CHAPTER 1:
AN INTRODUCTION
Chapter 1 Organization

- **Lesson 1: History of Forensic Science**
  - Honors: Research a Forensic Scientist Assignment
  - **Lab**: Locard Lab

- **Lesson 2: Growth and Organization of the Crime Lab**
  - Look at URI Crime Lab and Department of Health

- **Lesson 3: Specialized Services in Forensic Science**
  - Focus and **Lab**: Forensic Entomology
  - Q1 Project: Career Exploration in Forensic Science

- **Lesson 4: Admission of Evidence into Court**
  - Cases: *Frye vs US* and *Coppolino vs State*

- **Lesson 5: The Forensic Scientist**
  - Meet a Forensic Scientist (Guest Speaker)
What is FORENSIC SCIENCE?

- **Definition**: The application of SCIENCE to the **criminal** and **civil** laws that are enforced by police agencies in a criminal justice system.

  - Criminal laws – murder, theft, rape, etc.
  - Civil laws – regulate food quality, environment, pesticides, prescription drugs
History of Forensics – Initial Advances

- Breakthroughs in anatomy and chemistry (late 1700’s)
  - Carl Wilhelm Scheele and Valentin Ross: found ways to detect poisons (arsenic) in body tissues
- Mathieu Orfila – Father of Forensic Toxicology
  - Tested the effects of poisons on animals
History of Forensics – Later Progress

- **The Bertillon System**
  - First method of personal/criminal identification
  - Made by French ethnologist Alphonse Bertillon
  - Anthropometry
    - Systematic procedure taking many body measurements
    - Eventually replaced by fingerprints
Bertillon’s System of Body Measurements
More advancements...

- Francis Henry Galton
  - First to classify fingerprints
  - First to prove that fingerprints are unique

- Hans Gross (1893)
  - Applied many scientific disciplines and scientific method to the field of criminal investigation
    - Microscopy, chemistry, zoology, botany, physics, etc.
Who is the best known 19th c. figure?

- **Sherlock Holmes**
  - Fictional, but many believe creator Sir Arthur Conan Doyle popularized crime detection methods
20th Century Breakthroughs

- Dr. Karl Landsteiner
  - Discovered that blood can be grouped (A, B, AB, O)

- Dr. Leon Lattes (1915)
  - Simple procedure for determining blood group of dried blood stain

- Albert S. Osborn
  - Developed principles for document examination
More key figures...

- Dr. Walter C. McCrone
  - Expert microscopist
  - Applied microscopy to analytical problems in forensics

- Calvin Goddard
  - Used microscopy to study ballistics
  - Comparing bullets from various guns
Locard’s Principle

- Frenchman Edmund Locard
  - Founder of Institute of Criminalistics at the University of Lyons

- Locard’s Principle
  - When two objects come into contact with each other, a cross-transfer of materials occurs.
  - In other words…EVERY CONTACT LEAVES A TRACE!
CHECKING POINT 1

* END of Lesson 1 (History)
* What’s Next
  * Locard Lab
  * Mini Quiz on Forensic Science History
* After that, let’s move onto Lesson 2 (Growth and Organization of the Crime Lab)
CRIME LABS - Background

- Oldest Forensics Lab = LAPD (1923)
- FBI (under J. Edgar Hoover) organized national lab in 1932 – available to all law enforcement agencies across US
  - Largest forensics lab
  - Model for state/local labs
- Each state has city, county, and state labs
  - Roughly 350 public crime labs
Growth of Crime Labs

1) Supreme Court decisions in the 1960’s placed greater emphasis on evidence acceptance/evaluation

2) Increase in crime rates over last 40 yrs.
   1) More drug-related arrests – chem. analysis

3) Beginning of DNA profiling
   1) Blood, semen, hair, saliva = INDIVIDUALIZATION
Major Crime Labs in US (History)

1) FBI (Dept. of Justice) – Quantico, VA
2) Drug Enforcement Administration Lab (Dept. of Justice)
3) Bureau of Alcohol, Tobacco, Firearms, and Explosives (Dept. of Justice)
4) US Postal Inspection Service
In Rhode Island...

