



Forensic Science

Unit 1 - Introduction



EVIDENCE DO NOT TAMPER

How well can you observe?

- In the following pairs of photographs, detect as many things as you can that are different.



A



B



A



B



A



B



A



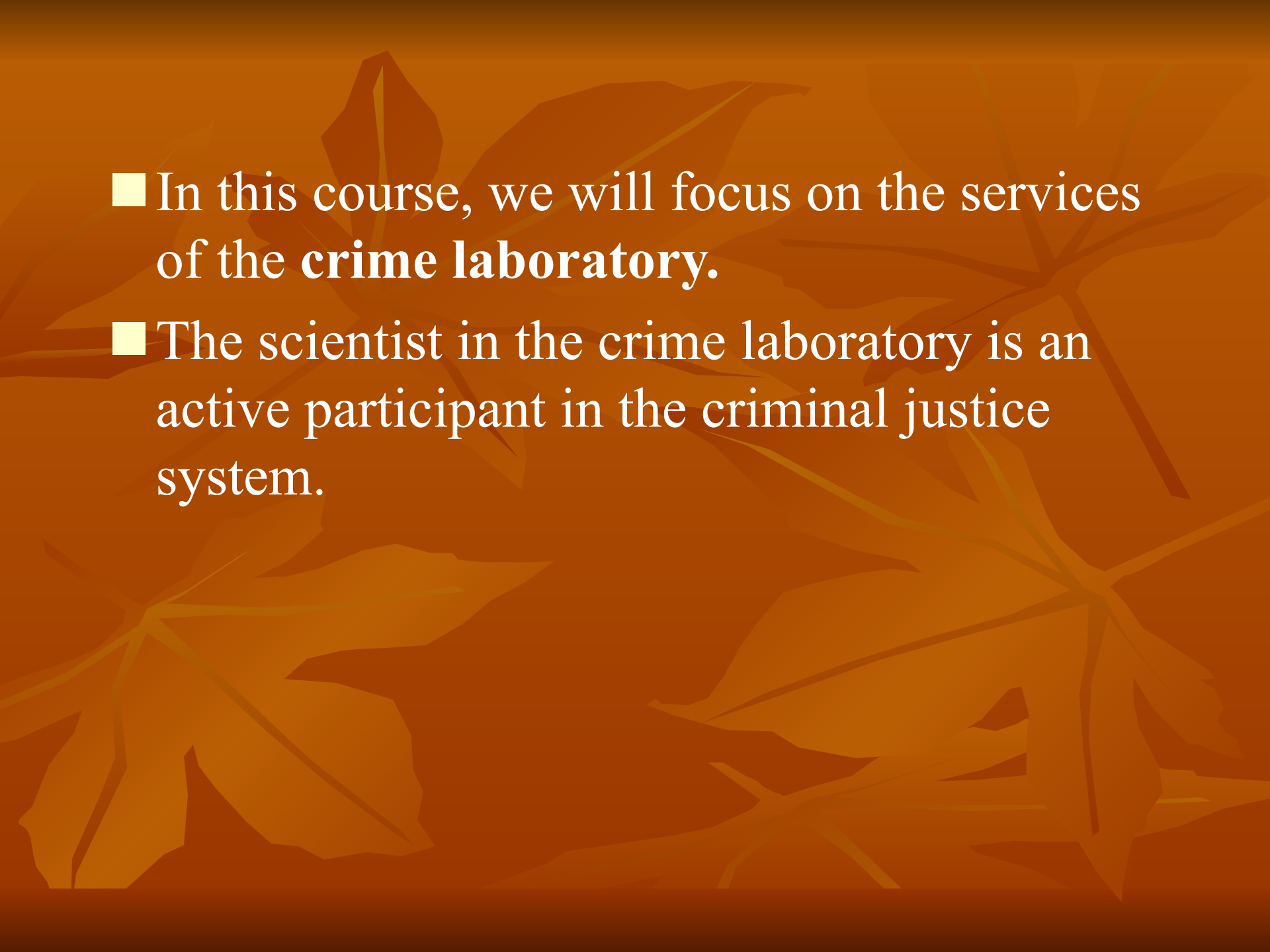
B

Definition and Scope of Forensic Science

- What is forensic science?
- In its broadest definition, forensic science is the application of science to law.



