

Scientific Evidence

- “Trilogy” of Court Cases
- Crime Labs
- Areas of Expertise
- What constitutes Evidence?

Scientific Evidence in Court

- Must be relevant to the case at hand
- Must be more probative than prejudicial
- Probative evidence: *tending to prove a particular intention or to persuade you of the truth of an allegation*
- Forensic evidence is aimed at informing the court where it lacks expertise.
- Assist in determining fact
- What is admissible evidence?
 - Real Science vs. Pseudo (Quack) Science

Reminder: Locard's Exchange Principle



- The most basic concept of Forensic Science:
 - Criminal in contact with an object or person, cross transfer of evidence occurs
- ♦ First major case: Counterfeit coins
 - ♦ Analyzed metallic particles found in clothing, same as the counterfeit coins

Frye Case (1923, polygraph evidence)

- Use of Polygraph (Lie Detector) in Court
- **Frye Standard**: evidence in question must be **generally accepted** by the scientific community, as testified by experts
 - Technique must be accepted by a “meaningful segment of the relevant scientific community” through
 - Books
 - Papers
 - Prior judicial decisions
 - Length of existence of technique

Problems with Frye:

- Inflexible (and slow) for new developments or extensions of existing techniques and methods.
- Requires complete agreement in the scientific world.

Daubert v. Merrell Dow Pharmaceutical, Inc. (1993)

- Dealt with a product liability case: Plaintiff claimed that prenatal use of **Bendectin** (prescribed for nausea and vomiting during pregnancy) caused serious birth defects
- There were conflicting testimony from experts (Prosecutor vs. Daubert experts)
- Court determined that Daubert evidence did not meet the applicable “general acceptance” standard for the admission of expert testimony.

Daubert Standard

- Supreme Court established alternate standard to Frye for all **Federal evidence** which is more flexible (Federal Rules of Evidence (Rule 702)).
- Assigns trial judge as "gatekeeper" responsible in determining the admissibility and reliability of scientific evidence
 - Criteria for determining value of scientific evidence *may include*:
 - Has the technique been tested
 - Has the technique been subjected to peer review
 - What is the technique's potential error rate
 - Existence of standards
 - Has the method received widespread acceptance within the appropriate community

Allows for authentic scientific breakthroughs

States accepting <i>Daubert</i> :	States staying with <i>Frye</i> :	States with their own tests, or typically a <i>Frye-plus</i> test:
Connecticut Indiana Kentucky Louisiana Massachusetts Missouri New Mexico Oklahoma South Dakota Texas West Virginia	Alaska Arizona California Colorado Florida Illinois Kansas Maryland Michigan Nebraska New York Pennsylvania Washington	Arkansas Delaware Georgia Iowa Military Minnesota Montana North Carolina Oregon Utah Vermont Wyoming



- Federal Courts use *Daubert* Standard
- About half of the State Courts use *Daubert*
- Most Local Courts still use *Frye*.

Joiner Case (1995)

- Case asserted that PCB's caused cancer in plaintiff
- What can an expert claim in court? What is their expertise?
- Testimony must be based on FACT
- There must be close relationships between existing data and opinions

EXPERT WITNESS IN THE FIELD OF
EXPERT WITNESSES



Crime Labs

- Earliest crime lab established by Locard



- 1932, the FBI under J. Edgar Hoover organized a national laboratory that aimed to offer forensic services to all law enforcement agencies in the country. *at no expense*



- ♦ One of the largest and most comprehensive forensic laboratories in the world.
- ♦ Formed the FBI's Forensics Science research and Training Center in 1981

Crime Labs

- Approximately 320 public crime labs operate at various levels of government
- Why are there so many new labs?
 - Increase in Drug analysis (80% involve drugs or alcohol)
 - Rights of defendants
 - Rapid growth of available techniques (DNA profiling, Bloodstains, semen stains, hair and saliva residue, bite marks)
- Four major federal crime labs
 1. FBI (Department of Justice)
 - Largest crime lab in the world
 2. DEA (Drug Enforcement Agency)
 - Responsible for the analysis of drugs seized in violation of laws regulating the production, sale, and transportation of drugs
 3. ATF (Bureau of Alcohol, Tobacco, and Firearms)
 - Responsible for the analysis of alcohol, weapons, and explosives
 4. US Postal

Rationale of Crime Labs

- Before evidence can be properly analyzed it must be recognized, collected and properly packaged at the crime site.
- Ensure the rights of defendants
- Makes sure that evidence is properly handles and tested

Services of Crime Lab

- Physical Science Unit
 - Biology Unit
 - Firearms Unit
 - Document Examination Unit
 - Photography Unit
 - Toxicology Unit
 - Latent Fingerprint Unit
 - Polygraph Unit
 - Voiceprint Analysis Unit
 - Evidence-Collection Unit
- Basic Services**
- Optional services**

Other Forensic Science Services

- There are a number of specialized forensic science services outside the crime lab.
- These services require the involvement of individuals who have highly specialized skills.

