Chapter 1
Introduction

Definition

- Application of science to criminal and civil laws
- Enforced by police agencies in a criminal justice system

AAFS

- American Academy of Forensic Sciences
- Largest forensic science organization in world

AAFS

- Criminalistics
- Digital and multimedia sciences
- Engineering sciences
- General
- Jurisprudence
- Odontology

AAFS

- Pathology/biology
- Physical anthropology
- Psychiatry/behavioral sciences
- Questioned documents
- Toxicology

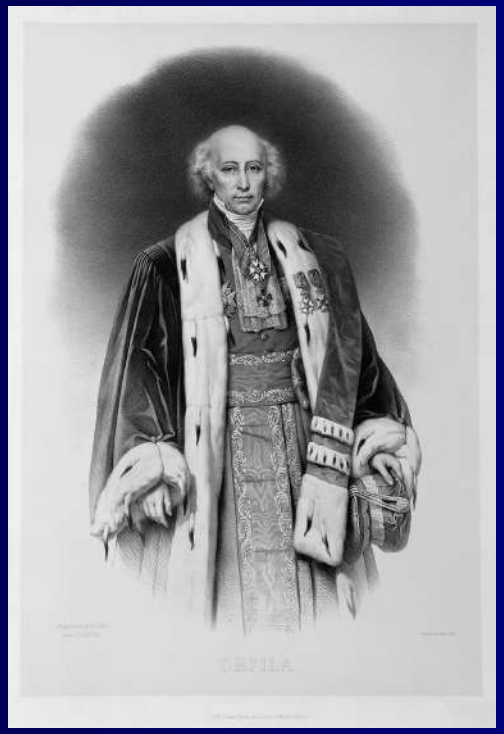
History and Development of Forensic Science

Literary Roots

- Sir Arthur Conan Doyle
  - Sherlock Holmes

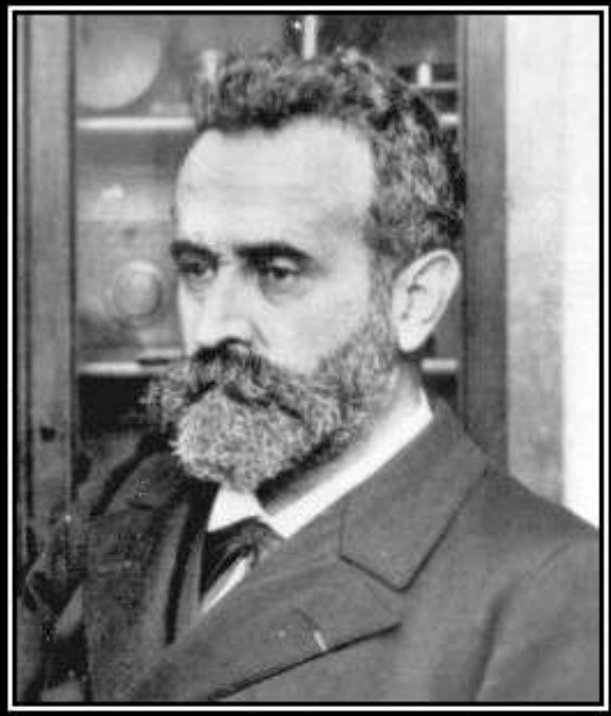
History

- Mathieu Orfila (1787-1853)
- Father of forensic toxicology
- 1814: detection of poisons, effects on animals



History

- Alphonse Bertillion (1853-1914)
- 1879: first scientific system of personal identification
- Anthropometry
- Replaced by fingerprinting



ALPHONSE BERTILLON (1853-1914)