- **Science** occupies an important and unique role in the criminal justice system-a role that relates to the scientist's ability to supply accurate and objective information that reflects the events that have occurred at a crime.
- **Forensic science** is the application of science to those criminal and civil laws that are enforced by police agencies in a criminal justice system.

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- In this course, we will focus on the services of the **crime laboratory**.
 - The scientist in the crime laboratory is an active participant in the criminal justice system.

Other Forensic Science Services

- There are a number of specialized forensic science services outside the crime laboratory that are routinely available to law enforcement personnel.
- These services are important aids to a criminal investigation and require the involvement of individuals who have highly specialized skills.

Forensic Pathology

- This field involves the investigation of sudden, unnatural, unexplained, or violent deaths.
- Forensic pathologists are typically medical examiners or coroners, and are charged with the responsibility of answering several basic questions:

- Who is the victim?
 - What injuries are present?
 - When did the injuries occur?
 - Why and how were the injuries produced?
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- The **primary role** of the medical examiner is to determine the cause of death.
 - If a cause cannot be found through observation, an **autopsy** is performed.

Performing an Autopsy



What Warrants an Autopsy

- Questionable Death-as determined by the coroner
 - Homicide
 - Drowning
 - Auto Accidents
 - Death of a child

Used to Collect Vitreous



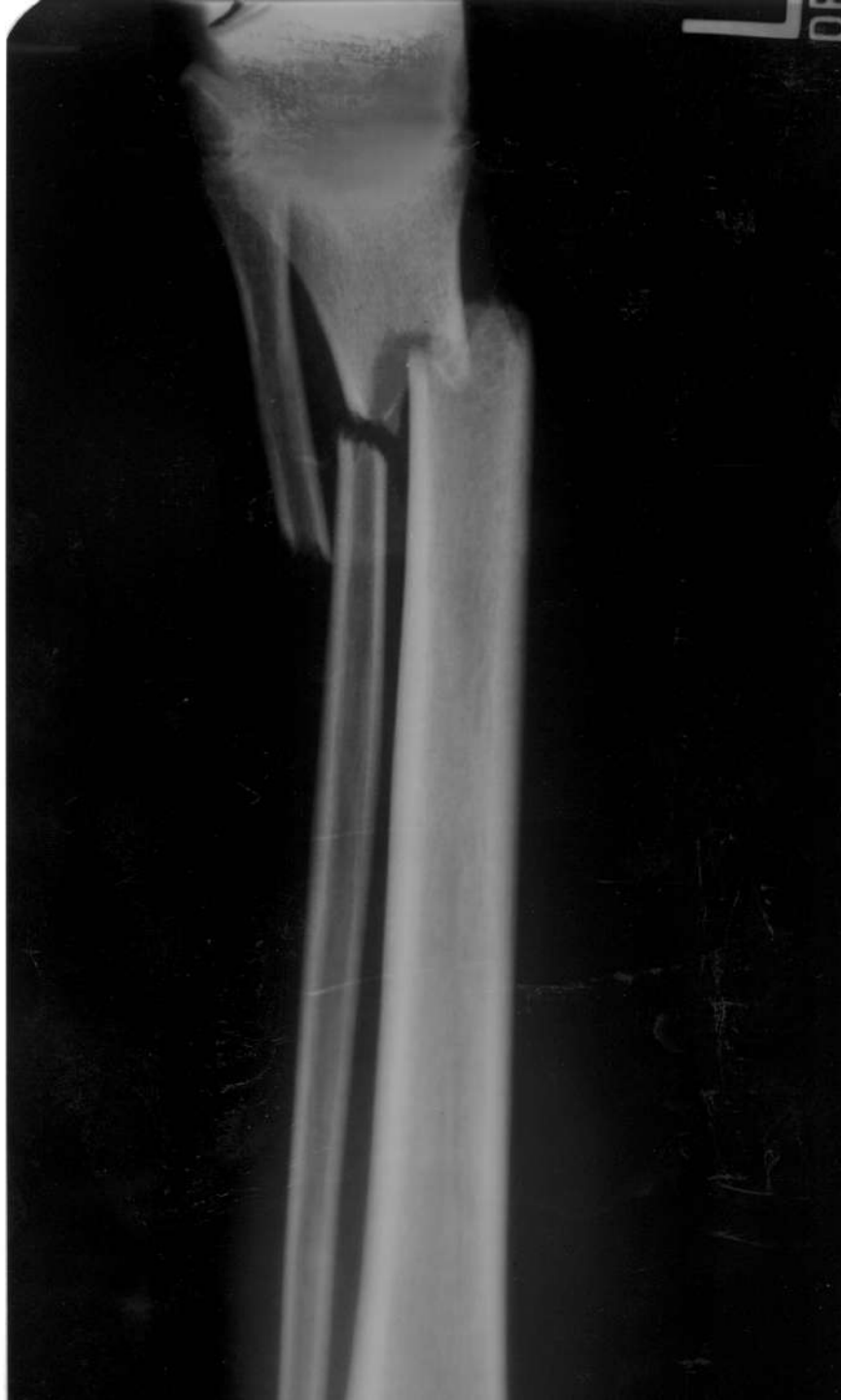
Tags & Heart Needle



Benefits of Autopsy

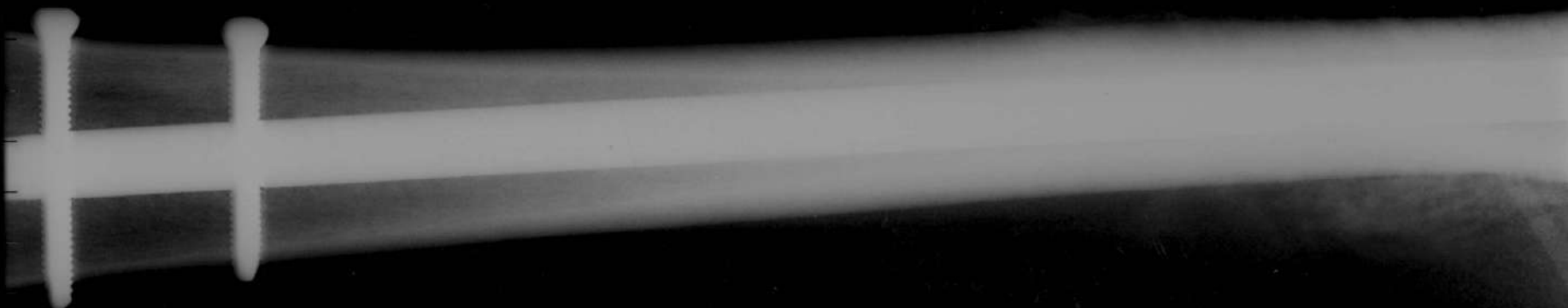
Discover cause of death for:

