



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 Laffarge 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 Study Guide Answers

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## **Forensic Science Study Guide Answers:**

Forensic Science Study Guide Answers: Bestsellers in 2023 The year 2023 has witnessed a noteworthy surge in literary brilliance, with numerous compelling novels captivating the hearts of readers worldwide. Lets delve into the realm of top-selling books, exploring the fascinating narratives that have enthralled audiences this year. The Must-Read : Colleen Hoover "It Ends with Us" This touching tale of love, loss, and resilience has gripped readers with its raw and emotional exploration of domestic abuse. Hoover masterfully weaves a story of hope and healing, reminding us that even in the darkest of times, the human spirit can succeed. Uncover the Best : Taylor Jenkins Reids "The Seven Husbands of Evelyn Hugo" This captivating historical fiction novel unravels the life of Evelyn Hugo, a Hollywood icon who defies expectations and societal norms to pursue her dreams. Reids compelling storytelling and compelling characters transport readers to a bygone era, immersing them in a world of glamour, ambition, and self-discovery. Discover the Magic : Delia Owens "Where the Crawdads Sing" This captivating coming-of-age story follows Kya Clark, a young woman who grows up alone in the marshes of North Carolina. Owens spins a tale of resilience, survival, and the transformative power of nature, entrancing readers with its evocative prose and mesmerizing setting. These bestselling novels represent just a fraction of the literary treasures that have emerged in 2023. Whether you seek tales of romance, adventure, or personal growth, the world of literature offers an abundance of captivating stories waiting to be discovered. The novel begins with Richard Papen, a bright but troubled young man, arriving at Hampden College. Richard is immediately drawn to the group of students who call themselves the Classics Club. The club is led by Henry Winter, a brilliant and charismatic young man. Henry is obsessed with Greek mythology and philosophy, and he quickly draws Richard into his world. The other members of the Classics Club are equally as fascinating. Bunny Corcoran is a wealthy and spoiled young man who is always looking for a good time. Charles Tavis is a quiet and reserved young man who is deeply in love with Henry. Camilla Macaulay is a beautiful and intelligent young woman who is drawn to the power and danger of the Classics Club. The students are all deeply in love with Morrow, and they are willing to do anything to please him. Morrow is a complex and mysterious figure, and he seems to be manipulating the students for his own purposes. As the students become more involved with Morrow, they begin to commit increasingly dangerous acts. The Secret History is a exceptional and suspenseful novel that will keep you wondering until the very end. The novel is a warning tale about the dangers of obsession and the power of evil.

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