

# Module 2

## Introduction to Forensic Science

Forensic Science Teacher Professional Development

# Overview



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# **Module 2A**

## **Introduction to Forensic Science**

**Forensic Science Teacher Professional Development**

# Unit 1.1: What is Forensic Science?

Forensic science is science which is applied to the criminal and civil laws enforced by agencies in the criminal justice system. Many different professions are included under the term forensic science.



# Unit 1.1: What is Forensic Science?



The American Academy of Forensic Sciences (AAFS)

The membership of AAFS is divided into eleven sections which include the following.

Physicians

Attorneys

Dentists

Toxicologists

Physical anthropologists

Document examiners

Psychiatrists

Physicists

Engineers

Criminalists

Educators

Digital evidence experts

And others

Members are in all 50 U.S. states, Canada, and 61 other countries.

AAFS allows professionals to keep up to date on research and new techniques while helping inform the public about the profession.

Follow this link to the AAFS Website and review the material it contains: <http://www.aafs.org/>

# Unit 1.1: What is Forensic Science?

For purposes of this course, the terms “forensic science” and “forensic scientist” will be used.

*Forensic science* is often interchangeable with *Criminalistics*.

*Criminalistics* is often used to describe the services of a crime laboratory.

Forensic laboratory personnel may be referred to as *criminalists*.

A *criminalist* is generally involved in the laboratory analysis of forensic evidence.



# Unit 1.2: History & Development of Forensic Science

Review the following history of forensics timeline provided by the American College of Forensic Examiners.

<http://www.forensicdna.com/timeline.html>

The DNA Initiative has a section which discusses the history of forensic DNA analysis. The organization provides funding, training, and technical assistance to advance criminal justice through DNA technology.



# Unit 1.3: What is Forensic Evidence?

Forensic evidence is simply information.

- Evidence is necessary to prove the body of the crime, known as the *corpus delicti*.
- Evidence is analyzed to identify the physical or chemical properties of a substance and provide comparisons between a suspect specimen and a known standard.
- After analysis, the forensic scientist must render a conclusion about the evidence to show individual or class characteristics.
- Individual characteristics are properties that can be attributed to a common source with a high degree of certainty.
- Class characteristics are properties of evidence that can only be associated with a group and not tied individually to a single source.





# Unit 1.3: What is Forensic Evidence?

- *Real evidence* is sometimes called physical evidence; it is relevant and material to the crime and usually can be produced in court.
- *Demonstrative evidence* demonstrates or illustrates the testimony of a witness. Examples are maps, diagrams of the scene of an occurrence, and animations.
- *Documentary evidence* is a kind of real evidence associated with human language.
- *Direct evidence* is testimonial evidence of witnesses that ties the offender to the crime.
- *Circumstantial evidence* is based not on personal knowledge, but rather an inference.



# Unit 1.3: What is Forensic Evidence?

- *Conclusive evidence* is strong enough to counter other evidence to the contrary.
- *Corroborating evidence* may differ from other evidence, but strengthens other evidence.
- *Derivative evidence* is obtained illegally and inadmissible because of the fruit of the poisonous tree doctrine.
- *Exculpatory evidence* can establish the innocence of a defendant.
- *Foundational evidence* is evidence that is admitted to prove the foundation of other admissible testimony.
- *Hearsay evidence* is evidence that a witness has no direct knowledge of and must be proven by another source.



# Unit 1.3: What is Forensic Evidence?

- *Incriminating evidence* establishes guilt of a party.
- *Presumptive evidence* is considered true and sufficient unless challenged by another party.
- *Prima facie evidence* establishes a fact unless other contradictory evidence is presented.
- *Probative evidence* can disprove or prove a point of contention.
- *Rebuttal evidence* is offered to contradict or disprove evidence presented by the other side.
- *Tainted evidence* is evidence that is inadmissible because it was obtained by illegal means.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Locard's Exchange Principle:

- Is named after a French police officer
  - States that whenever two objects come into contact, trace materials are exchanged between the two
  - Can be applied to any object at a crime scene, such as biological evidence, trace amounts of fibers, and prints, including but not limited to fingerprints, tire impressions, and tire tracks
- Exchange occurs even if the material is too microscopic to be detected. Once trace material is discovered in an investigation, it may be used to provide valuable information that can assist investigators in locating the perpetrator of a crime. The material exchange is demonstrated by evidence.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Bloodstain Pattern Analysis

Bloodstain pattern analysis is the study of the movement and direction of objects or persons while bleeding.

Bloodstain pattern analysis examines the direction of the origin of the blood, the angle at which the blood falls on a surface, the location and position of victims while bleeding, the movement of the individual bleeding, and the location of the individual producing the injury.