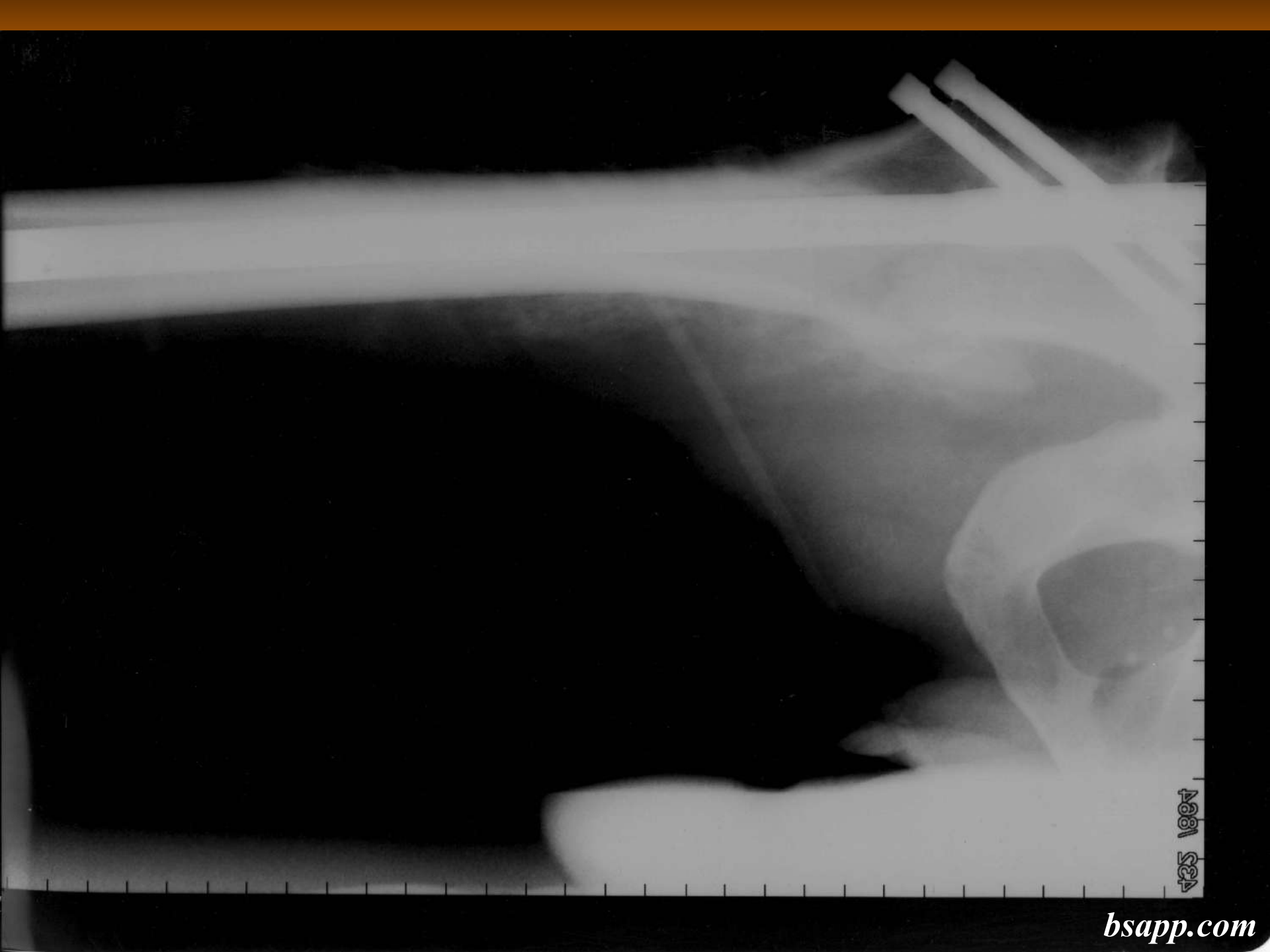
- Criminal cases
- Family peace of mind
- Genetic disease or deformity
- Insurance claims
- Medical advancement



X-Ray







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External Examination

- Trace Evidence
- Sign of injury or mistreatment
- Sign of illness, disease, or abnormalities