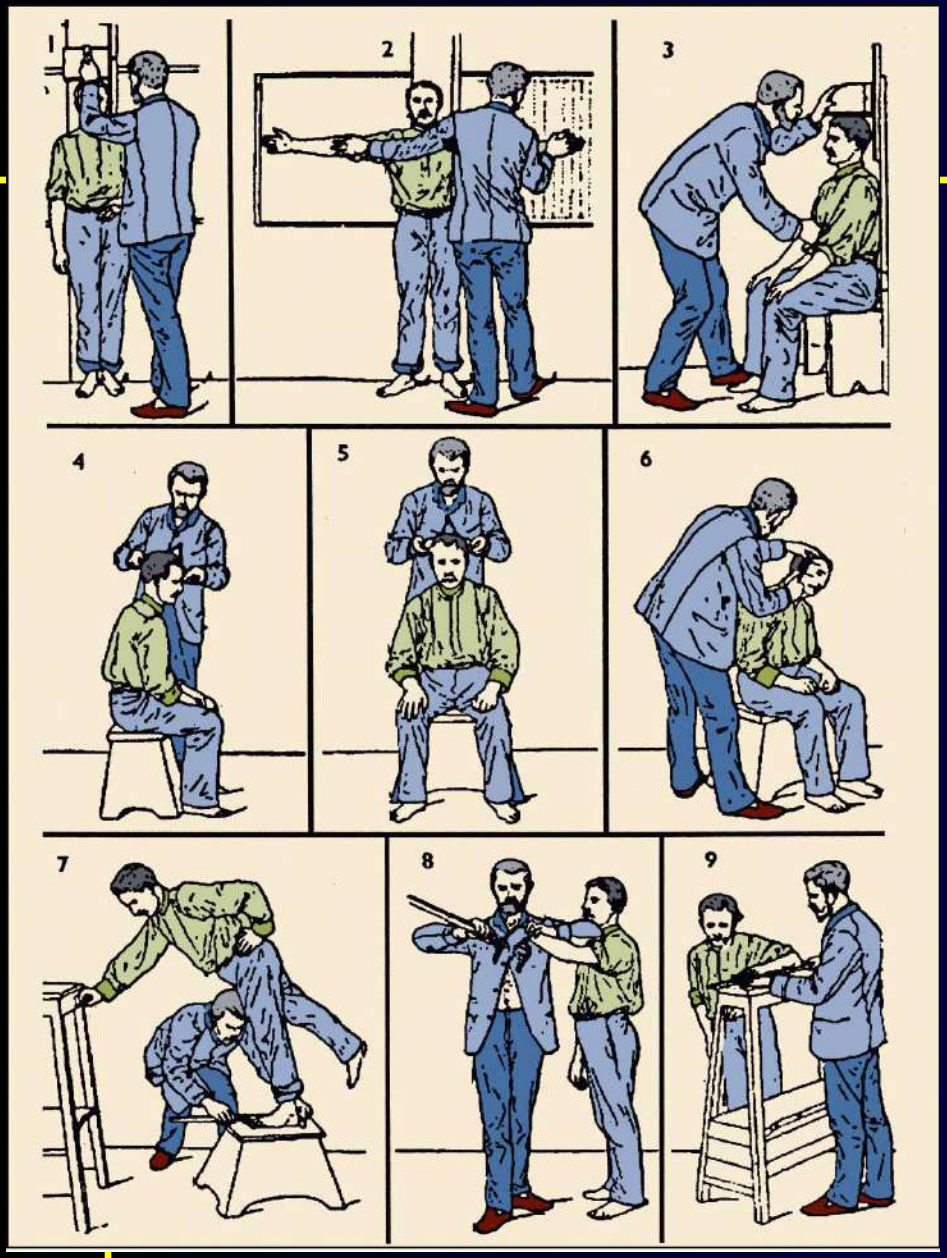
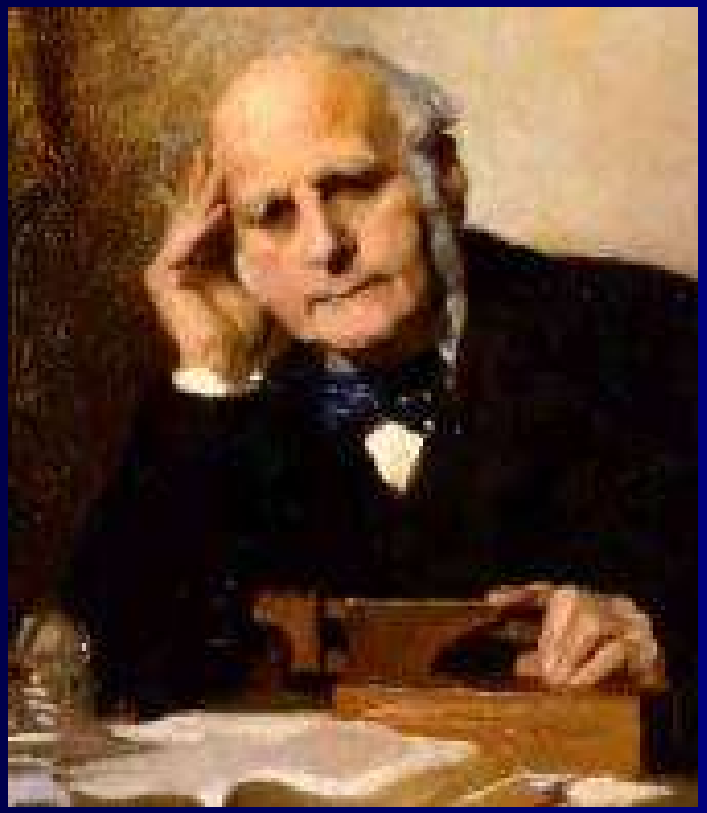


