scene

The following are to be collected and sent to the forensic laboratory:

1. Victim's clothing
2. Fingernail scrapings
3. Head and pubic hairs
4. Blood (for DNA typing purposes)
5. Vaginal, anal, and oral swabs (in sex-related crimes)
6. Recovered bullets from the body
7. Hand swabs from shooting victims (for gunshot residue analysis)

Forensic Anthropology

- Forensic Anthropology is concerned primarily with the identification and examination of human skeletal remains.
- An examination of bones may reveal their sex, approximate age, race, and skeletal injury.
- A forensic anthropologist may also help create facial reconstructions to identify skeletal remains.
- The sites where human remains are found must be treated as a crime scene. These scenes must be secured and thoroughly searched.
 - Special tools in use at a “tomb” site include aerial photography, metal detectors, ground-penetrating radar, infrared photography, and “cadaver dogs.”

Forensic Entomology

- Forensic Entomology is the study of insects and their relation to a criminal investigation, commonly used to estimate the time of death.
- By determining the oldest stage of fly found on a body, entomologists can approximate the postmortem interval (PMI).
- For older remains, the sequence of arrival of different insect species can be used to estimate PMI.
- If resources allow, all entomological, or insect, evidence should be collected by a forensic entomology expert who will take temperature readings and collect specimens from every area in which they are found.

Review

Introduction

Case example

Examining physical evidence

Classifying characteristics

Forensic Databases

- USA and Canada

Forensic pathology, anthropology and entomology