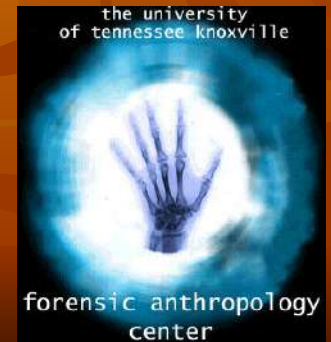
Samples



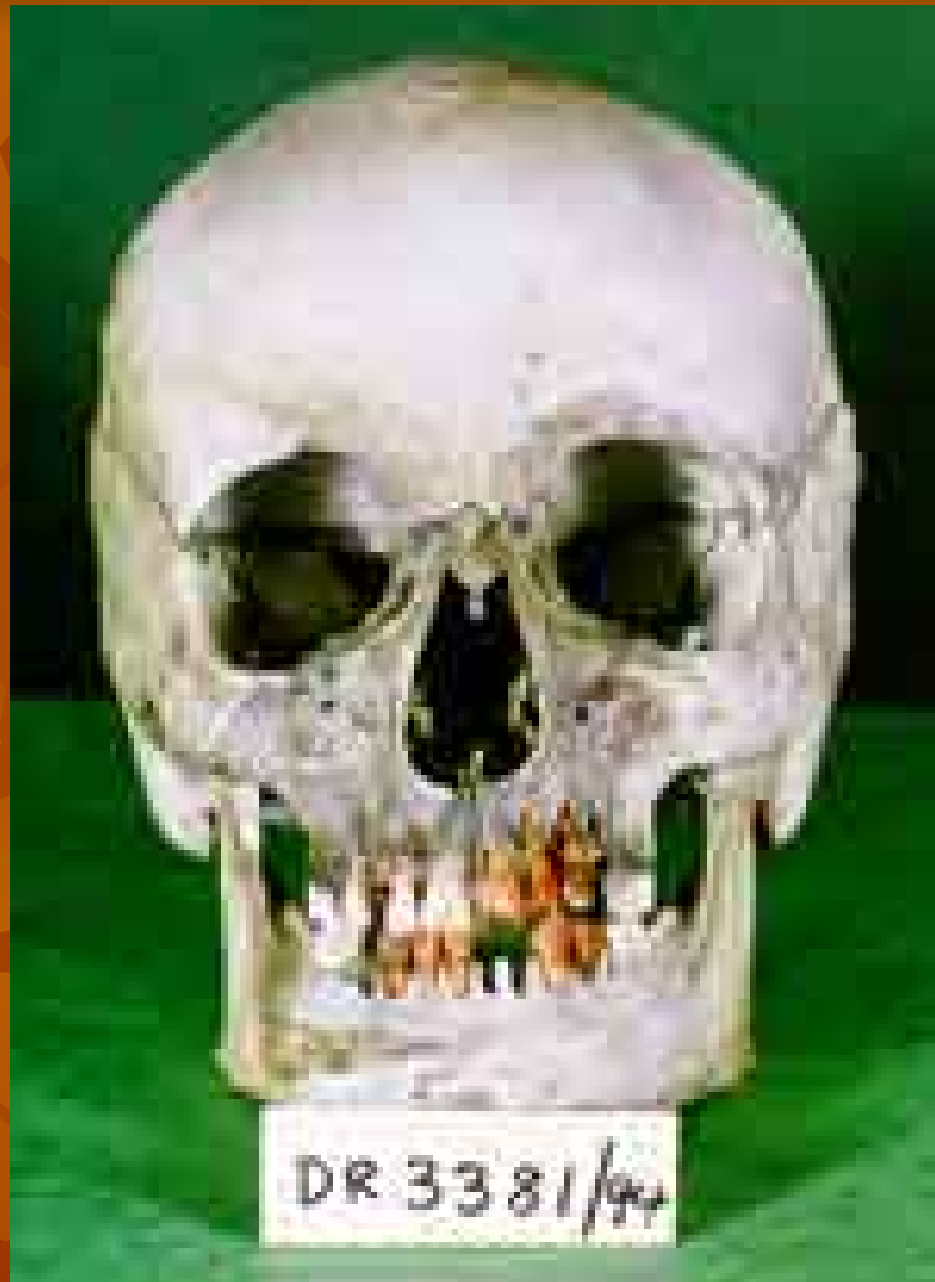
- Frequently, medical examiners must perform autopsies if a death is deemed suspicious or unexplained.
- For example, a decedent with a gunshot wound and a gun in his hand may appear to have committed suicide.
- However, an autopsy may reveal that the victim actually died of suffocation and the gunshot wound occurred after death to cover up the circumstances surrounding the commission of a crime.

Forensic Anthropology

- Forensic anthropology is a specialty that is concerned primarily with the identification and examination of human skeletal remains.
- What can be learned from examining human bones?
- The origin, sex, approximate age, race, and skeletal injuries may be revealed.



- A forensic anthropologist may also help in creating facial reconstructions to aid in the identification of skeletal remains.
- Two cases to follow:
 - Case 1 (see handout)
 - *Figure 1.* The skull found on the summit of Table Mountain among the reeds. The brown teeth are a result of staining from the organic compost.