Figure 1–1 Bertillon's system of bodily measurements as used for the identification of an individual. Courtesy Sirchie Finger Print Laboratories, Inc., Youngsville, N.C., www.sirchie.com.

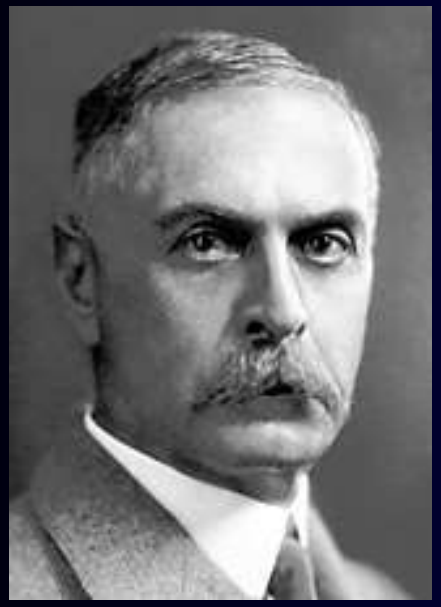
History

- Francis Galton (1822-1911)
- 1879: first definitive study of fingerprints and their classification
- Statistical proof of validity
- Principles underlie current methods



History

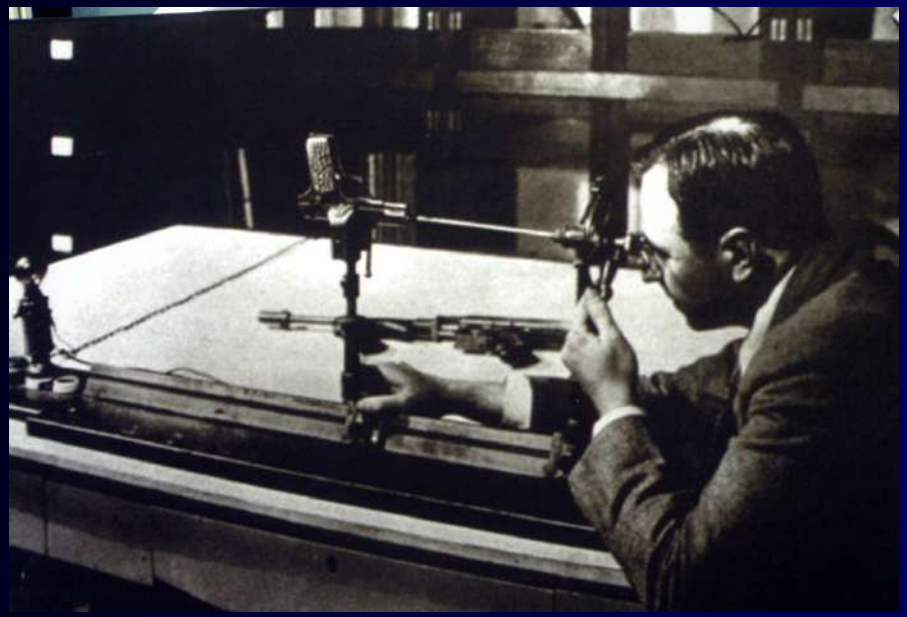
- Leone Lattes (1887-1954)
- 1915: procedure to determine blood type from dried bloodstains
- Based on Landsteiner's ABO blood groups



