



Basic principles of forensic science for an introductory overview course

## OVERVIEW

### Key Concepts of Forensic Science

- Application of a scientific method, tool, or technique to aid an investigation or judicial proceeding
- Used to support or refute hypotheses about how an event occurred
- Results integrated into the investigation, part of a larger story
- Many subdisciplines

#### Forensic laboratory



#### Medical examiner



### Characteristics of Forensic Data and Results

- Specific and complete, including caveats or limitations
- Reproducible; another forensic scientist provided with the same evidence and information should obtain the same results
- Falsifiable; results must be stated such that they can be tested for accuracy and completeness. A specific DNA profile or a specific blood alcohol measurement is falsifiable because the results can be confirmed by scientific testing
- Relevant to the case at hand. The analysis of a bloodstain sample would be done to obtain the DNA profile; cholesterol level in the blood is irrelevant

### Selected Historical Figures

- **Alphonse Bertillon (1853–1914; French)**
  - Used measurements of physical features for identification called **anthropometry** or **Bertillonage**. Replaced by fingerprinting
- **Francis Galton (1822–1911; English)**
  - Fingerprints
- **Alexander Gottler (1882–1968; American)**
  - Forensic toxicology. Performed chemical analysis for the New York Office of Chief Medical Examiner (OCME)
- **Calvin Goddard (1891–1955; American)**
  - Comparison microscopy and firearms
- **Hans Gross (1847–1915; Austrian)**
  - Coined the term **criminalistics**

- **Alec Jeffreys (1950–; English)**
  - Developed early DNA testing methods
  - First to use DNA typing in a criminal matter (Colin Pitchfork case)
- **Paul Kirk (1902–1970; American)**
  - Generalist and educator
- **Edmond Locard (1877–1966; French)**
  - Trace evidence. Opened an early forensic laboratory
  - Credited for Locard's Exchange Principle, paraphrased as "every contact leaves a trace"
- **Charles Norris (1867–1935; American)**
  - Physician. Early head of the OCME
- **Mathias Orfila (1787–1853; Spanish)**
  - Worked in Italy and France. Forensic toxicologist and educator
  - Utilized the Marsh test for arsenic in the Lufarge case
- **Bernard Spilsbury (1877–1947; English)**
  - Physician and forensic pathologist

### Bias and Human Error

- **Bias** can cause results of a forensic analysis to be influenced by factors other than evidence and testing results
- Usually unintended and unconscious
- Can be caused by **contextual information** irrelevant to the case
- **Confirmation bias** can occur if a specific result is anticipated or expected
- Prosecutorial bias/defense bias favors a specific side in the dispute

### Interface with the US Legal System

#### US legal system

- Legal system designed to settle disputes
- **Adversarial:** based on comparing competing arguments
- Criminal cases
  - Accused/defendant vs. government (local/state/federal)
  - Prosecution vs. defense
  - **Burden of proof** on prosecution
  - Standard of proof: beyond a reasonable doubt
- Civil cases
  - Individual vs. individual, corporations, companies, etc.
  - Plaintiff vs. defense

### Quality assurance/quality control (QA/QC)

- Practices and procedures used to ensure that forensic data are relevant and trustworthy
- **Cradle-to-grave process**—from evidence creation to final disposition
- Forensic laboratories can be **accredited**
- Analysts may be **certified** in some disciplines

- Burden of proof on prosecution
- Standard of proof: preponderance of evidence
- **Jurisdiction:** the entity empowered to hear a case—local (town, city, county), state, and federal
- Decision rendered by **trier-of-fact** (judge or jury)
- Rules on precedent—rulings by previous courts

#### US Rules of Evidence

- Process to allow evidence to be presented in a legal proceeding
- Evidence is admissible if it meets **admissibility standards**
- Applies to forensic results and data
- Admissibility standards vary across jurisdictions
- **Frye standard**
  - Informally called **general acceptance** admissibility standard
  - 1923 ruling
  - Decision to reject admission of polygraph (lie detector) test
  - Court ruled that to admit new type of test, it must have been accepted within that scientific discipline
- **Federal Rules of Evidence**
  - Congressionally enacted 1975
  - Frequently updated
  - Applies to federal jurisdictions
  - Adopted by other jurisdictions
  - Guidelines for expert testimony
- **Daubert standard**
  - Informally called **gatekeeper standard**
  - 1993 ruling in civil case
  - Trial judge to make admissibility decision; judge as **gatekeeper**
  - Ruling provided guidelines for making this decision
  - Included general acceptance, validation of method, standards, limitations, and potential errors
  - Part of **Daubert trilogy** of cases
- **Joiner decision**
  - Second of Daubert trilogy
  - 1997 ruling in civil case
  - Scientific evidence must be directly relevant
- **Kumho decision**
  - Third case of Daubert trilogy
  - 1999 ruling in civil case
  - Extended definition of expert beyond traditional sciences

- Methods created by **standard operating procedure (SOP)**
- **Traceability** ability to trace result directly to nationally/internationally accepted standard
- **Control samples** analyzed with evidence
- Results reviewed by colleagues (**peer review**)
- Data reviewed and confirmed

### Laboratory accreditation



#### Analyst certification

- Identify issues
- Implement corrective action
- Prevent future occurrences

# Forensic Science Unit Study Guide

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## Forensic Science Unit Study Guide:

**National Library of Medicine AVLINE Catalog** National Library of Medicine (U.S.),1975 Listing of audiovisual materials catalogued by NLM Items listed were reviewed under the auspices of the American Association of Dental Schools and the Association of American Medical Colleges and are considered suitable for instruction Entries arranged under MeSH subject headings Entry gives full descriptive information and source Also includes Procurement source section that gives addresses and telephone numbers of all sources **Catalog** National Medical Audiovisual Center,1981 **National**

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McGraw-Hill,2002 *The School Science Review* ,2007 **Which Degree Guide** ,2001 *PRENTICE HALL FORENSIC SCIENCE STUDENT STUDY GUIDE and LAB MANUAL* Prentice-Hall Staff,2007-12-15 Forensic Science introduces students to the science of solving crimes Students will learn about cutting edge forensic science practices and procedures such as DNA profiling digital imaging and crime scene reconstruction With relevant content engaging explorations and a wealth of hands on activities Forensic Science engages you and your students in the science behind solving crimes Read a review of Forensic Science

An Introductory Guide to EC Competition Law and Practice Valentine Korah,1994 **Forensic Science Review** ,1999 **Forensic Biology** Richard Li,2008-04-24 Addressing the important subject of forensic DNA analysis this title provides a concise scientific overview of the field The author focuses on the two main areas of forensic analysis identification of biological evidence and forensic DNA analysis *Bowker's Law Books and Serials in Print* ,2000

*The Book Review Digest* ,2003 The Publishers' Trade List Annual ,1989 **The American Political Science Review** Westel Woodbury Willoughby,John Archibald Fairlie,Frederic Austin Ogg,1925 American Political Science Review APSR is the longest running publication of the American Political Science Association APSA It features research from all fields of political science and contains an extensive book review section of the discipline **Studyguide for Fundamentals of Forensic Science by Houck, Max M.** Cram101 Textbook Reviews,2013-05 Never HIGHLIGHT a Book Again Virtually all testable terms concepts persons places and events are included Cram101 Textbook Outlines gives all of the outlines highlights notes for your textbook with optional online practice tests Only Cram101 Outlines are Textbook Specific Cram101 is NOT the Textbook Accompanys 9780521673761 **Quarterly Bulletin** Nebraska. State Teachers College, Kearney,1930

**Current Index to Journals in Education** ,1996

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