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- **Figure 2.** The sculptured face in modeling clay on a plaster model of the skull.



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- **Figure 3.** A photograph supplied by the parents at the time of the disappearance of their daughter.





- Case 2 (see handout)
- **Figure 1.** The skull of a young woman whose skeletal remains were found in a shallow grave in Crawford, Cape Town.

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- *Figure 2.* The reconstructed facial features on a plaster model of the skull.

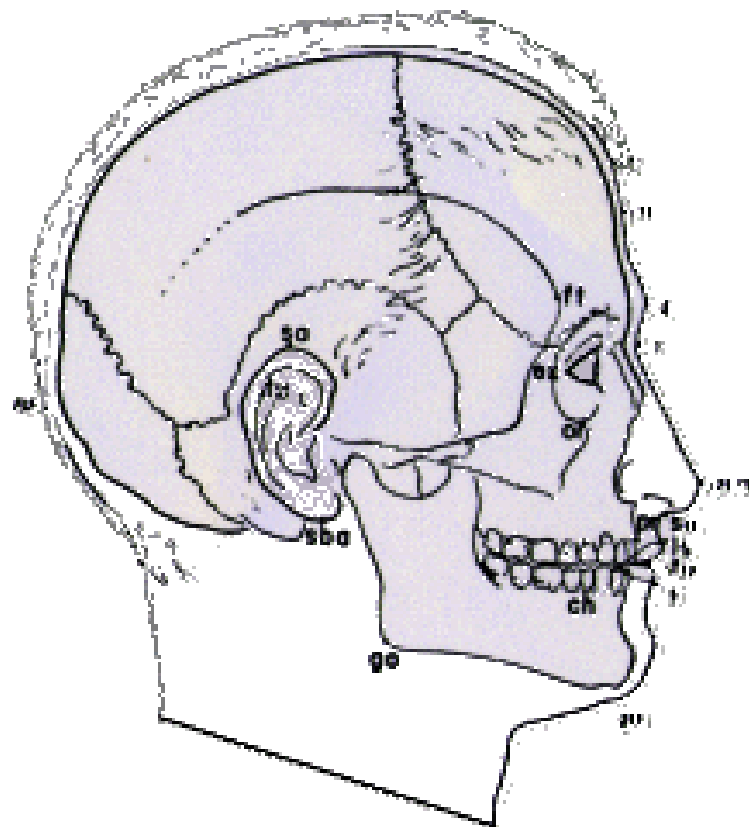
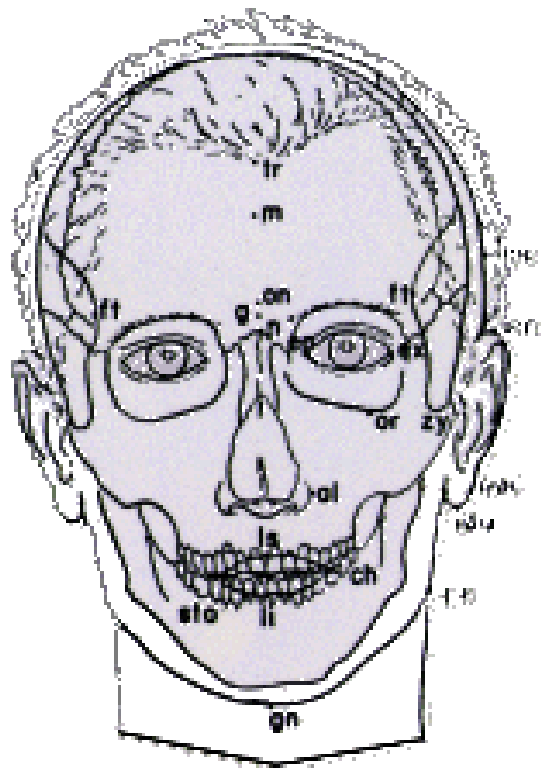




Figure 3. A comparative photograph sent by her mother.