1) Rhode Island State Crime Laboratory
* Located on the University of Rhode Island
* Evidence Examined: Firearms, projectiles, fingerprints, trace evidence, tool marks, fire debris
* [http://web.uri.edu/riscl/](http://web.uri.edu/riscl/)

Pictured Left: Director Dennis Hilliard
Rhode Island State Crime Laboratory

* A few videos
* https://youtu.be/kYAxz4cUZcE (Woonsocket Case)
* RISP Mobile Crime Lab https://youtu.be/xw8GVdH0SLo

2) Rhode Island Department of Health, Center for Forensic Science

Located in Providence
Evidence Examined: Drugs, Biological Samples (Blood, DNA), drunk driving cases, sexual assault cases, death investigation
Services: http://www.health.ri.gov/publications/manuals/ForenscSciencesLaboratoryServices.pdf
Basic Units of a Crime Lab

**Biological:**
- Blood
- Bloodstains
- Saliva
- Semen
- DNA

**Physical:**
- Drugs
- Glass
- Paint
- Explosives
- Trace
- Soil

**Firearms:**
- Firearms
- Bullets
- Cartridge cases
- Shotgun shells
- Tool Marks
- Gun Shot Residue (GSR)

**Toxicology:**
- Drugs and poisons in organs and body fluids

**Photography:**
- Digital imaging
- Infrared
- Ultraviolet
- Image enhancing

**Document Examination:**
- ? documents
- Erasures
- Forgeries
- Paper/inks

**Latent prints:**
- Fingerprint processing & examination

**Polygraph Unit**

**Evidence Collection Unit**
CHECKING POINT 2

* END of Lesson 2 (Growth and Organization of the Crime Lab)
* What’s Next
  * Mini Quiz on Growth and Organization of the Crime Lab
* After that, let’s move onto Lesson 3 (Specialized Services of the Crime Lab)
  * We will be presenting Career Projects and doing an Entomology Lab
Other Specialized Services (may not be within the crime lab)

- **Forensic Pathology**
  - Investigation of sudden, unnatural, unexplained or violent deaths
  - Autopsy performed to establish the **cause of death**
  - 5 categories of death: natural, homicide, suicide, accident, or undetermined
  - Time of death may also be determined
Other Forensic Science Services

- **Forensic Anthropology**
  - Identification and examination of skeletal remains
  - Bones can reveal species, sex, approximate age, possible ethnicity, and skeletal injury
  - Facial reconstruction can help identify “John or Jane Doe”
Other Forensic Science Services

- **Forensic Psychiatry**
  - Study of human behavior
  - Determine if persons are competent to stand trial
  - Develop a suspect’s behavioral profile based on previous patterns of other criminals
Ted Bundy, Serial Killer

- Educated individual
- Confessed to over 40 murders
  - All young female
  - Murdered with blunt instrument/raped
- How did he finally get caught?
- Forensic ODONTOLOGY!
Other Forensic Science Services

- **Forensic Odontology**
  - Study of teeth characteristics, alignment and the overall structure of the mouth to identify a person
  - Bite mark analysis compares marks on a victim to the teeth of the suspect
Other Forensic Science Services

- **Forensic Engineering**
  - Investigation of structural failures, accident reconstruction and causes of fires
  - Attempts to determine if human intervention caused the structural failure
  - Utilizes computer models and architectural models to help courts visualize crime scenes
Other Forensic Science Services

- Forensic Entomology
  - Study of insects to estimate the time of death
  - Stages: Adult, Eggs, Larva, Pupa, Adult
  - Stages of development tell how long ago the eggs were laid – age of oldest insect on the body dictates minimum time since death
  - Temperature and other weather conditions affect the development
Forensic Entomology – Lab Background

- Blowflies (*Diptera Calliphora*) detect carcasses within a few hours after death
- Blowfly egg masses – usually laid in body openings
Entomology – more background

- Larva (maggots) come in three stages - primary, secondary, tertiary
- often are found around body openings and wounds
Fly Pupae Background

- Largest larval stage
- Forms dark brown casing
  - Usually left in soil under/around food source
  - Sometimes wander anywhere from 3m-10m from carcass
Adult Blowfly
Rate of Development depends on...

