

FORENSIC SCIENCE

for High School

Kendall Hunt

Chapter 1 Print Sampler

STUDENT EDITION | TEACHER EDITION



Instructional Options

This program is designed with a variety of teaching options in mind. The program can be offered as a one-year or a one-semester science course, or applicable units and chapters can be pulled out to use in relevant science courses. The writing and content of this text target high school, but many ideas and activities can be adapted to middle school, as well as to nonscience majors in two- and four-year colleges.

Components

Student Edition, Teacher Edition + online resources, and material kits. All purchases of the new Forensic Science for High School 4th Edition include digital licenses for Diablo Highway.

What is Diablo Highway?

Diablo Highway is a virtual crime simulation based on a real, unsolved double-homicide from the 1930s. Students begin by reading about the crime, observing associated primary source documents, and exploring the two virtual crime scenes to find and collect evidence. This evidence is used by students to complete the subsequent lessons, each of which focuses on analyzing a specific type of evidence. The lessons each include a reading, quiz, and digital lab activity.

There are nine lessons on various types of evidence:

- Blood Typing
- Hair Analysis
- Fingerprint Analysis
- DNA Profiling
- Shoe Impressions
- Tire Impressions
- Fiber Analysis
- Firearms Identification
- Crime Scene Mapping

These lessons integrate seamlessly into the *Forensic Science for High School 4th Edition* textbook, with each lesson pairing with a chapter in the textbook. Lessons in *Diablo Highway* can be completed in any order after students have read the initial lesson about the crime and collected evidence from the two virtual crime scenes. This allows flexibility and autonomy for the instructor to teach the chapters and concepts in the order that works best for them and their students.

Upon completing all lessons, students attempt to solve the crime, identifying the culprit from the list of suspects using evidence they have collected. Finally, students compose a report stating their rationale for the suspect they selected. A suggested implementation guide is included in the Teacher Edition of the *Forensic Science for High School 4th Edition* textbook.

DIABLO HIGHWAY FORENSIC SCIENCE LAB ACTIVITY



► Table of Contents

| | |
|-----------------------|--|
| Foreword | |
| Preface | |
| About the Author..... | |
| Acknowledgments | |

Chapter 1

Introduction to Forensic Science and the Law

| | |
|---|--|
| Objectives..... | |
| What Is Forensic Science? | |
| Crime Laboratories | |
| Highlights in the History of Forensic Science | |
| Methodology..... | |
| Activity 1.1: The Locard Principle | |
| Criminal Justice and the Law | |
| Types of Crimes | |
| Steps in Pursuing Justice..... | |
| Federal Rules of Evidence | |
| The CSI Effect | |
| Case Study 1.1: Richard Crafts | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 2

Types of Evidence

| | |
|---|--|
| Objectives..... | |
| Evidence | |
| Testimonial or Direct Evidence..... | |
| Physical Evidence..... | |
| Case Study 2.1: Coral Eugene Watts | |
| Case Study 2.2: Robert Nelson..... | |
| Activity 2.1: Probability and Class Evidence..... | |
| Activity 2.2: Can This Evidence Be Individualized? | |
| Case Study 2.3: Fracture Match..... | |
| Project: Both Sides of the Issue; Public Information on Registered Sex Offenders... | |
| Career Connection | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 3

The Crime Scene

| | |
|--|-------|
| Objectives..... | ..... |
| At the Crime Scene ..... | ..... |
| Case Study 3.1: Jeffrey MacDonald ..... | ..... |
| Case Study 3.2: The Amanda Knox Trials ..... | ..... |
| Evaluating a Crime Scene ..... | ..... |
| Career Connection..... | ..... |
| Checkpoint Questions..... | ..... |
| Additional Activities ..... | ..... |
| References ..... | ..... |

Chapter 4

Fingerprints

| | |
|--|-------|
| Objectives..... | ..... |
| At the Crime Scene ..... | ..... |
| The History of Fingerprints..... | ..... |
| The Anatomy of Fingerprints..... | ..... |
| Laboratory Activity 4.1: Observing and Taking Fingerprints ..... | ..... |
| Classification of Fingerprints..... | ..... |
| Types of Prints..... | ..... |
| Laboratory Activity 4.2: Developing Latent Fingerprints..... | ..... |
| Other Methods ..... | ..... |
| Other Biometrics ..... | ..... |
| Case Study 4.1: Donald and Ronald Smith ..... | ..... |
| Case Study 4.2: Madrid Bombings ..... | ..... |
| Career Connection..... | ..... |
| Checkpoint Questions..... | ..... |
| Additional Activities ..... | ..... |
| References ..... | ..... |

Chapter 5

Hair

| | |
|---|-------|
| Objectives..... | ..... |
| Hair as Evidence..... | ..... |
| The Crime Scene ..... | ..... |
| Laboratory Activity 5.1: Observation of Hair..... | ..... |
| The Form and Structure of Hair ..... | ..... |
| Laboratory Activity 5.2: Microscopic Examination..... | ..... |
| Laboratory Activity 5.3: Optional..... | ..... |
| The Value of Hair as Evidence ..... | ..... |
| Hair as a Chemical Indicator..... | ..... |
| Case Study 5.1: Colin Ross ..... | ..... |

| | |
|-----------------------------|--|
| Career Connection | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 6

Fibers

| | |
|--|--|
| Objectives..... | |
| Using Fibers as Evidence | |
| Activity 6.1: Collection and Observation | |
| Activity 6.2: Sampling and Statistics..... | |
| Sources and Types of Fibers | |
| Laboratory Activity 6.1: Fabric Observation | |
| Fiber Morphology | |
| Laboratory Activity 6.2: Microscopic Examination of Fibers..... | |
| Laboratory Activity 6.3: Preparation of Fiber Cross Sections..... | |
| Activity 6.3: Probative Value of Fabrics..... | |
| Laboratory Activity 6.4: Preparation of a Polyester | |
| Fiber Analysis..... | |
| Laboratory Activity 6.5: Burn Tests..... | |
| Laboratory Activity 6.6: Thermal Decomposition | |
| Laboratory Activity 6.7: Chemical Tests..... | |
| Laboratory Activity 6.8: Distinguishing Fiber Type by Refractive Index | |
| Laboratory Activity 6.9: Observing Fluorescence in Fibers | |
| Laboratory Activity 6.10: Dyeing Fabrics | |
| Laboratory Activity 6.11: Thin-Layer Chromatography (TLC) of Dyes..... | |
| Activity 6.4: Matching Fibers from a Crime Scene..... | |
| Other Tests for Fiber Evidence..... | |
| Fiber Transfer and Persistence..... | |
| Case Study 6.1: Jeanine Harms | |
| Case Study 6.2: Amanda Davies Case..... | |
| Laboratory Activity 6.12: Testing Fiber Transfer and Persistence | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 7

Fibers

| | |
|--|--|
| Objectives..... | |
| Drugs and Crime | |
| Spot Test Lab | |
| Laboratory Activity 7.1: Spot Test Lab | |

| | |
|--|--|
| Objectives..... | |
| Drugs and Crime | |
| Spot Test Lab | |
| Laboratory Activity 7.1: Spot Test Lab | |
| Laboratory Activity 7.2: Is It Ibuprofen?..... | |
| Thin-Layer Chromatography..... | |
| Case Study 7.1: “The Drugs Made Me Do It” | |
| Laboratory Activity 7.3: Qualitative Analysis by Thin-Layer Chromatography (TLC) | |
| Laboratory Activity 7.4: The Quantitative Analysis of Aspirin by Spectrophotometry | |
| The Metabolism of Aspirin..... | |
| Testing for Marijuana..... | |
| Laboratory Activity 7.5: Detecting Marijuana | |
| Drug Tests That Use Color..... | |
| Laboratory Activity 7.6: Presumptive Color Tests for Drugs..... | |
| Confirmatory Tests..... | |
| Case Study 7.2: 52 Years for Selling “Incense” | |
| Project: Both Sides of the Issue; Legalization of Drugs | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 8

Toxicology: Poisons and Alcohol

| | |
|--|--|
| Objectives..... | |
| The Study of Poisons..... | |
| The History of Poisons..... | |
| Elements of Toxicology..... | |
| Measuring Toxicity | |
| Case Study 8.1: International Espionage | |
| Lead Poisoning | |
| Laboratory Activity 8.1: Detecting Lead | |
| Laboratory Activity 8.2: The Investigation of a Sudden Death | |
| Case Study 8.2: Robert Ferrante | |
| Alcohol..... | |
| Field Sobriety Tests | |
| Current Breath-Testing Technology | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 9

Trace Evidence

| | |
|--|-------|
| Objectives..... | ..... |
| Trace Evidence at the Crime Scene..... | ..... |
| Activity 9.1: How Well Can You Identify Trace Evidence? ..... | ..... |
| Metals: Product Liability?..... | ..... |
| Laboratory Activity 9.1: Identification of Metals ..... | ..... |
| Metals: Environmental Contamination ..... | ..... |
| Laboratory Activity 9.2: Testing for Environmental Contamination..... | ..... |
| Qualitative Analysis of Powders ..... | ..... |
| Laboratory Activity 9.3: Analysis of White Powders ..... | ..... |
| Laboratory Activity 9.4: The Case of the Purloined Pennies ..... | ..... |
| Flame Tests ..... | ..... |
| Laboratory Activity 9.5: Flame Tests..... | ..... |
| Cheiloscopy: The Study of Lip Prints..... | ..... |
| Laboratory Activity 9.6: Lip Prints—A Bank Robbery with Impact ..... | ..... |
| Lipstick: The Telltale Smudge..... | ..... |
| Laboratory Activity 9.7: Analyzing Lipstick with Thin-Layer Chromatography ... | ..... |
| Paint..... | ..... |
| Laboratory Activity 9.8: Paint Chip Analysis ..... | ..... |
| Case Study 9.1: A Web of Trace Evidence Ensnares Two Dangerous | ..... |
| Brothers in a Summer of Terror ..... | ..... |
| Career Connection ..... | ..... |
| Checkpoint Questions..... | ..... |
| Additional Activities ..... | ..... |
| References ..... | ..... |

Chapter 10

Soil and Glass Analysis

| | |
|---|-------|
| Objectives..... | ..... |
| Soil as Evidence..... | ..... |
| Laboratory Activity 10.1: Collecting and Observing Soil..... | ..... |
| What Is Soil?..... | ..... |
| Laboratory Activity 10.2: A Hit-and-Run Accident..... | ..... |
| Laboratory Activity 10.3: Where Is Alice Springs? ..... | ..... |
| Case Study 10.1: Louis Felts..... | ..... |
| Glass as Evidence ..... | ..... |
| Laboratory Activity 10.4: Observation of Different Types of Glass ..... | ..... |
| Nature of Glass ..... | ..... |
| Laboratory Activity 10.5: Characterization of Glass ..... | ..... |
| Refractive Index ..... | ..... |
| Laboratory Activity 10.6: Determining Refractive Index ..... | ..... |

| | |
|--|-------|
| Laboratory Activity 10.7: Refractive Index..... | ..... |
| Glass Fracture Patterns..... | ..... |
| Laboratory Activity 10.8: Analysis of Glass Fracture Patterns..... | ..... |
| Case Study 10.2: Amanda Knox Revisited ..... | ..... |
| Career Connection..... | ..... |
| Checkpoint Questions..... | ..... |
| Additional Activities ..... | ..... |
| References ..... | ..... |

Chapter 11

Blood

| | |
|--|-------|
| Objectives..... | ..... |
| Blood at the Scene of the Crime..... | ..... |
| Laboratory Activity 11.1: Detection of Blood ..... | ..... |
| Human or Animal? ..... | ..... |
| Laboratory Activity 11.2: Human versus Animal Blood..... | ..... |
| Serology..... | ..... |
| Laboratory Activity 11.3: ABO/Rh Blood Typing..... | ..... |
| Testing Dried Blood ..... | ..... |
| Case Study 11.1: Christopher Vaughn..... | ..... |
| Blood Spatter Evidence..... | ..... |
| Laboratory Activity 11.4: Blood Pattern Analysis..... | ..... |
| Case Study 11.2: The Sam Sheppard Case..... | ..... |
| Career Connection..... | ..... |
| Checkpoint Questions..... | ..... |
| Additional Activities ..... | ..... |
| References ..... | ..... |

Chapter 12

DNA Analysis

| | |
|--|-------|
| Objectives..... | ..... |
| DNA ..... | ..... |
| Biological Aspects of DNA..... | ..... |
| Forensic Uses of DNA..... | ..... |
| Laboratory Activity 12.1: Extracting DNA from a Banana ..... | ..... |
| RFLP Analysis for DNA Profiling ..... | ..... |
| Activity 12.1: Simulation of RFLP..... | ..... |
| Electrophoresis..... | ..... |
| Laboratory Activity 12.2: Electrophoresis Separation of Dyes ..... | ..... |
| Statistical Analysis in DNA Profiling..... | ..... |
| Activity 12.2: Statistical Sampling Lab..... | ..... |
| PCR: Polymerase Chain Reaction and DNA Profiling ..... | ..... |

| | |
|--|--|
| Activity 12.3: Simulation of DNA Replication Using PCR..... | |
| Case Study 12.1: DNA Proves Innocence | |
| STR: Short Tandem Repeats | |
| Mitochondrial DNA..... | |
| Project: Both Sides of the Issue; Establishment of a DNA Databank..... | |
| Case Study 12.2: The Green River Killer Case..... | |
| Forensic Genetic Genealogy | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 13 Forensic Entomology

| | |
|---|--|
| Objectives..... | |
| Activity 13.1: Test Your Knowledge of the Insect World..... | |
| Laboratory Activity 13.1: Collection and Observation of Insects | |
| Taxonomy | |
| Life Cycle of Insects | |
| Forensic Entomology..... | |
| Case Study 13.1: Serial Killer Anthony Sowell..... | |
| The Insects of Death..... | |
| Case Study 13.2: Body in the Basement | |
| Laboratory Activity 13.2: The Effects of Temperature on Rearing of Maggots .. | |
| Laboratory Activity 13.3: Fly Infestation as a Function of Habitat | |
| Laboratory Activity 13.4: Beetle Infestation of Carrion | |
| Other Uses of Insects in Forensic Science | |
| Laboratory Activity 13.5: Maggot Ingestion of Drugs from a Corpse | |
| Collection of Evidence | |
| New Developments in Forensic Entomology..... | |
| Case Study 13.3: PMI Determined from Photographs | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 14 Human Remains

| | |
|---|--|
| Objectives..... | |
| The Process of Death | |
| Activity 14.1: Estimating Time of Death..... | |
| Laboratory Activity 14.2: The Potato Corpse | |
| Investigating Human Remains | |
| Forensic Anthropology: Skeletal Remains | |

| | |
|--|--|
| Human versus Animal Bones..... | |
| The Skeleton..... | |
| Activity 14.3: Identifying Bones | |
| Stature: Estimating Height | |
| Activity 14.4: Estimating Height..... | |
| Sex Determination | |
| Laboratory Activity 14.1: Determining Sex Using the Os Pubis | |
| Activity 14.5: Determining Sex Using Skull Features | |
| Determining Age..... | |
| Activity 14.6: Determining Age Using the Epiphyses | |
| Case Study 14.1: Massacre at El Mozote | |
| Determination of Race | |
| Facial Reconstruction | |
| Case Study 14.2: Facial Reconstruction | |
| The Cause of Death and Bone Anomalies..... | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 15 **Firearms, Toolmarks, and Impressions**

| | |
|---|--|
| Objectives..... | |
| Firearms..... | |
| Laboratory Activity 15.1: Characterization of Bullets and Cartridge Casings ... | |
| Laboratory Activity 15.2: The Griess Test | |
| Laboratory Activity 15.3: The Sodium Rhodizonate Test for Lead Residue..... | |
| Laboratory Activity 15.4: The Corpse in the Closet..... | |
| Case Study 15.1: The Case of People v. Contreras | |
| Project: Both Sides of the Issue; Gun Control Laws..... | |
| Toolmarks..... | |
| Impressions | |
| Laboratory Activity 15.5: Matching Toolmarks | |
| Case Study 15.2: Shoeprint Investigation of the Simpson-Goldman Murders... | |
| Laboratory Activity 15.6: Casting Shoeprints..... | |
| Laboratory Activity 15.7: Relating Shoe Size to Height..... | |
| Laboratory Activity 15.8: Comparing Bite Marks | |
| Laboratory Activity 15.9: The Case of the Bitten Bonbon..... | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| Books and Articles | |
| Websites | |
| References | |