Forensic Pathology



- Involves investigation of sudden, unnatural, unexplained or violent deaths
- Must answer basic questions and determine cause of death:
 - Who is victim?
 - What injuries are present?
 - When did the injuries occur?
 - Why and how were injuries produced?

- The **primary role of the medical examiner** is to determine the cause of death (**natural, homicide, suicide, accident, or undetermined**).

Estimating Time of Death by Stages of Decomposition (TOD, PMI)

- Rigor mortis -- stiffness
- Livor mortis – blood settles at lowest level
- Algor mortis – body temp
- Contents of the digestive tract: food remains in the stomach for about 3 hrs after eating.
- Clues from the Eye
- Entomology

Rigor Mortis

- Immediately after death
- Muscles relax then become rigid without shortening of muscles
- Starts within first 24 hours and disappears within 36 hours
- After 48 hours muscles begin to autolysis (dissolve)

Livor Mortis

- Settling of blood in areas closest to ground
- Begins immediately & continues for up to 12 hours
- Skin appears dark blue or purple in areas
- Skin will not discolor in areas where clothes or object restrict areas of body
- This can tell if victim was moved



Algor mortis

- Body temperature continually cools after death until it reaches environmental temperature
- General rule of thumb: body loses 1 - 1.5°F/hr
- Questions: What are some Factors that would affect Algor Mortis?
 - Ambient temperature
 - Wind?
 - Excess body fat?
 - Clothing

Stomach Contents

- Stomach empties 4-6 hours after a meal (varies greatly between people and with type of food ingested)
- Small intestine empty: ~24 hrs after last meal
- Colon empty: ~ 48-72 hrs after last meal

Potassium Levels in Ocular Fluid

- Lens clouds over within several hours
- After death, cells within inner surface of eyeball release K^+ into ocular fluid
- Rate of release help form timeline

Autopsy

- Performed when death seems suspicious or unexplained
- May give conflicting conclusion as to cause of death or may reveal different cause than expected



Forensic Anthropology

- Concerned with the identification and examination of human skeletal remains.



• Bone examination can reveal origin, sex, approximate age, race and skeletal injury

• Some able to perform facial reconstruction to aid in identification

Case 1:

A skull found on the summit of Table Mountain among the reeds. The brown teeth are a result of staining from the organic compost.



The sculptured face in modeling clay on a plaster model of the skull.



A photograph supplied by the parents at the time of the disappearance of their daughter.

Case 2:

The skull of a young woman whose skeletal remains were found in a shallow grave in Crawford, Cape Town.



The reconstructed facial features on a plaster model of the skull.



A comparative photograph sent by her mother.

Forensic Entomology

- Study of insects and their relation to a criminal investigation
- Used to estimate time of death when circumstances surrounding death unknown
- Must take into account climate and weather conditions



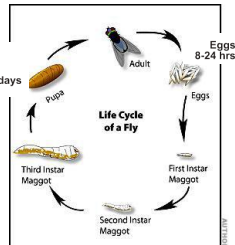
Forensic Entomology & Decomposition

• After decomposition begins, insects such as blow flies first to infest body

• Eggs laid within human remains & hatch into maggots or fly larvae

• Larvae responsible for consumption of human organs

• Specific insects present in specific phase of life cycle at specific points of decay



Forensic Psychiatry

- Relationship between human behavior and legal proceedings examined
- Determine whether people are competent to make decisions
- Evaluate behavioral disorders and determine if people are competent to stand trial



"A free plastic toy, confetti scattered around the victim... Yep, it looks like our cereal killer alright!"

Forensic Odontology

- Provide information for identification of victims when body is in unrecognizable state
- Bite mark analysis – analysis of marks on victim's body compared to suspect's teeth structure



Forensic Engineering

- Concerned with failure analysis, accident reconstruction and causes and origins of fires or explosions



Forensic Computer and Digital Analysis

- Identification, collection, preservation, and examination of information derived from computers and other digital devices
- Recovery of deleted or overwritten data from a hard drive, and the tracking of hackers.



The Functions of the Forensic Scientist

- Examine the evidence
- Perform the appropriate analysis or measurement
- Render a conclusion based on evidence
- Testify in court
- Furnish training in the proper recognition, collection, and preservation of physical evidence



Role of Forensic Evidence

- To establish that a particular person or thing was at a particular place at a specific time
- To establish that something was done with a particular tool
- To establish a relationship between people

What's wrong with this slide?

- Science is a process that permits one to test hypotheses. Science **cannot prove anything** more complex than a simple fact.
- Science operates by falsifying hypotheses not proving them.
- Science can say that it is “likely” and give odds

Forensic Evidence **Should Be** Used

- To **test** whether a particular person or thing was at a particular place at a given time.
- To **test** whether something was done with a particular tool
- To **test** whether a relationship exists between people