Karl Landsteiner

History

- Calvin Goddard (1891-1955)
- Comparison microscope to determine if a particular gun fired a bullet

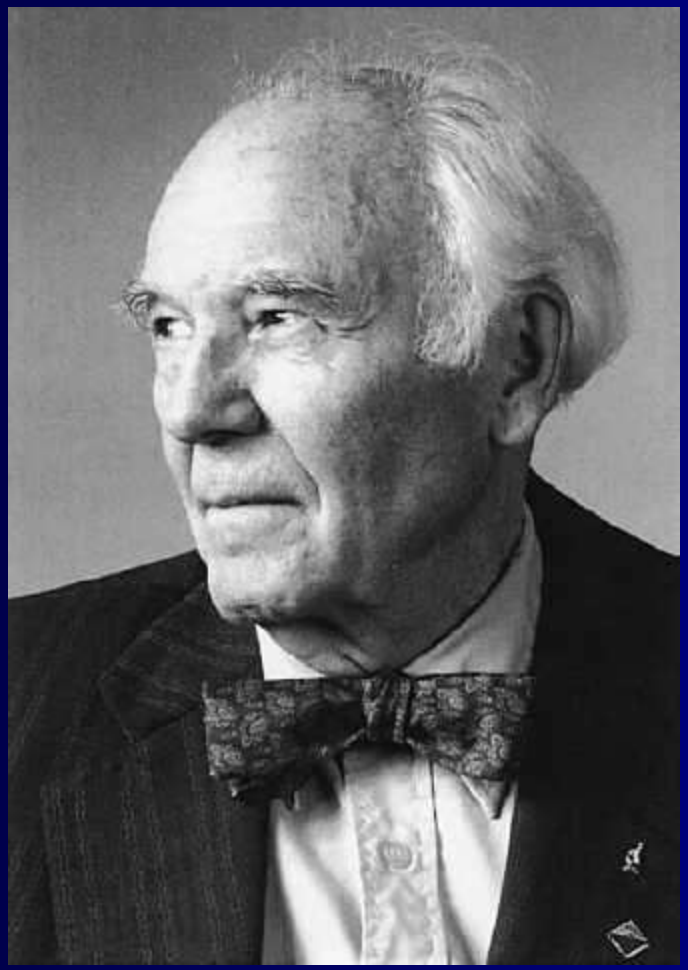


History

- Albert Osborn (1858-1946)
- 1910: developed the fundamental principles of document examination
- *Questioned Documents*

History

- Walter McCrone (1916-2002)
- Microscopy and other analytical methodologies to examine evidence
- Criminal and civil cases
  - Shroud of Turin
  - Vinland map



History

- Hans Gross (1847-1915)
- 1893: application of scientific principles to criminal investigation
- *Criminal Investigation*
  - Microscopy
  - Chemistry
  - Physics
  - Mineralogy
  - Zoology
  - Botany
  - Anthropometry
  - Fingerprinting

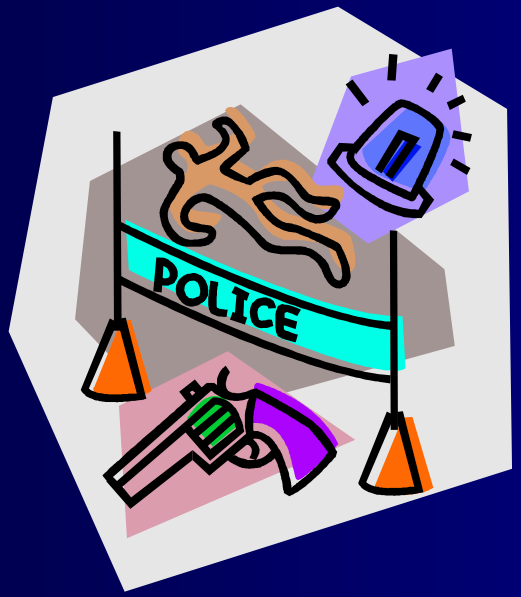
"You've left DNA samples all over the place!"