Chapter 16

Document and Handwriting Analysis

| | |
|--|--|
| Objectives..... | |
| Documents as Evidence..... | |
| Analysis of Handwriting and Handprinting..... | |
| Activity 16.1: Analyze Your Own Handwriting | |
| Case Study 16.1: Anonymous Writing..... | |
| Methods of Forgery | |
| Activity 16.2: Simulated Forgery Scene | |
| Activity 16.3: Blind, Simulated, and Traced Forgery..... | |
| Activity 16.4: Analysis of Handwriting Using a Letter Angle Template | |
| Activity 16.5: Analysis of the Tops and Bottoms of Letters | |
| Activity 16.6: Detecting Deliberately Disguised Handwriting | |
| Obliterations | |
| Laboratory Activity 16.1: Finding Erasures..... | |
| Indentations..... | |
| Laboratory Activity 16.2: Enhancing Indented Writing..... | |
| Individualizing Typing and Printing..... | |
| Paper | |
| Inks | |
| Laboratory Activity 16.3: Analysis of Paper..... | |
| Laboratory Activity 16.4: Ink Comparison Using Paper Chromatography..... | |
| Counterfeiting..... | |
| Laboratory Activity 16.5: Know Your Money | |
| Laboratory Activity 16.6: Testing for Counterfeit Currency..... | |
| Case Study 16.2: The Printer..... | |
| Career Connection..... | |
| Checkpoint Questions..... | |
| Additional Activities | |
| References | |

Chapter 17

Cybercrime

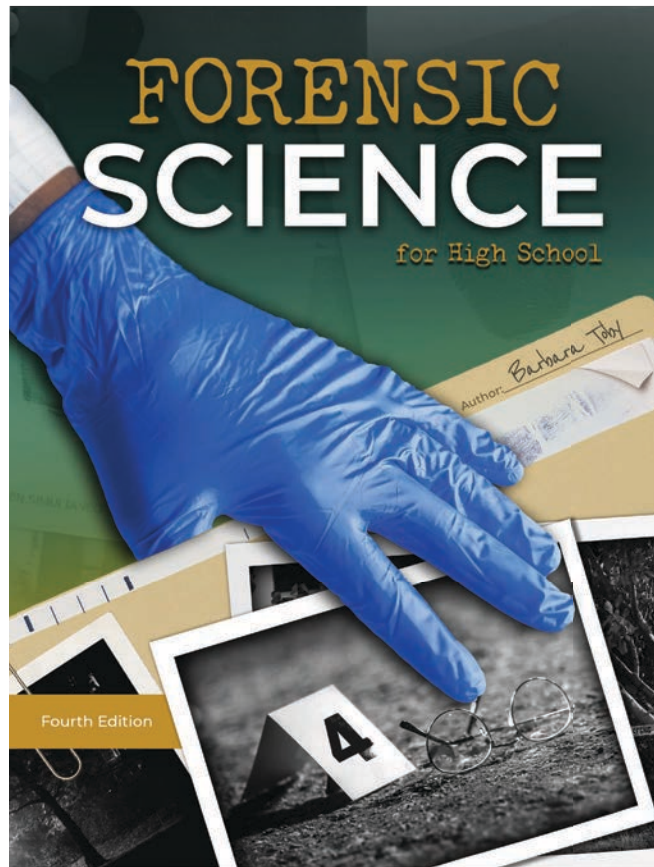
| | |
|---|--|
| Objectives..... | |
| Activity 17.1: International Cybercrime..... | |
| The Language of Cybercrime..... | |
| Types of Cybercrime..... | |
| Activity 17.2: Cyberstalking, Harassing, and Bullying | |
| Case Study 17.1: The Case of the Hired Hacker..... | |
| Computer Forensics | |
| Class Activity 17.3: FBI Most Wanted..... | |
| How to Protect Yourself from Cybercrime..... | |
| Case Study 17.2: Online Stalker..... | |
| Tracking Scammers | |

Career Connection.....
Checkpoint Questions.....
Additional Activities
References

Appendices
Glossary
Index.....

SAMPLE

**Table of contents subject to change.*



Chapter 1

Introduction to Forensic Science and the Law

STUDENT EDITION

Chapter

1

Introduction to Forensic Science and the Law



The United States Supreme Court in Washington, D.C.

“

The clearest way to show what the rule of law means to us in everyday life is to recall what has happened when there is no rule of law.

—Dwight D. Eisenhower, former President of the United States

”

Objectives



- Explain how crime labs in the United States are organized and what services they provide.
- Describe the growth and development of forensic science through history.
- Analyze federal rules of evidence, including the *Frye* standard and the *Daubert* ruling.
- Compare basic types of law in the criminal justice system.
- Describe how the scientific method is used to solve forensic problems.
- Describe different jobs done by forensic scientists and the experts they consult.

Key Vocabulary

| | | | | |
|----------------|---------------------------------|---|------------------------------------|-----------------------|
| criminalistics | constitutional or statutory law | probable cause | bail | probative |
| evidence | common law or case law | violation | <i>nolo contendere</i> | material |
| ballistics | <i>stare decisis</i> | infraction | preliminary or evidentiary hearing | hearsay |
| odontology | civil law | elements | grand jury | expert witness |
| pathology | criminal law | booking | indict | <i>Frye</i> standard |
| entomology | misdemeanor | <i>Miranda</i> rights or <i>Miranda</i> warning | plea bargaining | <i>Daubert</i> ruling |
| palynology | felony | arraignment | | junk science |

criminalistics

the examination of physical evidence. The term *forensics* may also include broader areas of investigation, such as pathology.

evidence

anything that tends to establish or disprove a fact. Evidence can include testimony, documents, and other objects.

ballistics

the science that deals with the motion, behavior, and effects of projectiles, most often firearms and bullets

The word *forensic* is derived from the Latin *forensis* meaning forum, a public place where, in Roman times, senators and others debated and held judicial proceedings.

► What Is Forensic Science?

Forensic science is the study and application of science to matters of law. Forensic scientists examine the associations among people, places, things, and events involved in crimes. You can use the terms *forensic science* and **criminalistics** interchangeably.

Forensic scientists use crime labs to help them examine **evidence**. Most crime labs include several departments:

physical science (including chemistry, physics, and geology)

biology

ballistics

document examination

photography

toxicology and drug analysis

fingerprints

trace evidence

A forensic scientist's main job is to study the different types of evidence found at a crime scene. When evidence is brought into the lab, the first task is to identify what it is and then to attempt to determine its origin. Where did the evidence come from? How did it get there? The forensic scientist must be ready to testify as an expert witness at a trial or hearing. In this role, he or she presents data, weighs evidence, and gives an impartial opinion to the court. A forensic scientist also performs scientific research and trains others in the area of forensic science.

Forensic scientists come from many backgrounds; many have studied biology or microbiology, chemistry, physical science, geology, or one of the other sciences. They then learn about forensics through experience and independent study. Many have advanced degrees in forensic science. Some forensic scientists learn their profession through experience with a police force.

► Crime Laboratories

The vast majority of crime labs are public, that is, funded by taxes at the federal, state, or local level. Most public labs provide services for police, prosecutors, and other law enforcement agencies. Private labs exist and can be accessed for a fee by public agencies or private citizens. Sometimes public labs can be used by legal defense teams and private citizens, but these users must pay a fee. Most labs are maintained by the states for individual regions. Large cities, such as New York and

Los Angeles, may have their own labs, while local labs may serve county and municipal agencies.

Federal Labs

The Department of Justice maintains forensic labs in the FBI, DEA, ATF, and the USPS.

The Federal Bureau of Investigation (FBI) maintains the largest crime laboratory in the world. The agency is an intelligence and threat-focused organization. It provides support for investigations from other federal agencies, as well as state, county, and local law enforcement agencies. They deal with federal crimes such as:

- Theft from government properties such as from banks and federal buildings.
- Crimes involving more than one state or crossing over state lines of anything obtained by fraud or theft and conveyed by any means and transported to another state or internationally.
- “Fencing” of stolen property, which involves knowingly selling property that has been stolen to make a profit.
- Obstruction of commerce by violence or threats.
- Money laundering, which involves hiding where the money made from illegal activities came from to make it look legitimate (legal).

They gather, share, and analyze intelligence from the other agencies including state, county, and local. They provide laboratory examinations and training to these agencies and maintain the Integrated Automated Fingerprint Identification System (IAFIS). The FBI employs over 35,000 special agents and professional staff.

The FBI maintains the IAFIS system that is a national fingerprint and criminal history database. It responds to requests from federal, state and local authorities on a 24-hour basis 365 days a year. The Next Generation Identification-NGI system is gradually replacing IAFIS in increments and has the ability to process fingerprints more quickly, effectively, and accurately.



Research crime lab at Michigan State University



FBI Headquarters in Washington, D.C.

The Drug Enforcement Agency (DEA) operates seven laboratories throughout the country. These laboratories work mainly on investigating major illicit drug activities inside and outside the United States, but may also work with local enforcement agencies on joint operations. The DEA supports other law enforcement with analysis of suspected controlled substances, crime scene investigation, latent fingerprint identification, analysis and evaluation of digital evidence, processing of hazardous waste cleanups at clandestine laboratory investigations and disposals, and expert witness testimony.

The DEA has also established a Computer Forensics division that processes digital evidence. They provide on-site duplication support when evidence cannot be removed from a business and provides expert witness testimony.

The Bureau of Alcohol, Tobacco, and Firearms (ATF) operates three regional laboratories and a fire research laboratory. The ATF deals with crimes involving alcohol, weapons, explosives, tobacco, and organized crime.

The Department of Homeland Security (DHS) now maintains the Secret Service laboratory, which has two main duties: one is to guard against counterfeiting and the other is to protect the president. The DHS employs over 250,000 in jobs that range from aviation and border security to emergency response, from cybersecurity analyst to chemical facility inspector. Their duties are wide-ranging, but the goal is clear—keeping America safe.

The Department of Treasury maintains a laboratory for the Internal Revenue Service (IRS) specializing in questioned documents. The U.S. Postal Service has its own laboratory to handle crimes involving the mail. The Department of the Interior maintains the U.S. Fish and Wildlife Service laboratory, which is the only laboratory in the world dedicated to crimes involving animals, such as poaching and importing endangered species, and crimes in national parks.

State or local crime laboratories may have the following divisions and functions:

- A physical science unit to examine drugs, soil, glass, paint, blood spatter patterns, and other trace physical evidence using chemistry, physics, or geology.
- A firearms unit to examine tool marks, weapons, firearms, and bullets.

Other Facts

In the fiscal year of 2022, ATF laboratories accomplished the following:

- 34,436 firearms cases initiated
- 2,242 arson cases initiated
- 1,194 explosives cases initiated
- 10,138 cases recommended for prosecution
- 6,315 cases indicted
- 5,388 cases convicted

—www.atf.gov

- A document analysis unit to examine handwriting, typewriting, word processing and computer applications, paper, and ink.
- A biology unit to analyze body fluids, DNA, blood factors, hair, fibers, and plant life using biology, biochemistry, and microbiology.

Some larger crime laboratories may also have units specializing in photography, toxicology (poisons), latent fingerprints, polygraphs, arson, and evidence collection.