- Temperature
  - Higher the temp, the faster the insects will develop
Timeline…

- Under normal conditions, eggs hatch in 8-12 hours
- Maggots take 3-4 days to reach full size
- Maggots pupate 1-2 days later
- Adults hatch from pupa after 6-8 days
  - Able to lay eggs 5 days later
  - So how long has a body been dead if you find adult flies on it?
  - 13-15 days!
In the past... Day 1
Egg masses a few days later
Larger Larvae
CHECKING POINT 3

* END of Lesson 3 (Specialized Services of the Crime Lab)

* What’s Next
  * Continuing to present Career and Entomology Projects
  * No quiz on this lesson, but you must know the material for the Ch. 1 Test

* Let’s move onto Lesson 4 (Admissibility of Evidence into Court)
The Science of Evidence

- Procedures and techniques used to examine evidence must satisfy criteria of admissibility established by courts (Frye Standard and Federal Rules of Evidence)
- Frye v. US (admissibility of polygraph)

   Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in a particular field in which it belongs.
Frye Standard

- Court decides if procedure, technique, or principle is “generally accepted” by majority of relevant scientific community

- What do you think were some pros and cons of admitting evidence under this standard?
Federal Rules of Evidence

- More flexible standard that does not rely on general acceptance as standard for admitting evidence

- Admissibility of all evidence
  - Including expert testimony
  - Allows for…
    - new evidence
    - new testing techniques
    - new scientific evaluations
1993, court stated that Frye Standard or “general acceptance” is not an absolute prerequisite to admissibility of evidence

Federal Rules of Evidence (#702) – ensures that expert testimony rests on reliable foundation and is relevant to case

Judges ultimately act as gatekeeper in admitting evidence
Questions asked by judge when admitting evidence

1) Can the scientific technique/theory be tested?
2) Is the technique/theory subject to peer review or publication?
3) What is the technique’s potential rate of error?
4) What maintenance of standards exist when controlling the technique’s operation?
5) Has this technique/theory attracted widespread acceptance in the scientific community?
How can you relate this to *Coppolino v. State*?

- Does a new procedure (detecting succinic acid in brain) allow for admissibility of evidence in court?
  - Not known amongst widespread community
  - Court stated that researchers MUST devise new scientific tests to solve special problems that continually arise in forensics
CHECKING POINT 4

* END of Lesson 4 (Admissibility of Evidence into Court)
* What’s Next
  * Mini Quiz on Evidence Admissibility (focus on two cases we discussed)
* Let’s move onto Lesson 5 (The Forensic Scientist)
FORENSIC SCIENTIST

- Independent Finders of FACT
- Testify to TRUTH
- Use tests that are
  - RELIABLE
  - ACCURATE
  - REPRODUCIBLE
- UNBIASED
  - Evidence cannot be influenced by theories
FORENSIC SCIENTIST

- DATA is basis of all conclusions
- ACCURATE DATA is derived from careful collection of evidence
- POOR EVIDENCE COLLECTION OR HANDLING can result in wrong conclusions
- Garbage in – garbage out
- DOCUMENTATION IS ESSENTIAL
Forensic scientists must be properly trained in…

- Recognition
- Collection
- And Preservation of Physical Evidence
  - Law Enforcers in RI trained as Crime Scene Investigators through the BCI Courses at URI
Forensic Scientists Provides Expert Testimony

- Expert witness: individual whom the court determines to possess a particular skill or knowledge in a trade or profession that is not expected of the average layperson and that will aid the court in determining the truth of a matter at trial.
Forensic Scientists Provides Expert Testimony

- Expert in knowledge, skill, experience, training, or education may offer testimony if...
  - 1) testimony based on sufficient facts or data
  - 2) testimony is product of reliable scientific principles
  - 3) witness has applied principles and methods reliably to the facts of the case

DNA Expert Testimony in the Aaron Hernandez trial
https://youtu.be/kOG9U7LC1wg

Expert Testimony in Hollywood:
https://youtu.be/3nGQLQF1b6I
CHECKING POINT 5

END OF CHAPTER 1

* What’s Next
  * Chapter 1 Test