<http://www.swgstain.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Cadaver Dog Handler

Cadaver dogs are trained to detect the scent of decomposition of human remains and are used to conduct searches on land and in water for remains.

<http://www.cadaverdog.com/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Crime Scene Reconstruction

Crime scene reconstruction uses investigation and scientific techniques to determine the sequence of events before, during, and after a crime.

Reconstructions are based on data collected at the scene and hypotheses formed as a result of the information gathering process.

<http://www.acsr.org/>

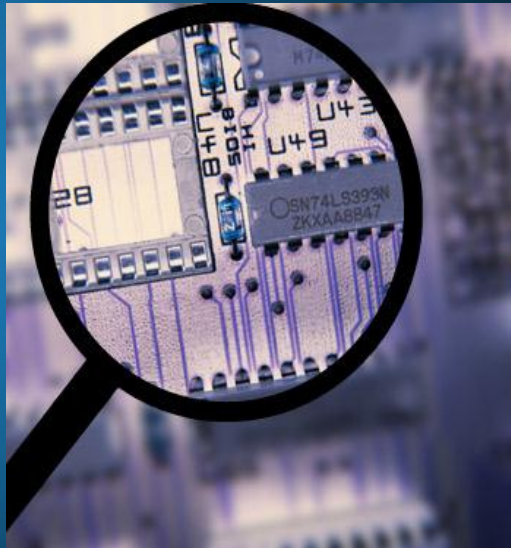


# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Digital Forensics

Digital forensics involves the forensic detection and recovery of digital evidence at a crime scene. Digital forensic professions are involved with the seizure, digital imaging, analysis, and reporting results of digital media investigations.

<http://www.digitalforensicsassociation.org/>



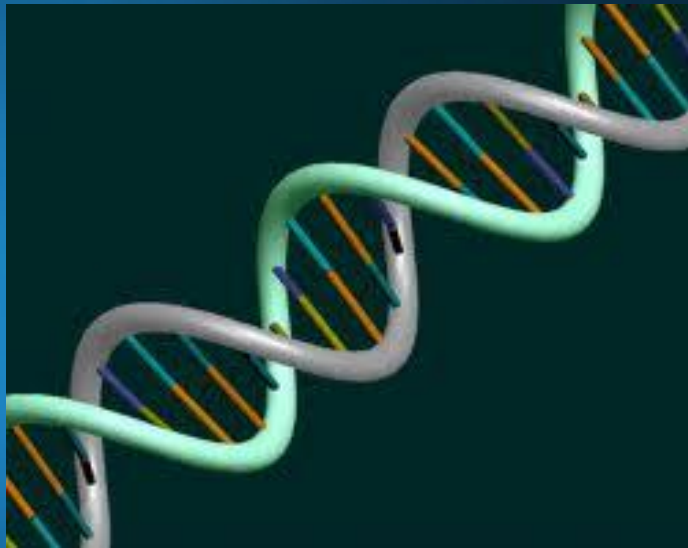


# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## DNA

Forensic DNA analysis can link a suspect to a crime or eliminate a suspect. Each individual's DNA profile is unique. DNA samples can be obtained from blood, bone, hair, and other body tissues and fluids.

<http://www.nij.gov/topics/forensics/evidence/dna/basics/welcome.htm>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Firearms and Tool Mark Examination

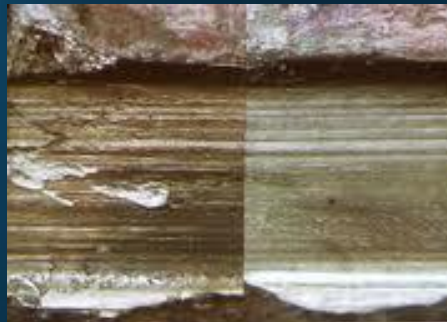
A tool mark is an impression or scrape that is left behind when a harder object (the tool) is pressed or moved across a softer surface. Tool mark examinations are usually conducted by analysts in a firearms lab.

As with tools, the manufacturing process of many firearms results in the unique characteristics of the weapon.

As with tool marks, marks made by firearms can be classified as individual and class characteristics.

<http://www.afte.org/>

<http://www.swggun.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Accounting

Forensic accounting is the study and interpretation of evidence relating to accounting practices. Forensic accountants apply accounting, auditing, and investigative skills to assist in investigations and provide litigation support.

<http://www.nafanet.com/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Anthropology

Forensic anthropologists examine skeletal, decomposed, or otherwise unidentified human remains.

Forensic anthropologists also assess the age, sex, ancestry, stature, and unique features of the deceased from skeletal remains.

<http://www.theabfa.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Art

Forensic artists combine art with science to further justice. Forensic artists may draw suspect composites, perform facial reconstruction, and compile crime scene charts and graphs. Some forensic artists also use computer animation to assist with their visual representations.