Sometimes forensic scientists may consult with other scientists who specialize in specific disciplines such as:

anthropology

psychiatry

odontology

engineering

computer technology

pathology

geology

environmental science

entomology

palynology

polygraphy

voiceprint analysis

odontology

in forensics, examination of bite marks and dental identification of corpses

pathology

investigation of sudden, unexplained, or violent death

entomology

the study of insects

palynology

the study of pollen and spores

polygraphy

the use of the "lie detector"

► Highlights in the History of Forensic Science

History is not an isolated list of dates, but the story of events and people. Advances in any area of study come from previous ideas and discoveries, and sometimes from other areas that seem to be unrelated. And so it is with forensic science. For example, the development of spectroscopy by Kirchhoff and Bunsen in a German lab almost 150 years ago created a way to identify different drugs. Here are other highlights in the history of forensic science:



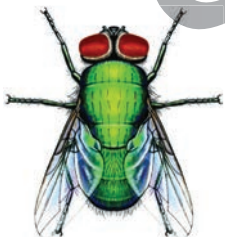
Abacus



Archimedes' gold crown



Pile of gunpowder

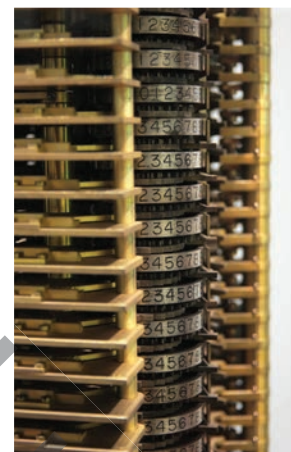


Blowfly

Timeline of Forensic Science Developments

| | |
|--------------|--|
| about 500 BC | A bead and wire abacus is the first computer. |
| about 200 BC | According to legend, Archimedes determines density of a suspected gold crown using its weight and how much water it displaces. |
| AD 66 | Emperor Nero murders his wife and presents her head on a dish to his mistress, who identifies the head as Nero's wife by two discolored front teeth. |
| 142 | Gunpowder is first described in China. |
| 904 | The Chinese first use gunpowder in warfare as incendiary projectiles called "flying fires." |
| 1132 | Gunpowder is used in thick bamboo to fire clay pellets; bamboo later replaced by bronze, and clay replaced with iron balls. |
| 1149 | King Richard I of England creates the job of coroner to investigate questionable deaths. |
| 1216 | The first written mention of the composition of gunpowder in Europe by Roger Bacon. |
| 1248 | The Chinese book <i>Hsi Duan Yu</i> describes how to distinguish a drowning victim from one who has been strangled. Also mentioned is a stabbing solved by observing flies attracted to blood on the killer's sickle. |
| 1300 | Portable, handheld "cannons," or <i>gonnes</i> , are developed. |
| 1514 | The earliest known use of blood spatter evidence is a trial in London in which the defendant, Richard Hunne, had been jailed for heresy (expressing a belief that went against the teachings of a particular religion) and was then convicted of suicide, post mortem (after death). |
| 1540 | Rifling appears in firearms. |
| 1598 | Fortunatus Fidelus is the first to practice forensic medicine in Italy. |
| 1609 | Francois Demelle publishes the first treatise on systematic document examination. |
| 1628 | Birth of Italian Marcello Malpighi, credited with noticing patterns in the skin of fingers. |
| 1642 | Blaise Pascal, at age 18, builds the first numerical calculating machine. |
| 1668 | Analysis of blowfly infestation of rotting meat allows Francesco Redi to refute the hypothesis of "spontaneous generation" of maggots. |
| 1670 | The first high-powered microscope is constructed by Anton Van Leeuwenhoek of Holland. |

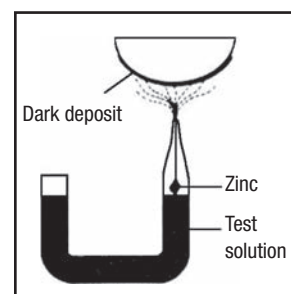
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| 1732 | Luigi Galvani discovers that the human nervous system transmits information electrically; this is the basis of current “lie detection” equipment. |
| 1735 | Carl Linnaeus, also known as Carl von Linné, publishes the first edition of <i>Systema Naturae</i> in the Netherlands. He is often called the “Father of Taxonomy” for his introduction of a system of hierarchical classification. |
| 1776 | The body of General Joseph Warren, killed at the Battle of Bunker Hill, June 17, 1775, is disinterred from a mass grave and identified by Paul Revere, who had made his false teeth. |
| 1784 | The first documented case of physical matching occurs when an Englishman is convicted of murder because the torn edge of a wad of newspaper in a pistol matches a piece remaining in his pocket. |
| 1810 | First recorded use of questioned document analysis involving a chemical test for a particular ink dye. |
| 1810 | The first detective force, the Sûreté, is established in Paris. |
| 1813 | Mathiew Orfila, considered the father of modern toxicology, publishes his book on the subject. Poisoning was a popular way of dispatching people. |
| 1816 | A farm laborer is convicted of murder based upon impression evidence. |
| 1832 | Charles Babbage invents his “Analytical Engine,” the forerunner of modern computers. |
| 1835 | Scotland Yard, London’s detective force, is the first to use bullet comparison to catch a murderer. |
| 1836 | James Marsh discovers a very sensitive chemical test to detect arsenic compounds. |
| 1836 | The first multishot pistol is developed by Samuel Colt. By the time of his death in 1862, he had made and sold almost a million guns. |
| 1840 | Forensic toxicology is first used to convict Marie Lafarge, by use of the Marsh test, of poisoning her husband with arsenic. |
| 1841 | Edgar Allan Poe’s short story, <i>The Murders in the Rue Morgue</i> , is the first detective story using forensic science, influencing future authors including Arthur Conan Doyle. |
| 1847 | The earliest examination of hairs in a criminal investigation in the murder of the Duchesse de Praslin. |
| 1850 | For the first time, a murderer is convicted in the United States based on dental evidence. |



A Babbage-type computing machine

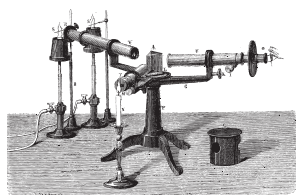


The 1873 Colt “Peacemaker”

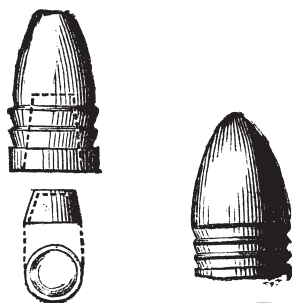


Marsh test apparatus

In 1849 J. W. Webster, professor of chemistry at Harvard, was accused of murdering George Parkman, M.D. The body had been dismembered and the head burned in a furnace; however, blocks of porcelain teeth were found in the ashes. Dr. Parkman's dentist recognized the dentures as some he had made for the victim. Eventually Webster confessed and was hanged.



Kirchhoff and Bunsen's spectroscopy apparatus



Minie ball

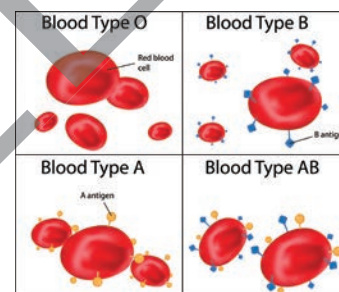


Fingerprint

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| 1852 | Earliest reported case involving fiber analysis where the fibers of the victim's clothes matched those on the murder weapon. |
| 1853 | Soil on suspect's boots matches that at the crime scene. |
| 1855 | First use of forensic entomology to estimate postmortem interval (PMI) by a French doctor, Bergeret d'Arbois. |
| 1856 | Sir William James Herschel, working in India, uses thumbprints on documents to identify workers. |
| 1859 | Gustav Kirchhoff and Robert Bunsen develop the science of spectroscopy. |
| 1863 | The first presumptive test for blood is developed, using the fact that hemoglobin oxidizes hydrogen peroxide. |
| 1863 | One of the earliest recorded cases involving simple firearms identification occurs during the United States Civil War, when Confederate General Stonewall Jackson is fatally wounded on the battlefield. Examination of the caliber and bullet shape determines that the bullet could only have been fired by one of his own men: The Confederates used a 67-caliber ball projectile, whereas the Union forces used a 58-caliber minie ball. |
| 1879 | Frenchman Alphonse Bertillon develops a system to identify people using body measurements. |
| 1880 | Scotsman Henry Fauld, working in Tokyo, uses fingerprints to exonerate an innocent burglary suspect. |
| 1886 | Paul Vieille invents a smokeless gunpowder called Poudre B which revolutionizes the effectiveness of small guns and leads to more recipes. |
| 1887 | Arthur Conan Doyle publishes his first Sherlock Holmes story, <i>A Study in Scarlet</i> . |
| 1888 | American George Eastman invents the first handheld camera. He calls it the "Kodak" camera and retails it for \$25. |

A couple confessed to murdering a man named Gouffe for his money. A body found in a sack in the Rhone River some time later was identified as the victim by Lacassagne through some remarkable detective work. He established that the murder victim had walked with a limp and had suffered from inflammation of one ankle and water on the knee. The corpse's height and age were assessed through his bones and teeth. All these details were the same as for the murdered man, but Gouffe had had brown hair, and the corpse's hair was black. Lacassagne had observed in previous studies that hair could change color inside a coffin. When it was learned that the murderers had originally placed the body in the sack in a trunk, which had broken open in the river, the identification was complete.

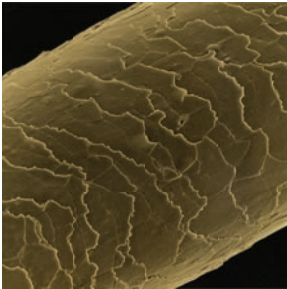
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| 1888 | Chicago is the first U.S. city to adopt the Bertillon system of identification. |
| 1889 | Alexandre Lacassagne publishes a text on matching bullets to individual gun barrels. |
| 1892 | Francis Galton, a nephew of Charles Darwin, publishes his book on fingerprints and their use in solving crimes. |
| 1892 | Argentina becomes the first country to replace the Bertillon system of measurements with fingerprints when Juan Vucetich solves a particularly gruesome murder using bloody fingerprints. |
| 1894 | Alfred Dreyfus is convicted of treason in France based, in part, on mistaken handwriting identification by Bertillon. |
| 1894 | Doctor Jean Pierre Ménégnin presents his theory of successional insect waves inhabiting a corpse. |
| 1895 | Two Canadian researchers start a number of systematic entomological studies on human corpses. |
| 1896 | Edward Henry develops the prototype fingerprint classification system now used in Europe and the United States. |
| 1898 | Photomicrographs of two bullets allow individualization of the minutiae. |
| 1900 | Scotland Yard adopts the Galton–Henry system of fingerprint identification. |
| 1900 | Austrian Karl Landsteiner identifies human blood groups. In 1930 he receives a Nobel Prize for this work. |
| 1901 | Paul Uhlenhuth develops the precipitin test, which distinguishes between human and animal blood. The test is used in the murder conviction of Ludwig Tessnow in the same year. |
| 1902 | Harry Jackson, a burglar, becomes the first Englishman to be convicted solely on the basis of fingerprints. |
| 1903 | Two convicts with the same name and same anthropometry (Bertillon) measurements are found in Fort Leavenworth prison. Two years later, their fingerprints are found to clearly distinguish between them. |
| 1903 | The New York City Police Department starts to create fingerprint files of arrested persons. This system is adopted by the New York State prison system two years later. |
| 1903 | Russian botanist Mikhail Tswett invents chromatography. |
| 1904 | Edmond Locard formulates his famous principle, “Every contact leaves a trace.” |



President Theodore Roosevelt



Bite mark



Human hair



Lie detector polygraph

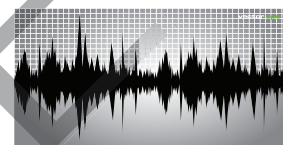
In ancient India a grain of rice was used as a lie detector. The suspect was asked to chew a grain of rice and then spit it out. A suspect who couldn't do it because his or her mouth was too dry was declared guilty.

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| 1904 | Presumptive test for blood is developed based on benzidine, a new chemical developed by Merck. |
| 1905 | President Theodore Roosevelt establishes the FBI. |
| 1906 | Bite mark evidence is first used in an English court to convict two hungry burglars using teeth marks found in cheese at the scene. |
| 1907 | The first recorded instance of fired cartridge casings being evaluated as evidence in an investigation of a brawl involving U.S. soldiers at Brownsville, Texas. |
| 1910 | The first police crime laboratory is started in Lyon, France, by Edmond Locard. |
| 1910 | Victor Balthazard publishes the first comprehensive study of human and animal hair. He also uses photographic enlargements of bullets and cartridge cases in an attempt to connect an individual bullet to a particular weapon. |
| 1910 | American Albert Osborne publishes the seminal treatise <i>Questioned Documents</i> . |
| 1915 | Italian Leone Lattes develops a method for determining the blood group of dried bloodstains. |
| 1920s | Luke May, one of the first American criminalists, pioneers striation analysis in tool mark comparisons. |
| 1920s | Russian palaeontologist Mikhail Gerasimov develops a method to reconstruct facial appearance from a skull. He is later popularized as the character Andreev in the detective novel <i>Gorky Park</i> . |
| 1920s | German investigator Georg Popp uses botanical and soil identification in solving a crime. |
| 1921 | The first lie detector is built by John Larson, a University of California medical student. |
| 1922 | A Nobel Prize is awarded to Englishman Francis Aston for developing the mass spectrometer. |
| 1923 | The Los Angeles Police Department establishes the first police laboratory in the United States. |
| 1923 | In the court case <i>Frye v. United States</i> , polygraph test results are ruled inadmissible, bringing about the concept of "general acceptance," or evidence accepted by the scientific community. |
| 1925 | The comparison microscope for use in bullet comparison is perfected, and its use is widely publicized in the Sacco and Vanzetti trial of 1926. |

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| 1929 | The infamous St. Valentine's Day Massacre occurs when seven gangsters are gunned down. Examination of all firearms-related evidence dispels the rumors that police were involved. |
| 1932 | The FBI crime laboratory is created. |
| 1935 | In Scotland, blowfly larvae provide a vital clue in the murders of Dr. Ruxton's wife and maid. |
| 1937 | Walter Specht finds that the chemical luminol glows in contact with latent blood. |
| 1940 | Landsteiner and Wiener describe Rh blood groups. |
| 1940 | The Complex Number Calculator, the first digital computer, is demonstrated at Bell Labs. |
| 1941 | Voiceprint identification is first studied at Bell Labs in New Jersey. |
| 1946 | The Electronic Numerical Integrator and Computer, ENIAC, is dedicated. It contains 18,000 vacuum tubes in cabinets 8' x 100', weighing 80 tons. It can do 5,000 additions and 360 multiplications per second. |
| 1948 | The American Academy of Forensic Sciences (AAFS) meets for the first time in Chicago and soon publishes the <i>Journal of Forensic Science</i> . |
| 1948 | Keith Simpson launches the science of bite mark analysis (forensic odontology) when he examines bite marks on a dead woman. |
| 1952 | British researchers Martin and Synge receive the Nobel Prize for their invention of gas-liquid partition chromatography, a powerful method of analyzing mixtures of drugs and poisons. |
| 1954 | R. F. Borkenstein, a captain in the Indiana State Police, invents the Breathalyzer for field sobriety testing. |
| 1955 | De Saram publishes careful and detailed measurements of body temperature decrease in executed prisoners to determine time since death. |
| 1955 | The murder trial of Dr. Sam Sheppard publicizes blood spatter evidence, and inspires several movies, television programs, and books. |
| 1957 | The growth stages of skeletal bones are identified by Americans Thomas Mocker and Thomas Stewart, forming the basis of forensic anthropology. |
| 1959 | James Watson and Francis Crick discover the DNA double helix. |
| 1960s | Maurice Muller adapts the Ouchterlony antibody-antigen diffusion test for precipitin testing to determine species. |