Forensic Entomology

- The study of insects and their relation to a criminal investigation is known as forensic entomology.
- This knowledge can be used to estimate the time of death in a crime. How?
- After decomposition begins, insects infect the body. Fly eggs are laid within human remains and hatch into maggots or fly larvae.



- The larvae are responsible for the consumption of human organs and tissues.
- The forensic entomologist must take into account climate and weather conditions when estimating the postmortem interval.



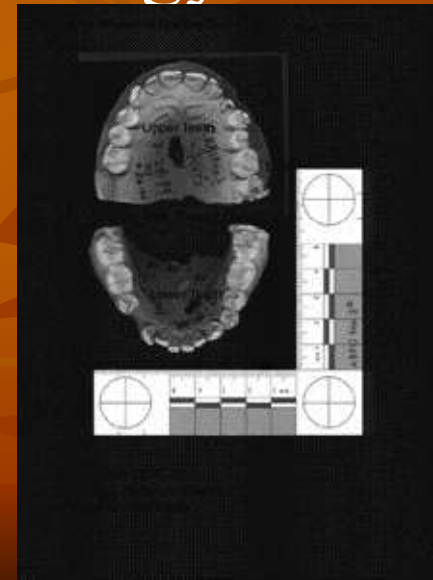
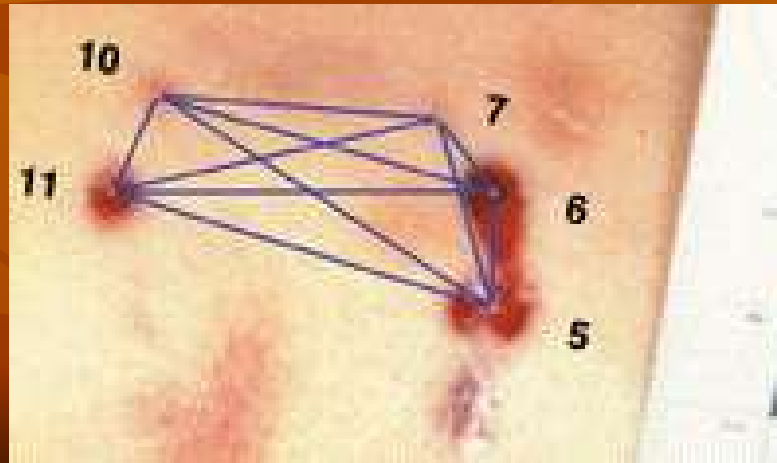
Forensic Psychiatry

- Forensic psychiatry is a specialized area in which the relationship between human behavior and legal proceedings is examined.
- They evaluate behavioral disorders, and determine whether people are competent to stand trial.
- They also examine behavioral patterns of criminals as an aid in developing a suspect's behavioral profile.

Forensic Odontology

- Practitioners of forensic odontology provide information for the identification of victims when the body is left in an unrecognizable state.
- Teeth are composed of enamel, the hardest substance within the body. The characteristics of teeth, their alignment, and the overall structure of the mouth provide individual evidence for identifying a specific person.

- With the use of dental records, x-rays, and dental casts or even a photograph of the person's smile, a comparison can be made between a set of dental remains and a victim.
- Another application of forensic odontology is bite mark analysis.



Forensic Engineering

- Forensic engineers are concerned with failure analysis, accident reconstruction, and causes and origins of fires or explosions.
- How did an accident or structural failure occur?
- Were the parties involved responsible? How so?

- Accident scenes are examined, photographs are reviewed, and any mechanical objects involved are inspected.
- Accident/crime scene reconstruction is mainly based on physical evidence.













History and Development of Forensic Science

- There are many who can be cited for their specific contributions to the field of forensic science. The following is just a brief list of those who made the earliest contributions to formulating the disciplines that now constitute forensic science:
- **Homework: Create flashcards on how did they contribute?**

- Mathieu Orfila (1787-1853)
- Alphonse Bertillon (1853-1914)
- Francis Galton (1822-1911)
- Leone Lattes (1887-1954)
- Calvin Goddard (1891-1955)
- Albert S. Osborn (1858-1946)
- Hans Gross (1847-1915)
- Edmond Locard (1877-1966)

Units in a 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
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- There are more than 300 public crime labs in the U.S. at this time.
 - Drug abuse has accelerated to nearly uncontrollable levels and has resulted in crime labs being inundated with drug specimens: drug seizures must be tested.

