BIOL 104 Forensic Biology

Chapter 1 Introduction to Forensic Science

I. Forensic Science

* It is the study and application of science to matters of law (criminal and civil)
* Includes the business of providing timely, accurate, and thorough information to all levels of decision makers in our criminal justice system
* Also called criminalistics

1. Criminalists vs Criminologists

* A criminalist examines physical evidence for legal purposes
* Criminologists study the crime scene for motive, traits, and behavior as to help interpret the evidence

- They learn to think like criminals

1. Forensic Scientists

* Apply the principles and techniques of the physical and natural sciences to the analysis of the many types of evidence that may be recovered during a criminal investigation
* May also provide expert court testimony

- Known as an expert witness

* Individual whom the court determines possesses knowledge relevant to the trial

1. Developments in Forensic Science

* 700s AD- Chinese used fingerprints to establish identity of documents and clay sculptures
* ~1000- Roman courts determined that bloody palm prints were used to frame a man in his brother’s murder
* 1149- King Richard of England introduced the idea of the coroner to investigate questionable death
* 1200s- A murder in China is solved when flies were attracted to invisible blood residue on a sword of a man in the community
* 1598- Fidelus was first to practice forensic medicine in Italy
* 1670- Anton van Leeuwenhoek constructed the first high powered microscope
* 1776- Paul Revere identified the body of General Joseph Warren based on the false teeth he had made for him
* 1784- John Toms convicted of murder on basis of torn edge of wad of paper in pistol matching a piece of paper in his pocket
* 1859- Gustav Kirchoff and Robert Bunsen developed the science of spectroscopy
* 1864- Crime scene photography developed
* 1879- Alphonse Bertillion developed a system to identify people using particular body measurements
* 1896- Edward Henry developed the first classification system for fingerprint identification
* 1900- Karl Landsteiner identified human blood groups
* 1904- Edmond Locard formulated his famous principle, “Every contact leaves a trace”
* 1922- Francis Aston developed the mass spectrometer
* 1959- James Watson and Francis Crick discover the DNA double helix
* 1977- AFIS developed by FBI, fully automated in 1996
* 1984- Alec Jeffreys developed and used the first DNA tests to be applied to a criminal case

1. People of Historical Significance

* Mathieu Orfila- father of forensic toxicology
* Alphonse Bertillon- devised first scientific system of personal identification
* Francis Galton- conducted first definitive study of fingerprints and their classification
* Leone Lattes- developed a procedure to determine blood type from dried bloodstains
* Calvin Goddard- used a comparison microscope to determine if a particular gun fired a bullet
* Albert Osborn- developed the fundamental principles of document examination
* Walter McCrone- utilized microscopy to examine evidence
* Hans Gross- wrote treatise on criminal investigation
* Edmond Locard- considered the father of criminalistics; responsible for Locard’s exchange principle

- States that when a criminal comes in contact with an object or a

person, a cross transfer of evidence occurs

1. The Crime Lab

* Characterized by rapid growth due to
* 350 public crime labs exist at federal, state, county, and municipal levels
* History

- First established in 1910 by Locard

- First police crime lab established in 1923 in Los Angeles, CA

- Scientific Crime Detection Lab established in 1929

- First FBI crime lab opened in 1932

1. Crime Lab Services
2. Physical science

* Physical Science Unit- Incorporates the principles of chemistry, physics, and geology to identify and compare physical evidence

1. Biology

* Biology Unit- Applies the knowledge of biological sciences in order to investigate blood samples, body fluids, hair, and fiber samples

1. Firearms

* Firearms Unit- Investigates discharged bullets, cartridge cases, shotgun shells, and ammunition

1. Document

* Document Unit- Provides the skills needed for handwriting analysis and other questioned document issues

1. Photographic

* Photographic Unit- Applies specialized photographic techniques for recording and examining physical evidence

1. Other Crime Lab Services

* Toxicology Unit- examines body fluids and organs for the presence of drugs and poisons
* Latent Fingerprint Unit- processes and examines evidence for latent fingerprints
* Polygraph Unit- conducts polygraph or lie detector tests
* Voiceprint Analysis Unit- attempts to tie a recorded voice to a particular suspect
* Evidence Collection Unit- dispatches specially trained personnel to the crime scene to collect and preserve physical evidence

1. Other Forensic Science Services

* Forensic Pathology- concentrate closely on the understanding of types and causation of injuries and causes of sudden and unnatural death

- Deals with the different stages of death

* After a human body expires there are several stages of death.
  1. 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 hours and disappears within 36 hours).
  2. 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 hours).
  3. 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).
* Forensic Anthropology-concentrates on the identification of deceased individuals whose remains are decomposed, burned, mutilated or otherwise unrecognizable
* Forensic Entomology- is the study of insects and their relation to a criminal investigation, commonly used to establish the time of death
* Forensic Psychiatry- work with courts in evaluating an individual's competency to stand trial, defenses based on mental diseases or defects (e.g., the "insanity" defense), and sentencing recommendations
* Forensic Odontology- evaluates teeth to determine the identification of the deceased
* Forensic Engineering- investigation of materials, products, structures or components that fail or do not operate/function as intended, causing personal injury for example
* Cybertechnology- involves the examination of digital evidence

1. Skills of a Forensic Scientist

* A forensic scientist must be skilled in applying the principles and techniques of the physical and natural sciences to the analysis of the many types of evidence that may be recovered during a criminal investigation.
* A forensic scientist may also provide expert court testimony.
* An expert witness is an individual whom the court determines possesses knowledge relevant to the trial that is not expected of the average person.
* The expert witness is called on to evaluate evidence based on specialized training and experience that the court lacks the expertise to do.
* The expert will then express an opinion as to the significance of the findings.
* Forensic scientists also participate in training law enforcement personnel in the proper recognition, collection, and preservation of physical evidence.

1. The *Frye* Standard

* The *Frye* v. *United States* decision set guidelines for determining the admissibility of scientific evidence into the courtroom.
* To meet the *Frye* standard, the evidence in question must be “generally accepted” by the scientific community.
* However, in the 1993 case of *Daubert* v. *Merrell Dow Pharmaceutical, Inc.,* the U.S. Supreme Court asserted that the *Frye* standard is not an absolute prerequisite to the admissibility of scientific evidence.
* Trial judges were said to be ultimately responsible as “gatekeepers” for the admissibility and validity of scientific evidence presented in their courts, as well as all expert testimony.

1. The *Daubert* Criteria

* In *Daubert*, the Supreme Court offered some guidelines as to how a judge can gauge scientific evidence:

1. Whether the scientific technique or theory can be (and has been) tested.

2. Whether the technique or theory has been subject to peer review and publication.

3. The technique’s potential rate of error.

4. Existence and maintenance of standards controlling the technique’s operation.

5. Whether the scientific theory or method has attracted widespread acceptance within a relevant scientific community.

1. Major Crime Labs

* FBI- Federal Bureau of Investigations
* DEA- Drug Enforcement Agency
* ATF- Bureau of Alcohol, Tobacco, Firearms, and Explosives
* US Postal Service
* US Fish and Wildlife Service

1. The Crime Scene Team

* A group of professional investigators, each trained in a variety of special disciplines
* Team members include

- First police officer on the scene

- Medics (if necessary)

- Investigator(s)

- Medical examiner

- Photographer and/or Field Evidence Technician

- Lab Experts

**Class Assignment:**