The Thompson submachine gun often used by gangsters



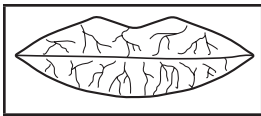
Voice sound spectrum



ENIAC



Key-Chain Breathalyzer



Lip pattern,
branching grooves



DNA fingerprint

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| 1960 | Gas chromatography is used for the forensic identification of petroleum products. |
| 1961 | Hungary becomes the first country in Europe to carry out research on the subject of lip prints. |
| 1967 | The FBI inaugurates the National Crime Information Center (NCIC), the first national law enforcement computing center with information on wanted persons and stolen vehicles, weapons, and other items of value. |
| 1969 | The Association of Firearm and Tool Mark Examiners (AFTE) is formed. |
| 1972 | Body armor made of Kevlar is introduced. It is currently credited with saving the lives of more than 2,000 police officers since inception. |
| 1972 | Dr. William M. Bass starts the Forensic Anthropology Center, otherwise known as “The Body Farm,” at the University of Tennessee. |
| 1973 | Canada’s Royal Canadian Mounted Police (RCMP) finish computerizing their fingerprint files. |
| 1975 | The Federal Rules of Evidence are enacted. |
| 1976 | Gas chromatography–mass spectrometry (GC-MS) is first evaluated for forensic purposes. |
| 1977 | The Fourier transform infrared spectrophotometer (FTIR) is adapted for use in the forensic laboratory. |
| 1977 | In Japan, investigators accidentally discover that superglue reveals latent fingerprints. |
| 1977 | The Internet is born. |
| 1977 | A limited computerized scanning mechanism is first used to develop a database in forensic science by the FBI’s Automated Fingerprint Identification System (AFIS). |
| 1978 | Britain’s Yorkshire Ripper case highlights the value of computers in investigating serial killings and leads to the development of “psychological profiling” techniques in the following decade. |
| 1979 | Bite mark evidence is a key in convicting serial killer Theodore “Ted” Bundy. |

Peter Sutcliffe, called the Yorkshire Ripper, was arrested in 1981 after killing 13 women in northern England. He battered his victims with a ball-peen hammer and then stabbed them. If descriptive details about Sutcliffe, such as shoe size, blood type, and the like, had been stored on a computer, he probably would have been questioned further when he was picked up the first time, and the detectives working on the case later would have known that he had been interviewed before. Thus, a few lives could have been saved.

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| 1981 | IBM introduces its personal computer (PC) for use in the home, office, and schools. |
| 1982 | The term <i>serial killer</i> is first used to describe a killer who kills repeatedly and obsessively, on separate occasions. |
| 1984 | Professor Alec Jeffreys discovers that each human being has unique DNA, except in the case of identical twins. |
| 1986 | The polymerase chain reaction (PCR) DNA replication technique is developed specifically for forensic use by Cetus Corporation. |
| 1987 | DNA profiling is used to identify Colin Pitchfork as the murderer of two girls in England and to exonerate someone previously suspected of the murder. Three months later, the same techniques are applied to convict Tommy Lee Andrews for a series of sexual assaults in Florida. |
| 1989 | In the United States, Gary Dotson becomes the first person to have a conviction overturned on the basis of DNA evidence. Dotson had served eight years of a 25–50 year sentence for rape. |
| 1990 | Author Patricia Cornwell's first novel, <i>Postmortem</i> , is published. It features good forensic science, as do more than ten of her subsequent books. |
| 1990 | The first prosecution under the federal computer crime statute is for a release of a "worm" into the Internet by a graduate student. |
| 1991 | A computerized, automated imaging system is introduced for comparing marks of bullets and shell casings. It is called the Integrated Ballistics Identification System, or IBIS. The following year, a similar system, called DRUGFIRE, is introduced in the FBI. |
| 1992 | DNA short tandem repeats (STR) are used in forensic DNA analysis. |
| 1993 | In the court case of <i>Daubert v. Merrell Dow</i> , the court changes the standard of admission of scientific evidence. |
| 1995 | eBay is founded by a French-born Iranian computer programmer. |
| 1996 | Computerized searches of the AFIS fingerprint database are implemented by the FBI, using both live scan and card scan devices. |
| 1996 | Mitochondrial DNA typing is admitted in a U.S. court for the first time. |
| 1998 | An FBI index of DNA profiles called NDIS (National DNA Index System) is incorporated with CODIS (Combined DNA Index System). |



Bullets

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| 1999 | AFIS is further refined to form IAFIS, Integrated Automated Fingerprint Identification System. |
| 1999 | IBIS and DRUGFIRE are combined to form the National Integrated Ballistics Identification Network (NIBIN). |
| 2001 | USA PATRIOT Act of 2001 allows for the search and seizure of computers. |
| 2002 | CODIS enables the first match between NDIS and a DNA profile from Florida, resulting in an arrest and conviction. |
| 2003 | Digital forensics comes to prominence in recovery investigation, examination, and analysis from cell phones, computers, and tablets. |
| 2007 | The largest AFIS repository in America is operated by the Department of Homeland Security's U.S. Visit Program, containing over 63 million persons' fingerprints, primarily in the form of two-finger records. |
| 2007 | There are approximately 400 crime labs and nearly 40,000 people involved in forensic science in the United States. |
| 2010 | Forensic scientists employ the use of data from new cars on drivers' recent destinations, typical routes, and other personal data. |
| 2011 | Michigan State University develops software that automatically matches hand drawn facial sketches to mug shots stored in databases. |
| 2011 | Establishment of the Scientific Working Group for Wildlife Forensic Sciences (SWGILD), dealing with activities pertaining to illegal trafficking of wildlife such as shipments of elephant tusks, distribution of endangered species, illegal logging, and dog fighting. |
| 2012 | The National DNA Index System uploaded more than 92,000 submissions from federal conviction/probation, arrest, and detainment agencies. |
| 2014 | Researchers at the National Institute of Standards and Technology (NIST) develop a laser-based imaging system that can create 3D images of objects from as far away as 10.5 meters. |
| 2014 | Scientists at the Polytechnic University in Madrid are researching a new biometric—body odor. It turns out that individuals have recognizable odors that remain steady. Their accuracy rate is at 85% so far. |
| 2014 | Digital surveillance from XBox. |
| 2014 | Use of AI (artificial intelligence) in forensics, especially digital forensics, is on the rise. |
| 2015 | DNA Phenotyping can be used to indicate physical characteristics such as hair, skin, eye color. |

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| 2015 | Drone Forensics: Drones are used for smuggling, illegal surveillance. |
| 2017 | Immunochromophotography is used to test very small samples to detect disease (CoVid, AIDS) and detect drugs medications. |
| 2021 | Nanosensors are used to detect illicit substances. |
| 2021 | Block chain technology is used on/for cloud data and is virtually tamper-proof. |
| 2016 | Use of social media networks is widespread globally. |
| 2021 | Use of public or ancestry DNA is used to solve crimes. |
| 2021 | Use of rapid DNA testing becomes available. |
| 2023 | Worldwide social networks are used by 4.8 billion people. |



Drone with a camera



► Methodology

A fundamental principle of investigation for every crime scene comes from Edmond Locard, a forensic investigator in the early 1900s. Locard strongly believed that a criminal could be connected to a crime by trace evidence collected at the crime scene. He stated:

Whenever two objects come into contact, there is always a transfer of material. The methods of detection may not be sensitive enough to demonstrate this, or the decay rate may be so rapid that all evidence of transfer has vanished after a given time. Nonetheless, the transfer has taken place.

The forensic scientist must be methodical in his or her work. He or she must first observe general characteristics of the evidence and then observe more specific features. He or she must link evidence to a crime and to the suspects by identifying and comparing relevant material.

Scientists solve problems using an approach known as the scientific method. It includes the following steps:

1. Observe a problem or questioned evidence and collect objective data.
2. Consider a hypothesis or possible solution to the problem based on observation, giving direction to the work plan. This step requires inductive reasoning, experience, and imagination.
3. Examine, test, and analyze to support or refute the hypothesis.



Doctor Edmond Locard at his police crime laboratory in Lyon, France, circa 1910



Scientist using microscope

4. Evaluate and verify all evidence. This step is especially critical to a forensic scientist because someone's liberty can depend on this work. All possible errors must be stated. Consideration must be given to standardization, reproducibility, validity, reliability, and accuracy.

Finally, the forensic scientist must come up with a theory or opinion that is able to stand up to scientific and legal scrutiny.

ACTIVITY 1.1: The Locard Exchange Principle

In this activity, you will explore how the Locard Exchange Principle applies to your current surroundings.

You are sitting at your desk. What are you in contact with? What possible transfer of material could have taken or is taking place? Make a list. How could you have prevented any transfer if you had thought about it first? What transferred material could be traced to you directly?

Think about when you came to school today. Did you leave any evidence that you were here other than being observed by others (eyewitness accounts)?

Is it difficult not to leave a trace? And, after the fact, is there lots to worry about from leaving evidence of your presence? Do you think premeditated contact can diminish identifiable transfers? Give some hypothetical examples where destroying evidence might leave more that could identify you.

► Criminal Justice and the Law

Laws have been established to regulate relationships between individuals and between organizations or agencies and individuals. These codes of conduct have been in existence since the beginning of civilization in one form or another and are based on what a particular society deems important. Modern laws are a result of a long history of social customs, rules, practices, legal decisions, and rulings that are considered acceptable.

The United States Constitution is the supreme document and final authority on laws pertaining to individual rights, and on the power of the government to create laws and to create limits on punishments. The Constitution itself does not contain a list of all laws that govern our country. It must be interpreted in deciding whether new or existing laws are acceptable based upon the ideals of our core democratic principles. All federal laws overrule state laws.

There are a number of different types of law in the U.S. criminal justice system:

- **Constitutional** or **Statutory law**, or written or codified law, is the “law on the books” as enacted by a governmental body or agency having the power to make laws (such as Congress). Statutory law is based on the Constitution.
- **Common law** or **case law** is made by judges. *Precedents* are decisions made in previous cases or superior courts that are used as a basis to justify later decisions made in similar cases. They must be followed, and become a part of the law itself. The U.S. Supreme Court carries the greatest influence, as decisions it makes are incorporated into the process by which lower courts make their decisions. The principle of recognizing previous decisions as precedents is called **stare decisis**, “to stand by the decision.” Once a decision is made in court, it is written down and becomes law. This makes for predictability and consistency in how the law is applied.
- **Civil law**, sometimes referred to as private law, deals with relationships between individuals involving such matters as property or contracts. It provides a formal means for regulating noncriminal relationships among individuals, businesses, agencies of government, and



United States Constitution

constitutional or statutory law

legislative acts declaring, commanding, or prohibiting something

common law or case law

the body of law made up of judicial opinions and precedents

stare decisis

“to stand by the decision,” meaning previous legal decisions are to be followed

civil law

law that deals with noncriminal suits brought to protect or preserve a civil or private right or matter

criminal law

regulation and enforcement of rights, setting the acceptable limits of conduct in society

misdemeanor

a minor crime, less than a felony, usually punished with a fine or confinement other than in a prison

felony

a serious crime, such as murder, punishable by more than one year of imprisonment up to execution

other organizations. Contracts, marriages, divorces, wills, property transfers, negligence, and products manufactured with hidden hazards are all civil concerns. It is up to an individual to bring the suit to court. Civil law is more concerned with assigning blame than with establishing intent. In civil cases, a “preponderance of evidence” is required to convict. Violations of civil law are generally punishable by fines or transfer of property.

- **Criminal law**, sometimes referred to as public law, deals with regulation and enforcement of rights. It is concerned with offenses against an individual that are deemed offensive to society; the state becomes the plaintiff (as in *U.S. v. Toby* or *State of Michigan v. Smith*). The roots of our law come from medieval England, where offenders who violated the “King’s Peace” were thought to be offending not just an individual, but the order established under the rule of the monarch. A **misdemeanor** is a minor crime such as theft, minor assault and battery, or possession of small amounts of illegal drugs. A **felony** is a major crime such as murder, rape, armed robbery, serious assault, dealing in illegal drugs, fraud, auto theft, or forgery. In criminal cases the prosecution must prove guilt “beyond a reasonable doubt” to convict the suspect. Violations of criminal law are punishable by fines, community service, probation, incarceration, or, in extreme cases, life in prison or capital punishment (death).
- Equity law is remedial or preventive (such as an injunction or a restraining order). These laws are for cases not covered by common law.
- Administrative law includes rules or laws established by agencies such as the Internal Revenue Service (IRS), Social Security Administration, or branches of the military.

Forensic scientists may examine evidence concerning the breaking of any and all of the types of law listed above. All collectors and handlers of evidence must be aware of the rights guaranteed in the Bill of Rights of the U.S. Constitution, so that all evidence is collected properly and without violating any individual’s rights.

The following are some of the individual rights guaranteed by the U.S. Constitution in times of normalcy.



Jail cell

Individual Rights Guaranteed by the Bill of Rights

- The right to be presumed innocent until proven guilty
- The right not to be searched unreasonably, either on one's person or in one's home
- The right not to be arrested without **probable cause**
- The right against unreasonable seizure of personal property
- The right against self-incrimination
- The right to fair questioning by police
- The right to protection from physical harm throughout the justice process
- The right to an attorney
- The right to trial by jury
- The right to know any charges against oneself
- The right to cross-examine prosecution witnesses
- The right to speak and present witnesses
- The right not to be tried again for the same crime
- The right against cruel and unusual punishment
- The right to due process
- The right to a speedy trial
- The right against excessive bail
- The right against excessive fines
- The right to be treated the same as others, regardless of race, gender, religious preference, country of origin, or other *personal attributes*

According to the Patriot Act of 2001, actions labeled as presenting a "clear and present danger" to the national security of the country may lead to the suspension and/or limitation of these rights.

► Types of Crimes

Any time a law has been broken, a **violation** has occurred. Violations can be minor crimes or major crimes. Crimes are classified as infractions, misdemeanors, or felonies for the purpose of sentencing.

An **infraction** is a minor offense or petty crime that is considered less serious than a misdemeanor. Examples include jaywalking, traffic violations, and littering. The penalty for an infraction is typically a fine.

Misdemeanors are punishable by no more than one year in jail. Cases involving misdemeanors are usually heard by the district

probable cause

situation in which a reasonable and prudent person, viewing the available information, would conclude that a crime has been committed and that the suspect committed it

The due process clause of the U.S. Constitution was derived from the Magna Carta in the year C.E. 1215. Under due process, neither the king (in those days) nor the American government (now) can take away your life, liberty, or property without following the appropriate legal procedures.