History

- Edmond Locard (1877-1966)
- 1910: incorporated Gross' principles within a workable crime laboratory

Locard's Exchange Principle

when a criminal comes in contact with an object or person, a cross-transfer of evidence occurs



CRIME LABORATORIES

The Crime Lab

- Rapid growth
- Lack of national and regional planning and coordination
- Approximately 350 public crime laboratories
- FBI Laboratory: world's largest
- Forensic Science Research and Training Center (1981)

The Crime Lab

- Los Angeles Police Department
  - Oldest US: 1923
  - August Volmer
- UC Berkeley
  - First US institute for criminology and criminalistics
  - School of criminology: 1948
  - Paul Kirk
- CA integrated network of labs

The Crime Lab

- Result of:
  - Supreme court decisions in the 1960s
    - Greater emphasis on scientifically evaluated evidence
  - Drug specimens
    - Accelerated drug abuse
  - DNA profiling

Employment Outlook

- Increased reliance by police agencies on civilian personnel
- Highly-sophisticated scientific analysis of evidence
- DNA databank of convicted offenders (state & national)
- Re-opening of old cases

Crime Lab Organization

Future Challenges

- Sophisticated technology
- Case work backlogs
- Person-of-interest DNA samples

Types of Crime Labs

- **Federal (Dept. of Justice)**
  - FBI
  - Drug Enforcement Administration
  - Bureau of Alcohol, Tobacco, Firearms and Explosives
  - US Postal Inspection Service
- **State and Local**
  - **MI: comprehensive statewide system**
  - **County, multicounty, city**

SERVICES OF THE CRIME LABORATORY

Five Basic Services:

Physical Science

- Chemistry
- Physics
- Geology
- Identify, compare physical evidence

Five Basic Services

- Biological science
  - Blood samples
  - Body fluids
  - Hair
  - Fiber samples

Five Basic Services

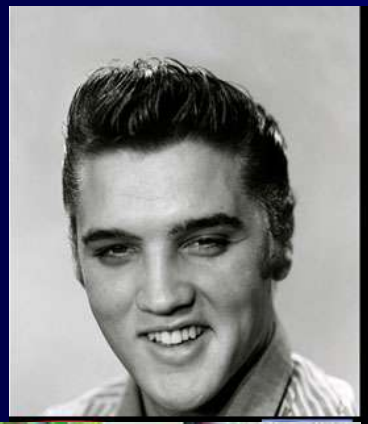
Firearms Unit:
Discharged bullets
Cartridge cases
Shotgun shells
Ammunition

Five Basic Services

- Document unit:
  - Handwriting analysis
  - Other questioned-document

Technical Support

- Photographic Unit:
  - Specialized photographic techniques
  - Record and examine physical evidence



Technical Support

- Optional services
  - Toxicology
  - Fingerprint analysis
  - Voiceprint analysis
  - Evidence collection
  - Polygraph administration
  - Crime scene investigation

FUNCTIONS OF THE FORENSIC SCIENTIST

Road to Solving the Crime

- Confessions
- Eyewitness accounts by victims or witnesses
- Evaluation of physical evidence from crime scene

Analysis of Physical Evidence

- Importance of physical evidence
- Scientific method
  - Systematic collection
  - Organization
  - Analysis of information
- Untainted by memory lapses, emotion, distortion

Scientific Method

- Formulate question: who committed crime
- Formulate hypothesis: reasonable explanation
- Test hypothesis through experimentation
  - Thorough
  - Recognized by other scientists as valid
- Validated results admitted in court

Analysis of Physical Evidence

- Determining admissibility of evidence: *Frye v. United States* (1923)
- "general acceptance in the particular field in which it belongs"
- Verified by
  - Expert witnesses
  - Evidence of reliability, reproducibility
  - Books, papers