<http://www.theiai.org/certifications/artist/index.php>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

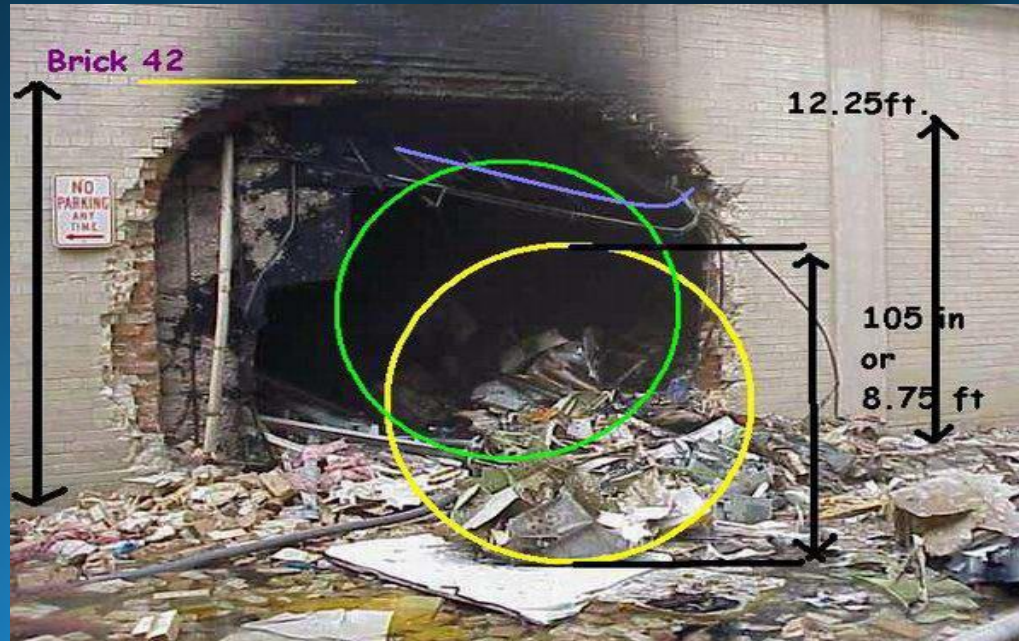
## Forensic Botany

Forensic botanists apply the study of botany to law. Because botanical plant evidence exists in almost all locations and has a diverse morphology, plant remains can be used to solve crimes by linking offenders to location and or victims. Pollen can provide information on the time of year or how long an evidence item was exposed to elements. Pollen from plants also has characteristic shapes that can be associated to a particular plant.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Engineering



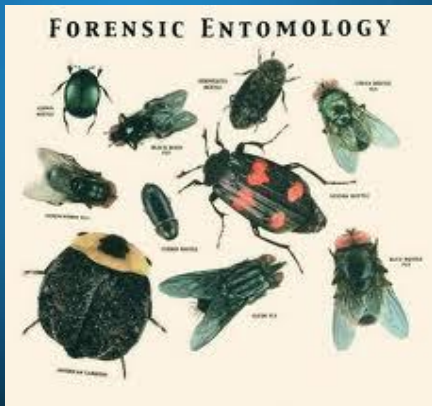
Forensic engineers apply engineering in the jurisprudence setting. Many types of engineering disciplines are represented in the profession.

<http://www.nafe.org/>

# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Entomology

Forensic entomology is the science of using information gained from insects and arthropods in investigation. Often, medico-legal entomology is used in time of death determination. However, entomology has also been used in child and elder abuse cases to show neglect and lack of proper care of wounds and in accident reconstruction. Entomology is used in urban settings in cases in which pesticides or treatments may be at issue. Stored-product entomology is also used to examine bug infestation or contamination in commercially distributed food.



<http://www.forensicentomology.com/>





# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Fiber Analysis

Fibers found at a crime scene can be used to link an offender to the crime scene and/or a victim. Fibers can be transferred by direct or indirect contact. Fibers can be both natural and synthetic.

<http://www.astm.org/Standards/E2224.htm>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Fingerprint Analysis

Fingerprints are defined as imprints deposited on a surface by the friction ridges on a fingertip.

Three different types of fingerprints found at crime scenes:

**1) Latent prints:** A latent print is defined as an impression that is not readily visible to the naked eye and requires further developing to enhance the details. Latent prints are the most common type of fingerprints found at crime scenes.

**2) Patent (or visible) prints:** Patent prints are fingerprint impressions that are visible due to the medium in which the impression is made. Some common mediums are dirt, grease, blood, or dust. Patent prints do not usually require further developing but may require additional visualization techniques.