The term *personal attributes* is not well defined; hence all the controversy now about who these rights apply to.

violation

a breach of a right, duty, or law

infraction

violation of a rule or law that is not punishable by prison

court closest to where the crime took place. A first offense of drunk driving, vandalism, shoplifting, simple assault, trespassing, or prostitution is an example of a misdemeanor. Fines may range from less than \$250 up to \$2,500. Community service is sometimes part of the sentence.

Felonies are more serious crimes that carry stiffer penalties. They are tried in the district court closest to where the crime took place. The district court conducts a preliminary examination to decide whether the case will be transferred to circuit court for trial. Arson, aggravated assault, burglary, robbery, homicide, and rape are examples of felony crimes. Punishments for a felony conviction may range from five years up to life in prison, or even, in some states, the death penalty. Fines may be levied up to \$100,000. Probation may also be determined for felonies.

Criminal law recognizes twelve categories of crime, which can range from infractions to felonies (Table 1.1). Such a list exemplifies our present society's view of wrongs. Can you think of more examples to add?

Table 1.1: Society's Major Crimes

| Category | Wrong |
|----------------------------|--|
| Violent crime | Murder, force, violence, threats, fear, rape |
| Property crime | Stealing, depriving, trespass, intimidation, arson |
| Crime against morality | Prostitution, seduction, illicit behavior, slavery, kidnapping |
| Crime against public order | Disorderliness, threats to public safety and peace |
| Crime against government | Rebellion, treason, sedition, perjury, corruption |
| Crime by government | Genocide, torture, brutality, civil rights violations |
| Hate crime | Bias, prejudice, discrimination |
| Organized crime | Dealing in illegal goods and services, money laundering |
| White-collar crime | Deception, fixing, gouging, nonviolent illicit financial gain |
| Occupational crime | Opportunism, misuse of professional capacities |
| Victimless crime | Addiction, illegal exchange |
| High-technology crime | Fraud, illicit computer use, blackmail |

► Steps in Pursuing Justice

The steps in pursuing justice are complex and confusing because of different jurisdictions (federal, state, local), different state rules and procedures, the type of crime, extenuating circumstances, prior history, and so on. What follows is a rather generic description of a criminal procedure.

A crime is committed. It then must be discovered. A suspect may be identified. The police investigate what may have happened. Information is collected. The crime scene is documented and searched for evidence. All information is assembled into a report for the prosecutor. An investigation ensues, and an arrest warrant is issued if the **elements** of a crime are present.

Basically, the elements of a crime involve (a) if a crime actually occurred, (b) if the accused intended for the crime to happen, and (c) if there is a timely relationship between a and b. For example, the five elements of a robbery may include (1) taking away (2) another's property, (3) in their presence, (4) with intent to steal, (5) using force or fear.

After a suspect has been arrested, he or she is taken to the police department for **booking** and informed of his or her **Miranda rights**, if questioning is to occur. If the suspect is not questioned, no *Miranda* warning is necessary. The individual is brought before a magistrate, judge, or commissioner for **arraignment** within a prescribed number of hours, usually less than 72. At this time, the court may appoint a public defender, inform the suspect of the charges and his or



“Lady Justice” adorns courthouses throughout the nation. Its origin dates from Roman times; the lady represents Themis, the goddess of justice and law. The scales signify the impartiality of justice; the sword, the power of those making decisions; the blindfold, that justice is not subject to influence.

elements

in criminal law, the specific factors or parts of a crime

booking

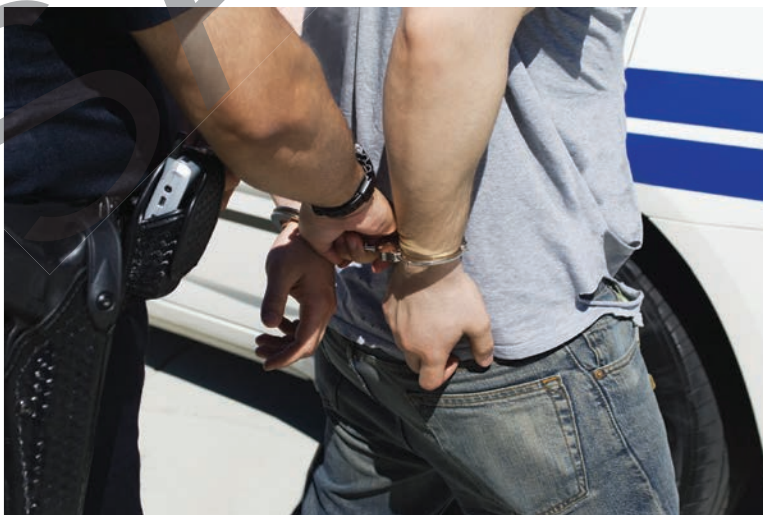
a police procedure following arrest that records basic information about the suspect, a photograph, and fingerprints, and perhaps includes a lineup

Miranda rights or Miranda warning

rights guaranteed by the Constitution that police must tell arrestees about, especially the right to remain silent and the right to an attorney

arraignment

the first act in a criminal proceeding, where the defendant is brought before the court to hear charges and enter a plea



bail

money put up to guarantee that the defendant will appear in court as directed. A bondsman pays the bail for a fee of 10 percent of the bail amount. If the defendant does not appear when the time comes, the bondsman may hire bounty hunters to find and return the suspect.

nolo contendere

in a criminal lawsuit, when a defendant neither admits nor denies committing a crime but accepts punishment as though he or she were guilty

preliminary or evidentiary hearing

a hearing before a magistrate or a judge to determine whether a person charged with a crime should be held for trial; also sometimes called a preliminary examination

grand jury

a group of people sworn to inquire into a crime and, if appropriate, bring accusations (indictments) against the suspected criminals

indict

to formally accuse a person of a crime

Miranda v. Arizona, 384 U.S. 436 (1966)

Before a law enforcement officer may question a suspect regarding the possible commission of a crime, the officer must inform the detainee about his or her *Miranda* rights, making sure the detainee understands them.

Warning of Rights

1. You have the right to remain silent and refuse to answer questions.
2. Anything you do or say may be used against you in a court of law.
3. You have the right to consult an attorney before speaking to the police and to have an attorney present during questioning now or in the future.
4. If you cannot afford an attorney, one will be appointed for you before any questioning if you wish.
5. If you decide to answer questions now without an attorney present, you will still have the right to stop answering at any time until you talk to an attorney.
6. Knowing and understanding your rights as I have explained them to you, are you willing to answer my questions without an attorney present?

her rights, and set **bail**, if deemed appropriate. The suspect offers a plea of guilty, not guilty, not guilty by reason of insanity, double jeopardy (if he or she has already been tried for the same crime in the same court), or ***nolo contendere*** (no contest). Future court dates are also set.

The suspect is then brought before a judge. If the crime is considered a felony, the next step is a **preliminary** or **evidentiary hearing**, again, within a prescribed number of days. There is no jury. As the prosecution presents the case, the accused has the right to cross-examine witnesses and produce favorable evidence. The judge considers the offense and the defendant's record and then either decides to dismiss and/or reduce the charges for insufficient evidence, or determines that there is enough evidence to set a date for arraignment for trial. A pretrial conference may be arranged if a not guilty plea has been entered.

Some states may use a **grand jury** instead of a preliminary hearing, especially for a felony. The grand jury determines whether there is enough evidence to bring the accused to a formal trial. The composition of the grand jury varies by state, but usually consists of 16 to 23 citizens. Only the prosecutor presents evidence. There is no cross-examination. The jury decides by majority vote; there is no need for a unanimous decision. If the jury decides to **indict** the suspect, a trial date is set.

The plea of not guilty by reason of insanity has a very specific legal definition. In 1984 Congress passed the Comprehensive Crime Control Act. The federal insanity defense now requires the defendant to prove, by "clear and convincing evidence," that "at the time of the commission of the acts constituting the offense, the defendant, as a



A typical jury box



A courtroom

result of a severe mental disease or defect, was unable to *appreciate the nature and quality or the wrongfulness* of his acts.” This is generally viewed as a return to the standard of “knowing right from wrong.” The act also contains guidelines that set out sentencing and other provisions for dealing with offenders who are or have been suffering from a mental disease or defect. Most crimes must show intent; an insanity plea removes intent.

In the United States, a person is presumed innocent until proven guilty beyond a reasonable doubt by a jury of his or her peers. The burden of proof in criminal cases rests entirely on the prosecution. Only about 50 percent of all people arrested are eventually convicted, and of those, only about 25 percent are sentenced to a year or more in prison.

Plea bargaining can occur at many points in the judicial process. In fact, about 90 percent of cases are plea-bargained, which reduces the court’s case load. A plea bargain means that the defendant and the prosecution work out a deal about the sentencing without going to trial.

► Federal Rules of Evidence

There are legal rules of evidence that govern if, when, how, and for what purpose evidence in a case is placed before a “trier of fact” (the judge or jury). These rules define what evidence is admissible and how it can be used for the jury. Most important, evidence must be relevant; that is, it must prove something (be **probative**) and it must address the issue of the particular crime (be **material**). If the evidence is not material or probative, it is useless. Evidence is admissible if it is reliable and the person who presents it is believable and competent. Generally, **hearsay** is inadmissible in criminal court because it is not reliable, is not taken under oath, and does not allow for cross-examination. It is, however, admissible in civil suits.

plea bargaining

an agreement in which a defendant pleads guilty to a lesser charge and the prosecutor in return drops more serious charges to avoid the cost and time of a trial

probative

in evidence law, tending to prove something

material

in evidence law, relevant and significant. A material witness has information about the subject.

hearsay

testimony given by a witness who relates not what he or she heard, saw, or knows personally, but what others have said. The knowledge is dependent on the credibility of the person who first made the statement, and therefore is not admissible in court unless it meets a hearsay exception.

expert witness

a person who is a specialist in a subject that is often technical, who may present his or her expert opinion without actually witnessing any occurrence relating to the case. This is an exception to the rule against giving an opinion in a trial, provided that the expert is qualified by his or her expertise, training, and special knowledge.



An expert witness testifying in court on fingerprint evidence

Frye standard

commonly called the “general acceptance” test, the Frye standard dictates that scientific evidence is admissible at trial only if the methodology or scientific principle on which the opinion is based is “sufficiently established to have gained general acceptance in the particular field in which it belongs.” The *Frye* test applies only to “new” or “novel” scientific methodologies.

Expert Testimony

The person who presents scientific evidence, the **expert witness**, must establish his or her credibility through credentials, background, and experience. Two legal decisions have had a great influence on whether scientific evidence can be used in court.

The Frye Standard: *Frye v. United States*, 1923

In 1923 James Frye was convicted of murder in the second degree. On appeal, the defense argued that the decision should not stand because the test used (a blood pressure deception test) should not be accepted as scientific evidence. The decision of the Supreme Court was to let the conviction stand. The court stated that, to be accepted in a court of law, the scientific evidence must be given by an expert witness and have gained “general acceptance” in the particular field of study. After the presentation by the expert witness, the jury can decide whether the evidence has any significance to the case. The **Frye standard** does not offer any guidance on reliability.

The Daubert Ruling: *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 1993

In 1993 two minor children and their parents sued Dow, claiming that the children’s serious birth defects had been caused because, during the mother’s pregnancies, she had used a prescription drug marketed by Dow. The court decided that the evidence did not meet the standard of “general acceptance” for admission of expert testimony. In appeals, the Supreme Court decided that, in the 70 years since the formulation of the *Frye* standard, society had become more complex

and technologically sophisticated, so that “general acceptance” was no longer the appropriate standard for admissibility.

In the **Daubert ruling**, the court stated that the *Frye* standard is not the only rule for admissibility of scientific evidence. The *Daubert* rule applies only to federal courts, but states are expected to use the decision as a guideline in setting standards. The trial judge must assume responsibility for admissibility and validity of evidence presented in his or her court. Guidelines offered for judgment are:

1. The scientific theory or technique must be testable.
2. The theory or technique must be subject to peer review and publication; this means that other experts in the field must be able to study the research to determine whether it seems valid.
3. The rate of error or possible errors must be given.
4. The technique must follow set standards.
5. The court must consider whether the theory or technique has attracted widespread acceptance within a relevant scientific community.

The *Daubert* ruling came about in response to a rapidly changing technological society. Unacceptable delays in accepting new theories or techniques (such as DNA fingerprinting) led to the decision. The ruling also strengthened the rules of evidence to keep “**junk science**” (pseudoscience) out of the courtroom.

The forensic scientist’s role is to help law authorities decide whether a crime has been committed and to help identify the perpetrator. The scientist brings proof of evidence and provides results and conclusions through a report written and presented to nonscientists.

A forensic scientist may be asked to evaluate evidence as an expert witness in court, and then give an opinion about the significance of his or her findings. That opinion is based on a reasonable scientific certainty that comes from training and experience. The accused person’s guilt or innocence and, therefore, life or liberty may be at stake. Both the defense and the prosecution can present expert opinions and argue the merits of the testimony.

The opinion’s significance may be accepted or rejected by the jury or judge. The forensic scientist or expert witness has an obligation to be an advocate for the truth and should not take sides for either the defense or the prosecution.

► The CSI Effect

Much has been said about the impact of glitzy TV shows, like *CSI*, on how the public perceives forensic science. This popular series has created misconceptions about crime labs and crime scene investigation. Let’s look at some specific examples:

Daubert ruling

revision of the *Frye* standard for admissibility of expert scientific evidence. The *Daubert* ruling implicitly endorses a classical definition of the scientific method, including hypothesis testing, estimates of error rates, peer-reviewed publication, and general acceptance.

junk science

theories based on distorted, flawed, or untested hypotheses not derived from or tested by the scientific method

What does a forensic scientist do? A forensic scientist has two major duties:

- Analyze evidence and prepare reports on the analyses. Sometimes a forensic scientist will work a crime scene, especially a murder.
- Testify in court as an expert witness. (The judge decides if expert testimony is needed and who is qualified to give it [*Daubert*]).

Emphasis is foremost on science, then on forensics. If you can’t do good science, then you are a liability to forensic science.

- *Misconception: Crime labs are well-equipped with the latest high-tech instrumentation.* A few are, but many are underfunded and under-equipped. Scientific equipment is expensive. For example; A GRIM 3 automated refractive index analyzer for glass costs about \$65,000; a pyrolysis gas chromatograph–mass spectrometer (PGC-MS) may cost \$110,000; a scanning electron microscope (SEM) may cost \$300,000; even an alternate light source (ALS) for detecting fingerprints and body fluids can cost \$20,000.