Analysis of Physical Evidence

- Other standards of admissibility: Rule 702, Fed. Rules of Evidence
- Expert witness testimony (knowledge, skill, experience, training, education)
  - Based on sufficient facts/data
  - Product of reliable principles/methods
  - Principles/methods applied reliably to facts of case

Analysis of Physical Evidence

- **Other standards of admissibility: *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993)**
- **US Supreme Court decision**
  - *Frye* standard not absolute
  - Rule 702 assigns responsibility of ensuring expert's testimony based on reliable foundation and relevant to case

Analysis of Physical Evidence

- Judging scientific evidence
  - Scientific can and has been tested
  - Subject to peer review and publication
  - Potential rate of error
  - Standards controlling technique's operation
  - Theory/method widely accepted within relevant scientific community

Analysis of Physical Evidence

- Judging scientific evidence
- *Kumho Tire Co., Ltd. v. Carmichael* (1999)
  - Gate keeping role of trial judge for all expert testimony
- *Coppolino v. State*
  - Method devised for specific case

Stages Of Death

- Rigor mortis
  - Shortening of muscle tissue
  - Stiffening of body parts in the position at death
  - First 24 hours to 36 hours post mortem

Stages Of Death

- Livor mortis
  - Settling of blood in areas of the body closest to the ground
  - Begins immediately on death and continues up to 12 hours

Stages Of Death

- Algor mortis
  - Loss of heat by a body
  - Begins about an hour after death
  - Loses heat by 1 to 1-1/2 degrees fahrenheit per hour until the body reaches the environmental temperature

Provision of Expert Testimony

- Determining competence: experience, training, education
- Opposing attorney has opportunity to cross examine
- Also ability to communicate to non-scientists
- Judges' call

Provision of Expert Testimony

- Opinion or conclusion often given
- Absolute certainly impossible
- Must be advocate of truth

RECOGNITION, COLLECTION, AND PRESERVATION OF PHYSICAL EVIDENCE

Job Activities: training

- Evidence technician: training in recognition, collection and preservation of evidence
- Agencies without 24/7 evidence techs
  - All officers must be trained
  - Manuals
  - Tours
  - Continuing education

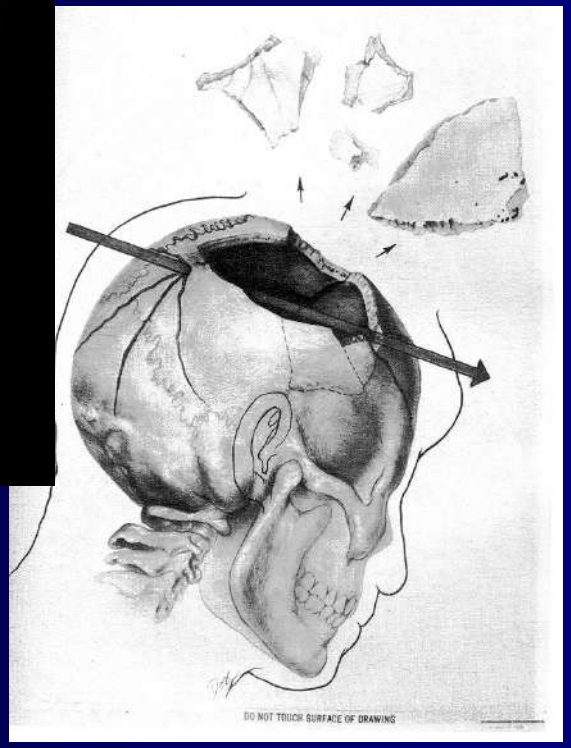
Other Forensic Science Services

Additional Specialization

- DNA analysis
  - Human
  - Non human
- Criminalistics
- Latent prints
- Pollen

Additional Specialization

- Arson
- Engineering sciences
- Physical anthropology
- Psychiatry
- Pathology



Additional Specialization

- Odontology
- Toxicology
- Entomology
- Geology
- Jurisprudence
- Computer & digital analysis

Forensic Science on the Internet

- www.forensicpage.com
- www.pearsoncustom.com/nh/sd_vlm/

Summary