The Functions of the Forensic Scientist

- What are these functions?
 - Analysis of Physical Evidence
 - Provision of Expert Testimony
 - Furnishing Training in the Proper Recognition, Collection, and Preservation of Physical Evidence

Physical Science Unit

■ Chemistry (drugs, explosives)



■ Physics (glass, scratches)

■ Geology (soil, rocks)



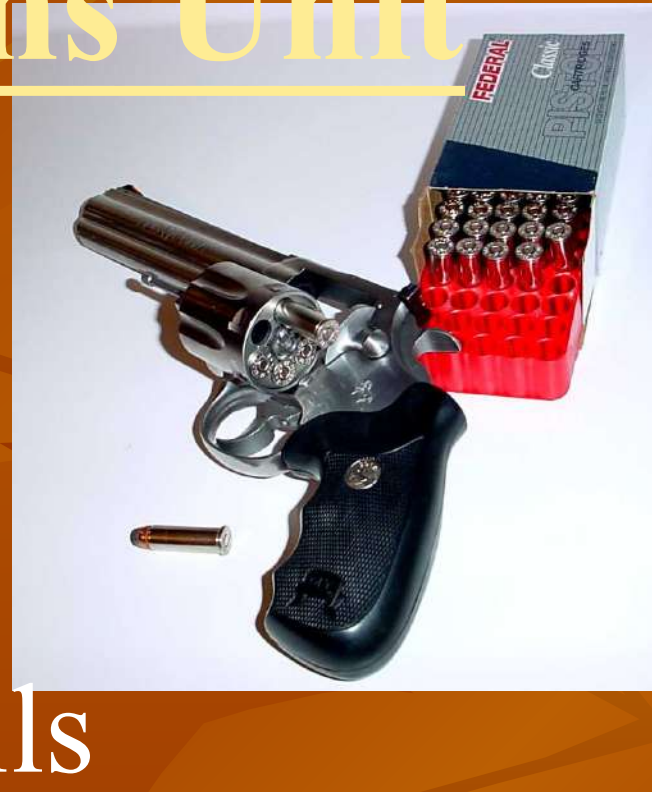
Biology Unit

- Bloodstains
- Body fluids
- Hair and fiber
- Botanical materials (wood and plants).



Firearms Unit

- Firearms
- Bullets
- Cartridge & Shells
- Ammunition





The Functions of Forensic Scientists

Collect and Analyze Physical Evidence



Demands & Constraints

- When and where do we collect?
- How do we collect?
- For what purpose?

Analysis of Physical Evidence

- First and foremost the 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 crime investigation.

- In doing this the scientist must also be aware of the demands and constraints that are imposed by the judicial system.
- The procedures and techniques that are used in the lab must not only rest on a firm scientific foundation but also satisfy the criteria of admissibility that have been established by the courts.

Important Supreme Court Cases

- *Frye v. United States* (1923):
 - Evidence in question must be generally accepted by the scientific community, as testified by experts.

■ *Daubert v. Merrell Dow Pharmaceutical, Inc.*
(1993):

- The Frye standard is not an absolute prerequisite to the admissibility of scientific evidence.
- The trial judge has the task of ensuring that an expert's testimony rests on a reliable foundation and is relevant to the task at hand.

■ *Kumho Tire Co., Ltd. V. Carmichael* (1999):

- The ‘gatekeeping’ role of the trial judge applied not only to scientific testimony, but to all expert testimony.

Provision of Expert Testimony

- Who is an expert witness?
- Depending on the subject area in question, this is someone who has specific knowledge acquired through experience, training, education, or a combination of the above.
- This person should be able to explain scientific data and conclusions clearly, concisely, and logically to a judge and jury composed of nonscientists.

- Furnishing training in the proper recognition, collection, and preservation of physical evidence.