- *Misconception: Crime scene investigators process the crime scene.* Processing is usually performed by trained police officers. CSIs are usually civilian employees, do not carry weapons, and do not have the power of arrest. Trained medical examiners handle the bodies.

- *Misconception: Crime scene investigators know and do everything.* Not so. Specialists concentrate on one or a few areas of expertise, such as fingerprinting, trace evidence, drug analysis, or DNA profiling.
- *Misconception: Crimes can be solved within the hour with high-tech equipment.* A crime is not solved in 44 minutes, nor is a DNA fingerprint available in half an hour. Many crime labs are understaffed. Backlogs, especially in DNA analysis, are prevalent, and can be as long as a year depending on priorities and politics. The cost of a thorough DNA profile can run as high as \$10,000! Fingerprints and toolmarks, not DNA, are still the most common types of evidence left at crime scenes.
- *Misconception: DNA can solve most crimes.* DNA is not the ultimate clue. Often DNA is simply not left at a crime scene. If present and recognized, it may be hopelessly contaminated. A profile may be developed, but there may be no matches to suspects or databases. There may be other compelling evidence so that a DNA profile is not required. Time and budget constraints can also influence the application of DNA analysis.
- *Misconception: All cases can be solved with high-tech science.* Most crimes are not solved by or even require forensic scientific analysis. Most do require traditional, down-to-earth police work such as eyewitness accounts, interviewing, interrogation, following leads, confronting suspects, and always, writing reports.

- *Misconception: Forensic science results are never wrong.* The practice of forensic science is not infallible. Even if no evidence is missed, or messed up, or lost, or ignored because the case is considered strong enough without it, or dismissed because of legal mistakes or omissions, lab personnel can make mistakes, instruments can malfunction, samples can become contaminated or switched, evidence can degrade or be fabricated, and experts can lie!
- *Misconception: Forensic science is glamorous.* Forensic science, for the most part, is not flashy, exciting, and glamorous. It is hard, tedious, but rewarding work. The CSIs are not always good-looking and interesting. The labs are not always spacious, well-equipped, and exciting. The evidence is often dirty, smelly, messy, and gross. Most analysts are behind in their case work and juggle several cases at once, and they may spend an inordinate amount of their time in court.



How has the “CSI effect” affected the justice system?

- Juries are more informed about the use of science in analyzing evidence. This is good. However, they may have unreasonable expectations of crime scene investigations.
- Despite complaints by prosecutors, there is no statistical evidence that those jurors who watch *CSI* influence the outcome of a trial. Yet, prosecutors may now have to emphasize why certain types of evidence in a case have not been presented.
- A few criminals are becoming more careful, such as by wearing gloves, washing up, or burning potential evidence; however, even the act of destroying evidence can provide clues. Also, the scientific analysis of evidence is seen as so sophisticated that it is difficult not to leave a detectable trace.
- More people want to be forensic scientists: Enrollment in forensic science degree programs has increased. Interestingly, far more women are enrolling than men.
- There are more “expert-for-hire” junk scientists available, like the proverbial ambulance-chasing lawyers.



CASE STUDY 1.1

Richard Crafts

Richard Crafts was convicted of the murder of his wife, Helle, in 1986. It was one of the first cases where a person was convicted of murder without a body to prove that the crime had taken place. The case was built on forensic evidence and astute investigative work.

Richard and Helle had had a tumultuous marriage, with accusations of infidelity on both sides. Helle had filed papers for divorce. November 18, 1986, was the last time Helle was seen or heard from. Her family and friends became alarmed; she had told one of them, “If anything happens to me, don’t think it was an accident.” This spurred her friends to encourage the police to investigate Richard as her possible murderer.



Richard Crafts at trial

The investigation turned up several interesting points. The nanny had found a stain on the master bedroom carpet, which Richard had replaced on November 22. Using credit card receipts, police discovered that Richard had purchased new bedding and a freezer and rented a wood chipper days before Helle disappeared. When a truck driver and other witnesses came forward and told police that they had seen someone chipping something into the Housatonic River in the middle of the night during a snowstorm, police began to piece together the events that led to Helle’s death.

Investigators went to the river where the truck driver had seen the wood chipper and began to search for evidence. They found a chain saw from which someone had attempted to file off the serial number; the serial number had been warranted to Richard Crafts. Human tissue, hair, and a blue fiber matching Helle’s robe were found embedded in the teeth of the chain saw. Searchers also found 2,660 strands of hair, 59 slivers of human bone, two tooth caps, five droplets of blood, two fingernails, part of a finger, and three ounces of human tissue.



Wood chipper

Investigators pieced together a scenario: Richard killed Helle in their bedroom with some sort of blunt object, leaving bloodstains on the carpet, bedding, and the towels used to clean up. He then put her body in a freezer to make it easier to dismember her with the chain saw. He rented a wood chipper to dispose of her body completely in the Housatonic River, and then disassembled the chain saw and threw it into the river.

After literally thousands of forensic tests, the tissue evidence was found to be consistent with Helle, and some was even determined to be positively Helle's. Even though the amount of evidence was not much, estimated to be roughly one one-thousandth of a human body, it was enough to provide material for more than fifty thousand forensic tests. Without forensic science, it is doubtful that Richard Crafts would have been convicted and sentenced to 50 years of imprisonment for the murder of Helle Crafts. He spent 32 years in prison and was released in 2020 for "good behavior." He now lives in a homeless shelter for veterans in Connecticut.

Here is a case where thousands of hours were expended to bring a killer to justice. What often is not stressed is the amount of "old-fashioned" police work involved in following leads, interviewing, and writing reports, all culminating in time spent in court at the trial.

Analysis Questions

1. If the truck driver had not come to the police, how do you think the investigators would have proceeded?
2. What is the significance of this case?



Career Connection: Forensic Scientist

Have you ever watched a crime show where people are gathering physical evidence at a crime scene, and then present the evidence in a court room? If so, you may not know that forensic science takes on a unique and important role in that process. According to the American Academy of Forensic Science, *forensic science* is used for the purpose of law. A **forensic scientist** carefully studies and analyzes physical evidence from crime scenes. Then the forensic scientist gives an objective conclusion based on scientific examination of that evidence. Their analysis and conclusion help the decision makers in criminal investigations build a case to prosecute a criminal or prove that a person who has been charged for a crime is innocent.

Forensic scientists can help to reduce the number of cases heard in court. Their analysis of evidence could stop a case from going to court. Forensic scientists often work in a lab but sometimes also at crime scenes. They use special tools and methods to do their job, including toxicology, spectroscopy, pathology, bloodstain analysis, and odontology. They also use techniques such as DNA analysis, fingerprinting, ballistics, voice recognition, and handwriting analysis. After their analysis is complete, they complete and issue a report of their findings. Some focus on one of these and becomes an expert on a single issue.

Sometimes a forensic scientist may serve as an expert witness for a criminal trial in court. In this role, the forensic scientist presents his or her findings from examining and analyzing the physical evidence as well

as his or her opinion on the results. Before testifying, a forensic scientist takes an oath to tell the truth. Then the forensic scientist explains the process he or she used to analyze the evidence so that it is clear to the jury. Prosecutors and defense attorneys may ask the forensic scientist questions (through direct and cross examinations), so the scientist has to be prepared to show his or her expertise.

A forensic scientist may have an undergraduate degree in biology, chemistry, computer science, digital forensics, or a physical science.

Related careers include crime scene investigator, crime prevention specialist, homicide detective, fraud investigator, special agent for FBI, DEA, ATF, or homeland security, intelligence analyst, information technologist, electrical and fire research engineer, profiler, forensic auditor, forensic chemist, and forensic biologist. To learn more about these occupations, requirements, pay, and job outlook, go online to the occupational outlook handbook on the U.S. Bureau of Labor Statistics.





Checkpoint Questions

Answer the following questions. Keep the answers in your notebook, to be turned in to your teacher at the end of the unit.

1. Briefly state the Locard Exchange Principle.
2. List four departments commonly found in a crime lab.
3. Forensic odontology is the study of _____ and _____.
4. Forensic scientists must sometimes consult with scientists who specialize in other areas. Name five of these areas.
5. When was science first used to help solve crimes?
6. The earliest known use of blood spatter evidence was in _____.
7. In 1776 Paul Revere identified the remains of General Joseph Warren by what type of evidence?
8. Bertillon used _____ to identify people in 1879.
9. The FBI was established in _____.
10. James Watson and _____ discovered the structure of DNA in 1959.
11. Federal Rules of Evidence that determine what evidence is accepted in court were enacted in _____.
12. The computerized AFIS was established by the _____ in 1996 but is gradually being replaced by the _____ system.
13. List steps that could be taken to solve a scientific problem (a scientific method).
14. Name seven types of laws in the United States.
15. Discuss three differences between civil and criminal cases.
16. Name ten individual rights guaranteed by the Bill of Rights.



Checkpoint Questions

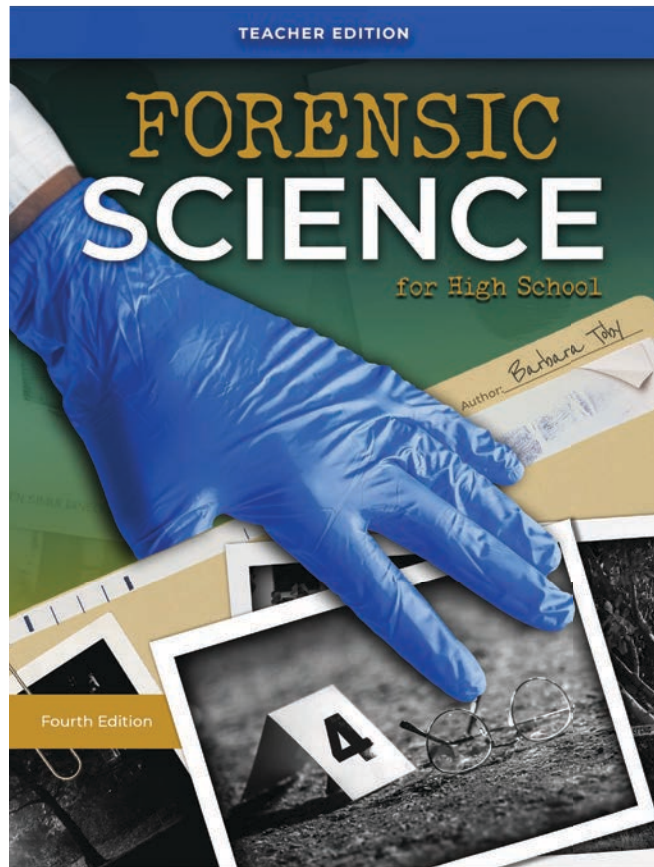
17. What is the purpose of a preliminary hearing?
18. Explain the plea of *nolo contendere*.
19. What must the defendant prove to be found “not guilty by reason of insanity?”
20. Explain how a violation and an infraction are different.
21. What are the differences between misdemeanors and felonies?
22. What are the Federal Rules of Evidence, and why are they needed?
23. Why should evidence be probative?
24. Why should evidence be material?
25. Why is hearsay inadmissible in court?
26. Explain the major differences between the *Frye* standard and the *Daubert* ruling when dealing with physical evidence and determining whether or not the evidence will be accepted in a court of law.
27. Describe the case that the *Frye* standard was based on.
28. Describe the *Daubert* case.
29. Give some examples of what might be considered “junk science.”
30. A forensic scientist testifying in court as an expert witness bases his or her opinion on _____.
31. Study the Timeline of Forensic Science Developments in the chapter and give three examples of a scientific discovery that developed into a forensic technique in use today (or depicted on the television show *CSI*).
32. If you were caught red-handed in a burglary, what procedures would you expect to experience before sentencing?



Checkpoint Questions

33. In what types of cases can a defendant opt for a jury trial?
34. When does an officer not have to read *Miranda* rights to an arrested person?

SAMPLE



Chapter 1

Introduction to Forensic Science and the Law

TEACHER EDITION

Chapter

1

Introduction to Forensic Science and the Law



The United States Supreme Court in Washington, D.C.

“

The clearest way to show what the rule of law means to us in everyday life is to recall what has happened when there is no rule of law.

—Dwight D. Eisenhower, former President of the United States

”

Objectives



- Explain how crime labs in the United States are organized and what services they provide.
- Describe the growth and development of forensic science through history.
- Analyze federal rules of evidence, including the *Frye* standard and the *Daubert* ruling.
- Compare basic types of law in the criminal justice system.
- Describe how the scientific method is used to solve forensic problems.
- Describe different jobs done by forensic scientists and the experts they consult.

Key Vocabulary

| | | | | |
|----------------|---------------|---|------------------------|-----------------------|
| criminalistics | statutory law | probable cause | bail | probative |
| evidence | common law or | violation | <i>nolo contendere</i> | material |
| ballistics | case law | infraction | preliminary | hearsay |
| odontology | stare decisis | elements | or evidentiary | expert witness |
| pathology | civil law | booking | hearing | <i>Frye</i> standard |
| entomology | criminal law | <i>Miranda</i> rights or <i>Miranda</i> warning | grand jury | <i>Daubert</i> ruling |
| palynology | misdemeanor | | indict | junk science |
| polygraphy | felony | arraignment | plea bargaining | |

► Alignment to NGSS

Chapter 1: Introduction to Forensic Science and the Law

| Overarching Essential Questions | Overarching Enduring Understandings |
|---|--|
| <ul style="list-style-type: none"> • What is the role of forensic science in modern society? • How has the growth and development of forensic science expanded over the past hundred years? • How have scientific advancements contributed to the evolution of forensic science? • How are crime labs in the United States organized and what services do they provide? | <ul style="list-style-type: none"> • The principles of scientific method are required in ALL forensic scientific analysis. • The growth and development of forensic science through history • Forensic science utilizes concepts from all scientific disciplines. |

Student Learning Objectives

| Afer instructon, students should be able to: | NGSS Standards |
|--|---------------------|
| Explain how crime labs in the United States are organized and what services they provide. | HS-ETS1-3 |
| Describe the growth and development of forensic science through history. | HS-ETS1-3; HS-LS1-2 |
| Analyze federal rules of evidence, including the <i>Frye</i> standard and the <i>Daubert</i> ruling. | |
| Compare basic types of law in the criminal justice system. | |
| Describe how the scientific method is used to solve forensic problems. | HS-ETS1-1 |
| Describe diferent jobs done by forensic scientsts and the experts they consult. | HS-ETS1-1 |

What national or state standards were used to inform this course's performance indicators?

Source: NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|--|--|--|
| <p>Asking Questions and Defining Problems: Ask questions that arise from examining models or a theory to clarify relationships.</p> <p>Engaging in Argument from Evidence: Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence.</p> <p>Obtaining, Evaluating, & Communicating Information: Compare, integrate, and evaluate sources of information presented in different media or format as well as in words in order to address a scientific question or solve a problem</p> | <p>Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. (HS-ETS1-1)</p> <p>Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, and reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. (HS-ETS1-3)</p> | <p>Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena.</p> <p>Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.</p> <p>Structure and Function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem.</p> <p>Connections to Nature of Science Science is a way of knowing.</p> <ul style="list-style-type: none"> • Science knowledge has a history that includes the refinement of, and changes to, theories, ideas, and beliefs. <p>Science is a human endeavor.</p> <ul style="list-style-type: none"> • Technological advances have influenced the progress of science and science has influenced advances in technology. <p>Science and engineering are influenced by society and society is influenced by science and engineering.</p> |

RST.11-12.1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

RST.11-12.2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

RST.11-12.3 Follow precisely a multistep procedure when carrying out investigations.

RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11–12 texts and topics*.

RST.11-12.8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.



Diablo Highway

This chapter pairs well with the *Diablo Highway*TM virtual crime simulation. Before, during, or after this chapter, you may want to have students complete the *Story of the Crime* lesson and quiz on *Diablo Highway* online.



Student Sheets

Student Sheet 1.1 (*Types of Law*)

Student Sheet 1.1: Answer Key (*Types of Law*)

Student Sheet 1.2 (*Steps in Pursuing Justice Flow Chart*)

Student Sheet 1.2: Answer Key (*Steps in Pursuing Justice Flow Chart*)

Student Sheet 1.3 (*Crossword Puzzle*)

Student Sheet 1.3: Answer Key (*Crossword Puzzle*)



Additional Online Resources

- Chapter 1 Slides
- CASE STUDY 1.1: Richard Crafs



Warm-Up

“ The clearest way to show what the rule of law means to us in everyday life is to recall what has happened when there is no rule of law. ”
 —Dwight D. Eisenhower, former President of the United States

- Show students the quote on the chapter opener. Then ask: Who was Dwight D. Eisenhower?
former U.S. Commander in World War II (led Operation Overlord [D-Day] in France), Supreme Commander of NATO forces, and elected president of the United States in 1952 and 1956
- What is the meaning of “the rule of law”?
a set of laws or principles that says no one is above the law and all people must follow the law
- What do you think happens when there is no rule of law?
Answers will vary, but students may say that there is chaos and people’s rights are not protected.

▶ What Is Forensic Science?



Teacher Tip

Before students read this section, have them write down their own definition of forensic science. Further, ask them to write what they think a forensic scientist does. After reading the section, discuss in what ways their assumptions or prior knowledge about this field were accurate or inaccurate. Then, have students revisit their earlier definitions of forensic science and description of what a forensic scientist does. Instruct them to write a new definition of forensic science in their own words, as well as a description of what a forensic scientist does. Alternatively, have students verbally explain these concepts to a classmate.

▶ Crime Laboratories

Federal Labs



Suggested Assignment

Have students conduct research on their local and state crime labs. In the form of an essay or a research paper, have them address the following components:

1. Location of the labs
2. Number of people employed in the labs
3. Services provided
4. Number of cases processed per year
5. The most common types of evidence analyzed

This assignment will give students an idea of the scope of their local crime lab's capabilities and the number and types of cases processed there.

► Highlights in the History of Forensic Science



Teacher Tip

Draw students' attention to words that may be unfamiliar to them, such as the following:

incendiary device
sickle
defendant
heresy
postmortem
disinterred
exonerate
sobriety

Ask a volunteer to share a definition of each word or have students look up the meaning of the word and write it on the whiteboard.



Suggested Assignment

Give students a time range from which to choose a historical event of interest and research the topic. Depending on how many students you have in class, you may wish to divide the timeline into blocks of years so that the topics are spread over the entire period and not concentrated in one decade.

Ask students to create a poster that includes the following components:

1. The date and title
2. Graphics (drawing, photo, sketch, table, or graph)
3. A one-page summary overview of the discovery or significant event
4. A description of how the discovery contributed to modern-day forensic science and analysis of evidence

Students' posters can then be presented individually to the class, and then posted in the room or outside the classroom as a timeline. Students should learn in more detail some of the history of forensic science.



Suggested Assignment

To extend learning, ask students the following questions:

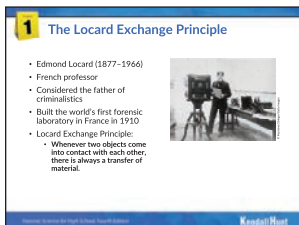
1. How many crime labs exist in the world today?
There are about 400 crime labs in the world today.
2. How many people work in forensic science today?
In 2022, there were 18,500 forensic science technicians in the United States.

▶ Methodology



Slides

Introduce the Locard Exchange Principle and Activity 1.1 by showing students this slide.



ACTIVITY 1.1: The Locard Exchange Principle



Time: 1/2 class period

In this activity, students will explore how the Locard Exchange Principle applies to their current surroundings. Students may work in small groups to read the activity and answer the questions.

Student Instructions

In this activity, you will explore how the Locard Exchange Principle applies to your current surroundings.

You are sitting at your desk. What are you in contact with? What possible transfer of material could have taken or is taking place? Make a list. How could you have prevented any transfer if you had thought about it first? What transferred material could be traced to you directly? Think about when you came

to school today. Did you leave any evidence that you were here other than being observed by others (eyewitness accounts)? Is it difficult not to leave a trace? And, after the fact, is there lots to worry about from leaving evidence of your presence? Do you think premeditated contact can diminish identifiable transfers? Give some hypothetical examples where destroying evidence might leave more that could identify you.

Possible Answers: Contact at desk from the floor to the seat to the desktop to objects thereon. Possible transfer of footprints, fibers from clothing, hair, fingerprints, pencil, etc.

Prevention: Don't come to class; otherwise, wear booties, gloves, and hat; spread plastic on the chair and desktop (but that might leave a trace identifiable to the person who brought in the plastic to sit on). What can be traced to the individual: fingerprints, chewing gum (under desk). At school today, other than classroom transfers: food in lunch (fingerprints, DNA, tooth marks), vehicle, notes, cell phone calls, stuff in locker.

Hypothetical examples: Use your imagination, such as wiping fingerprints with a handkerchief that is left behind, wiping up blood with a blanket from your car, vacuuming trace evidence and leaving behind fingerprints on the emptied cleaner, etc.

► Criminal Justice and the Law

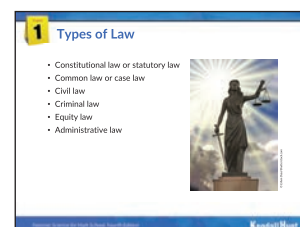


Slides

Show students this slide on the Types of Law to discuss their understanding of the differences.

Background Note

Use this summary of cases and the type of law that was applied in each case to support student understanding of the different types of law in the U.S. criminal justice system.



| Court Case | Summary of Case | Type of Law Applied to Case |
|---|---|--|
| <p><i>Marbury v. Madison</i> (Supreme Court) 1803</p> | <p>After Federalist John Adams lost the presidential election to Democratic-Republican Thomas Jefferson, Congress created new judgeships so that Adams could appoint more Federalist judges and maintain control of the judiciary. William Marbury was one of the appointed judges, but he did not receive his commission before Jefferson was sworn in as president. Secretary of State James Madison withheld Marbury's commission, and Marbury appealed to the Supreme Court to compel Madison to issue it. Chief Justice John Marshall ruled that while Marbury had the right to his commission and that Madison should issue it. However, Marshall pointed out that the Supreme Court could not compel Madison to do so because the law that allowed the Court to make that ruling was unconstitutional. Marshall held that Congress could not pass a law that went against the Constitution, and as a result, established the Supreme Court's power of judicial review—to determine whether the actions of Congress, the President, or the administration are consistent with the U.S. Constitution.</p> <p>[Sources: https://www.britannica.com/event/Marbury-v-Madison; https://supreme.justia.com/cases/federal/us/5/137/]</p> | <p>Constitutional or Statutory Law</p> |
| <p><i>United States v. Nixon</i> (Supreme Court) 1974</p> | <p>On June 17, 1972, five men broke into the Democratic National Committee headquarters at the Watergate Hotel in Washington, D.C. These five men were later connected to Republican candidate—and President at the time—Richard Nixon. The Attorney General secured a subpoena that ordered Nixon to release tapes that contained conversations Nixon had had with these men. Many believed that the tapes could also implicate Nixon in the Watergate break-in. Nixon ended up turning over edited transcripts of the conversations, but then asked the federal court to quash the subpoena. Nixon claimed that as President he had executive privilege. The case reached the Supreme Court, which ruled that while the president may claim executive privilege in some cases, he or she may not do so to prevent the release of evidence during a criminal prosecution.</p> <p>[Source: https://supreme.justia.com/cases/federal/us/418/683/]</p> | <p>Constitutional or Statutory Law</p> |

| Court Case | Summary of Case | Type of Law Applied to Case |
|---|--|-------------------------------|
| <p><i>Dynamex Operations West, Inc. v. Superior Court</i> (California) 2018</p> | <p>Drivers for Dynamex claimed that their company had misclassified them as independent contractors, rather than employees, and they were unlawfully denied certain protections under California’s wage laws. This case raised the question of what standards should be used to classify workers in California as either employees or as independent contractors. The California Supreme Court devised a three-part test to make this determination. In response, the California legislature created a new section of the state’s labor code to codify this three-part test.</p> <p>[Sources: https://www.law.cornell.edu/wex/common_law; https://www.courts.ca.gov/opinions/archive/S222732.PDF]</p> | <p>Common Law or Case Law</p> |
| <p><i>Rodriguez v. FDIC</i> (Supreme Court) 2020</p> | <p>The Internal Revenue Service (IRS) issued a tax refund to United Western Bancorp, Inc. (UWBI), which had declared bankruptcy. The question was whether the refund should go to Simon Rodriguez as the trustee for the bankruptcy estate or to the Federal Deposit Insurance Corporation (FDIC) as the receiver of the bank. A lower court determined that the refund should go to the FDIC under a previous a federal precedent that the refund should go to the entity that lost money. However, the Supreme Court ruled that federal “common lawmaking must be ‘necessary to protect uniquely federal interests’” and did not apply in this case. As a result, the tax refund was awarded to Rodriguez.</p> <p>[Sources: https://www.law.cornell.edu/wex/common_law; https://www.law.cornell.edu/supremecourt/text/18-1269]</p> | <p>Common Law or Case Law</p> |
| <p><i>Frigalment Importing Co. v. B.N.S. International Sales, Corp.</i> (New York) 1960</p> | <p>Frigalment entered into contract to buy chicken from B.N.S. However, the two companies disagreed over what “chicken” meant. According to Frigalment, the company had purchased only small chickens that could be used from broiling or frying. However, B.N.S. interpreted the contract to mean that Frigalment had purchased young chickens as well as older chickens that could be used for stewing. Frigalment sued for breach of warranty. The court ruled in favor of B.N.S., indicating that the Frigalment had the burden of proving that only young chickens would satisfy the terms of the contract, which Frigalment did not do.</p> <p>[Sources: https://law.justia.com/cases/federal/district-courts/FSupp/190/116/1622834/; https://www.americanbar.org/groups/law_students/resources/on-demand/quimbee-frigalment-importing-v-bns/]</p> | <p>Civil Law</p> |

| Court Case | Summary of Case | Type of Law Applied to Case |
|---|--|-----------------------------|
| <p><i>Braschi v. Stahl Associates Co.</i> (New York) 1989</p> | <p>Miguel Braschi lived with his partner Leslie Blanchard, who was listed as the renter of their apartment. After Blanchard died, Stahl Associates gave Braschi a month to leave the apartment before evicting him. Braschi sued, stating that under New York law he should be counted as Blanchard’s “family” and therefore allowed to continue to live in the apartment under the same terms and Blanchard. The New York Court of Appeals agreed with Braschi and established that the surviving member of a same-sex relationship was indeed “family” under New York law and could continue to live in a rent-controlled apartment.</p> <p>[Source: https://law.justia.com/cases/new-york/court-of-appeals/1989/74-n-y-2d-201-544-n-y-s-2d-784-543-n-e-2d-49.html; https://history.nycourts.gov/the-braschi-breakthrough-30-years-later-looking-back-on-the-relationship-recognition-landmark/]</p> | <p>Civil Law</p> |
| <p><i>Robinson v. California</i> (Supreme Court) 1962</p> | <p>A police officer stopped Robinson because he observed “tracks” on Robinson’s arms that suggested he had used heroin in the past. The officer claimed that Robinson admitted to using drugs and arrested him for being “addicted to the use of narcotics,” which was a misdemeanor under California law. Robinson denied that had admitted to doing drugs as well as denied that he was a drug addict, but he was convicted and sentenced to 90 days in jail. Robinson appealed, and his case went to the Supreme Court, which ruled in his favor, stating that a person cannot be punished simply for drug addiction, which is a status not the act of using illegal drugs.</p> <p>[Source: https://supreme.justia.com/cases/federal/us/370/660/]</p> | <p>Criminal Law</p> |
| <p><i>People v. Campbell</i> (Michigan) 1983</p> | <p>Steven Paul Campbell was convicted of murder for encouraging Kevin Patrick Basnaw to commit suicide and then supplying him with the gun to do it. Campbell appealed, and the Michigan Court of Appeals ruled in his favor. The court explained that Campbell’s actions were reprehensible, but he did not commit murder under Michigan law. The court also noted that “[t]he remedy for this situation is in the Legislature. We invite them to adopt legislation” that would make what happened in this case a crime.</p> <p>[Source: https://law.justia.com/cases/michigan/court-of-appeals-published/1983/124-mich-app-333-335-n-w-2d-27.html]</p> | <p>Criminal Law</p> |

Individual Rights Guaranteed by the Bill of Rights



Teacher Tip

Have students complete **Student Sheet 1.1 (Types of Law)** as a review of information they read regarding Criminal Justice and the Law. **Student Sheet 1.1 (Types of Law)** and **Student Sheet 1.1: Answer Key (Types of Law)** can both be found in the *Online Teacher Resources*.

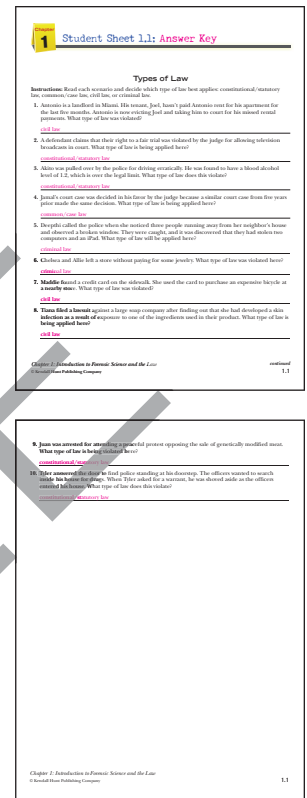


Cross-Curricular Connection

This material may spur a review of what students learned in government class. They should know how laws are enacted and by whom. You might ask a social studies or government teacher how to tie in and integrate.

From a Bill to a Law in Ten Steps

1. An idea for a law comes from a Representative but could originate from a citizen.
2. Research begins on the idea.
3. A bill is written and proposed to other Representatives.
4. The bill is introduced in the House of Representatives. It is assigned a number such as H.R. 1234. The bill is read aloud to the House.
5. The bill is sent to a committee in the House. The committee reviews and researches the bill. It may make revisions as needed.
6. The bill may go to a subcommittee before being debated by the House.
7. Each section of the bill is read aloud and then debated by the House of Representatives. Revisions are made based on the debate.
8. The House votes on the bill. If the majority support the bill, it passes and is sent to the Senate.
9. If the majority of the Senate supports the bill, it moves on to the President.
10. The bill goes to the President to sign and pass the bill. If the President does not sign the bill (veto), it is sent back to the House and Senate. Another vote can be made on the bill. If two-thirds of the House and the Senate support the bill, they can override the veto by the President. The bill becomes a law.





Possible Discussion Questions

In class, see how many of these rights are familiar to your students and whether they understand the implications of each. Note that some of these rights have conditions; for example, the right to bear arms has some restrictions and regulations, e.g., we can't bring guns to school.



Teacher Tip

Ask the government teacher if the Patriot Act is part of his or her curriculum. This may be a good place to integrate what students do in government class with forensic science. As an alternative, have students look up the Patriot Act and discuss how these rights may be affected and under what conditions.

Types of Crimes

Classroom Activity

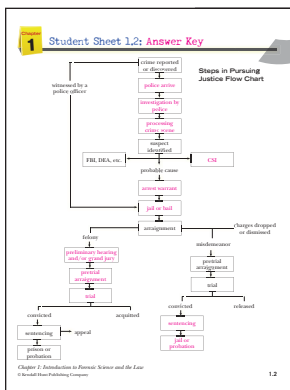
Check for student understanding of the difference between an infraction, misdemeanor, and felony. Have students work with a partner or small group to come up with a short list of simple scenarios of a person committing a crime. For example, "Chris robbed a bank with a weapon." Once the students have their scenarios written out, they should create an answer key on a separate piece of paper that specifies whether each crime was an infraction, misdemeanor, or felony. Then, groups should trade papers with another group to decide whether each scenario describes an infraction, misdemeanor, or felony. When each group is finished, trade papers again to check that all answers are correct. Share some examples to discuss as a class.

Steps in Pursuing Justice



Teacher Tip

Have students complete **Student Sheet 1.2 (Steps in Pursuing Justice Flow Chart)**. This will enable students to organize the entire process of arrest, investigation, and administration of justice from what they have learned in the pertinent sections of the chapter as well as from external resources. **Student Sheet 1.2 (Steps in Pursuing Justice Flow Chart)** and **Student Sheet 1.2: Answer Key (Steps in Pursuing Justice Flow Chart)** can both be found in the *Online Teacher Resources*.





Suggested Assignment

Have students determine where their local courts, either county or city, are located. Ask them to research and write an essay including the following information:

1. The number of cases processed in the past year
2. The number of cases that were plea-bargained in the past year
3. The criteria used for which cases are plea-bargained and which are not
4. An example of a local crime where the prosecution used plea bargaining with the suspect(s) to lower the charge
5. Comparison of the number of cases processed by the crime lab to the number of cases brought to court

Local courts, newspapers, and the Internet are good sources of information. Students will learn that the vast majority of court cases do not use any type of forensic analysis.



Teacher Tip

Make sure that students understand the difference between a prosecutor and defendant. A prosecutor brings the charges in a criminal case. A defendant is the person who is charged with a crime (criminal law) or in a lawsuit with a wrongdoing (civil law).



Suggested Assignment

Have students conduct research on grand juries and preliminary hearings. In the form of an essay or a research paper, have them address the following components:

1. What types of cases use a grand jury
2. What types of cases use a preliminary hearing
3. The number of grand juries and preliminary hearings held in your state last year
4. Discussion of a case held in front of a grand jury in your state, including information on:
 - a. the crime
 - b. the suspect(s)
 - c. the evidence presented
 - d. the length of the hearing
 - e. the conclusion of the hearing

This assignment will impress upon the student the fact that a grand jury only makes a decision on whether or not to indict, and not on guilt or innocence.

► Federal Rules of Evidence



Possible Discussion Questions

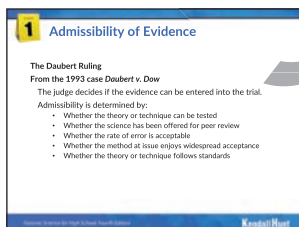
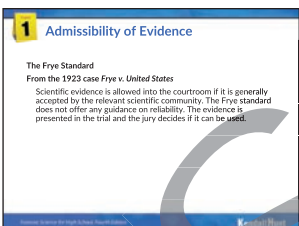
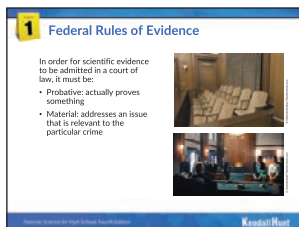
This might be a good time to ask the class, “What is ‘evidence’?” Students will come up with all kinds of answers ranging from specific types of evidence, such as fingerprints, hair, etc., to a more general statement of anything that helps to solve a case. This discussion will set the stage for the next chapter. Consider showing this slide while discussing types of evidence.

Expert Testimony



Slides

Show students these slides on the Admissibility of Evidence to discuss the Frye Standard and the Daubert Ruling.



► The CSI Effect



Possible Discussion Questions

Before reading this section, ask students:

- Which TV shows have they watched that deal with forensic science?
- Ask students to generate a list of shows and then invite them to share aspects of those shows that they think are exaggerated vs. realistic depictions.
- Then, read the section as a class to determine if what they have seen on TV is realistic. Use the outcome as a launching point for further class discussion on the portrayal of forensic science on the screen versus what actually happens in real life.
- Ask students if they have ever listened to a true crime podcast such as “Forensic Tales” or “Crime Redefined”. Preview a podcast before having students listen to one in class or assigning it for homework.



CASE STUDY 1.1

Richard Crafts

For the full case study, see the student text.

Analysis Questions

1. If the truck driver had not come to the police, how do you think the investigators would have proceeded?

Answers will vary, this is to get students thinking about the importance of investigation linked with forensic science.

2. What is the significance of this case?

Answers will range from conviction without a body to the extraordinary number of forensic tests.



Career Connection: Forensic Scientist

Other possible careers include crime scene investigator, crime prevention specialist, homicide detective, fraud investigator, special agent for FBI, DEA, ATF, or homeland security, intelligence analyst, information technologist, electrical and fire research engineer, profiler, forensic auditor, forensic chemist, and forensic biologist. To learn more about these occupations, requirements, pay, and job outlook, go online to the occupational outlook

handbook on the U.S. Bureau of Labor Statistics.

Optional: You may want to assign students the task of creating a career chart of careers that interest them and to fill in the chart with details about pros and cons of each. Suggest that students consider the following as categories: number of years of education/training, cost, salary, location, and time commitment/flexible hours.



Checkpoint Questions

1. Briefly state the Locard Exchange Principle.
Students state in their own words, “Whenever two objects come into contact, there is always a transfer of material.”
2. List four departments commonly found in a crime lab.
physical science, biology, ballistics, document examination, photography, toxicology, and/or fingerprints
3. Forensic odontology is the study of _____ and _____.
bite marks; teeth
4. Forensic scientists must sometimes consult with scientists who specialize in other areas. Name five of these areas.
engineering, computer technology, pathology, geology, environmental science, entomology, palynology, polygraphy, voiceprint analysis
5. When was science first used to help solve crimes?
200 C.E.
6. The earliest known use of blood spatter evidence was in _____.
1514
7. In 1776 Paul Revere identified the remains of General Joseph Warren by what type of evidence?
false teeth
8. Bertillon used _____ to identify people in 1879.
body mass
9. The FBI was established in _____.
1905
10. James Watson and _____ discovered the structure of DNA in 1959.
Francis Crick
11. Federal Rules of Evidence that determine what evidence is accepted in court were enacted in _____.
1975



Checkpoint Questions

12. The computerized AFIS was established by the _____ in 1996 but is gradually being replaced by the _____ system.
FBI; NGI
13. List steps that could be taken to solve a scientific problem (a scientific method).
1. Observe a problem or questioned evidence and collect objective data.
2. State a hypothesis or possible solution to the problem.
3. Examine, test, and analyze to support or refute the hypothesis.
4. Evaluate and verify.
There are many different versions of the scientific method. Students may have learned a slightly different version in another science class.
14. Name seven types of laws in the United States.
the U.S. Constitution, statutory law, common law, civil law, criminal law, equity law, and administrative law
15. Discuss three differences between civil and criminal cases.
Civil cases involve disputes between individuals, government, organizations, or businesses; the case has to be initiated by one side. Civil cases are concerned with assigning blame. A preponderance of evidence is required to convict. The remedy is usually in the form of fines or transfer of property. Criminal cases are crimes against an individual. The state initiates the case, becoming the plaintiff. The state must prove beyond a reasonable doubt to convict. The remedy is in the form of fines, community service, probation, and/or incarceration. Both civil and criminal cases may be heard before a jury.
16. Name ten individual rights guaranteed by the Bill of Rights.
Possible answers:
The right to be presumed innocent until proven guilty
The right not to be searched unreasonably, either on one's person or in one's home
The right not to be arrested without probable cause
The right against unreasonable seizure of personal property
The right against self-incrimination
The right to fair questioning by police
The right to protection from physical harm throughout the justice process
The right to an attorney
The right to trial by jury
The right to know any charges against oneself
The right to cross-examine prosecution witnesses
The right to speak and present witnesses
The right not to be tried again for the same crime



Checkpoint Questions

The right against cruel and unusual punishment

The right to due process

The right to a speedy trial

The right against excessive bail

The right against excessive fines

The right to be treated the same as others, regardless of race, gender, religious preference, country of origin, or other personal attributes

17. What is the purpose of a preliminary hearing?
The judge decides whether there is enough evidence for the case to go to trial. Bail may be determined.
18. Explain the plea of nolo contendere.
The accused does not deny the facts, claims no crime, or does not understand the charges.
19. What must the defendant prove to be found “not guilty by reason of insanity?”
The defendant did not know that what he or she was doing was wrong or would harm another.
20. Explain how a violation and an infraction are different.
Every crime is a violation; an infraction is very minor, usually punished by a fine.
21. What are the differences between misdemeanors and felonies?
Misdemeanors are considered less serious crimes than felonies. Felonies have harsher penalties.
22. What are the Federal Rules of Evidence, and why are they needed?
The rules of evidence were established to determine whether the evidence presented is acceptable to be admitted in court. These rules are necessary to prevent “junk science” from being submitted by nonscientists or those who are not experts.
23. Why should evidence be probative?
It must prove a point; otherwise it is useless.
24. Why should evidence be material?
If it is not relevant or significant, it is useless.



Checkpoint Questions

25. Why is hearsay inadmissible in court?

Hearsay is basically secondhand testimony that may be admitted in civil court but not in criminal court, because the person who supposedly knew the facts is not in court to state his or her exact words, the trier-of-fact cannot judge the demeanor and credibility of the alleged firsthand witness, and the other party's lawyer cannot cross-examine the firsthand witness.

26. Explain the major differences between the *Frye* standard and the *Daubert* ruling when dealing with physical evidence and determining whether or not the evidence will be accepted in a court of law.

The *Frye* standard came about in 1923, stating that the scientific evidence must be given by an expert witness and have gained "general acceptance" in the particular field of study. The jury then determines the significance of the evidence. The 1993 *Daubert* ruling came about in response to a rapidly changing technological society. It stated that the trial judge will decide on the admissibility of evidence based on five guidelines: The technique must be testable, be subject to peer review, have a stated rate of error, follow standards, and have widespread acceptance.

27. Describe the case that the *Frye* standard was based on.

See the reference to the *Frye* standard in the text or have students research the case for more detail.

28. Describe the *Daubert* case.

See the reference to the *Daubert* case in the text or have students research the case for more detail.

29. Give some examples of what might be considered "junk science."

Student answers will vary.

30. A forensic scientist testifying in court as an expert witness bases his or her opinion on

training and experience



Checkpoint Questions

31. Study the Timeline of Forensic Science Developments in the chapter and give three examples of a scientific discovery that developed into a forensic technique in use today (or depicted on the television show *CSI*).

Student answers will vary. Some examples are Van Leeuwenhoek's microscope, Kirchhoff and Bunsen's spectroscopy, Eastman's camera, Landsteiner's blood grouping, Lattes's reconstitution of dried bloodstains, Larson's lie detector, Aston's mass spectrometer, Martin and Synge's gas-liquid chromatography, and Watson and Crick's DNA model.

32. If you were caught red-handed in a burglary, what procedures would you expect to experience before sentencing?

Arrest; being booked; probably jail until arraignment, where you would plead "guilty"; then a preliminary hearing for sentencing. You would probably be out on bail until you show up for jail time, if this is the sentence.

33. In what types of cases can a defendant opt for a jury trial?

any type, both civil and criminal

34. When does an officer not have to read *Miranda* rights to an arrested person?

when the person is not going to be questioned

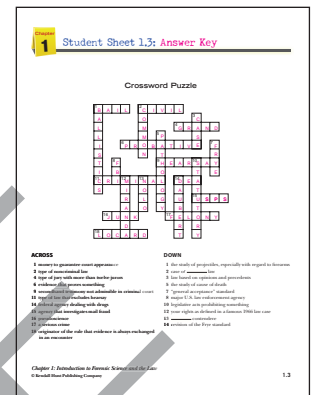
SAMPLE

Additional Activities



Teacher Tip

Now is a good time to assess your students' learning by having them complete **Student Sheet 1.3 (Crossword Puzzle)**, which can be found in the *Online Teacher Resources* to print and distribute to students. **Student Sheet 1.3: Answer Key (Crossword Puzzle)** is shown.



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