**3) Plastic (or impression) prints:** Plastic prints are recognizable fingerprints made by pressing on a soft receiving surface that will retain a three-dimensional representation of the friction ridge detail.

[www.crimescene-forensics.com/Fingerprints.html](http://www.crimescene-forensics.com/Fingerprints.html)



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Fire and Arson Investigation

Forensic fire and arson investigators examine fire-related incidents.

Investigators should

- determine the origin and cause of the fire or explosion in question,
- examine the physical attributes of a fire scene, and
- identify and collect physical evidence from the scene.

The evidence collected is analyzed to help determine if the cause of the fire was accidental or deliberate.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Glass Analysis

Glass is composed of the primary chemical components of sand, lime, and washing soda. Most bottle and window glass is composed of soda lime. Other types of glass have additions. Some types of glass are tempered for safety such as automobile glass that is designed to disintegrate on impact. Most glass evidence cannot be individualized, but physical matches can occur.

<http://www.swgmat.org/Introduction%20to%20Forensic%20Glass%20Examination.pdf>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Hair Analysis

Hair analysis examines the cuticle, cortex and medulla of hair. Each of the three forensic races, Caucasoid, Negroid, and Mongoloid, have different hair features. Hair evidence cannot be individualized by microscopic examination. DNA analysis is only available if the root of the hair is intact. Nuclear DNA can be found in hair root sheath cells, but only mitochondrial DNA is found in the hair shaft.

<http://www.swgmat.org/Forensic%20Human%20Hair%20Examination%20Guidelines.pdf>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Linguist

Forensic linguistics can be fairly characterized as the application of linguistic knowledge, methods, and insight to the forensic context of law, investigation, trial, punishment, and rehabilitation. Forensic linguists examine contexts within the written law, and examine language use in forensic and judicial processes.

<http://www.lsadc.org/>

<http://web.bham.ac.uk/forensic/IAFL/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Nursing

A forensic nurse is a nurse that provides specialized care for patients, both victims and perpetrators of violence. They care for the physical, psychological, and social trauma that occurs in patients who have been assaulted or abused. Forensic nurses also have a specialized knowledge of the legal system and collect evidence, provide medical testimony in court, and provide consultation to legal authorities.

<http://www.forensicnurses.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Odontology

Forensic odontology is the examination and evaluation of dental evidence. Forensic odontologists, or forensic dentists, help identify human remains through dental records and comparisons, assess bite marks, and can help with age determination.

<http://www.abfo.org/>

<http://asfo.org/>





# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Paint Analysis

Paint analysis is a type of trace analysis. Paints are defined as pigments carried within a suitable vehicle with minor amounts of additives such as driers, surfactants, etc., which when dry form a colored film over a surface. The vehicle portion of paint forms the film while the pigments provide color, opacity, and bulk to the film. Pigments can be distinguished from dyes, since unlike dyes, they are insoluble in the vehicle in which they are mixed. From a forensic analysis viewpoint, paint usually occurs as chips or flakes, but can occur in powder form.



<http://www.astm.org/Standards/E1610.htm>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Pathology

Forensic pathologists are medical doctors who specialize in forensic pathology. They perform autopsies and determine the manner and cause of death.

Forensic pathologists examine and document wounds, collect toxicology samples, and collect other tissue samples to determine manner and cause of death.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Photography

Forensic photographers are responsible for recording the crime scene through photographic methods. This process is a vital recording of the crime scene. Modern forensic photographers use both 35 mm film and digital photography to capture the scene.

<http://www.theiai.org/certifications/imaging/>

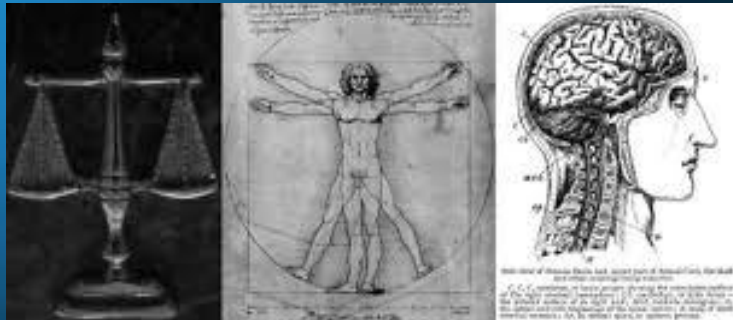


# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Psychiatry and Psychology

Forensic psychiatrists and psychologists apply psychiatry in the legal process. Forensic psychiatrists are often used to determine a defendant's competency to stand trial. Forensic psychologists are trained in clinical, social, organizational, or other branches of psychology and also operate within a legal setting. Often forensic psychologists determine sentencing and treatment recommendations for offenders. Forensic psychologists may also evaluate police personnel and work with both public defenders and state attorneys.

<http://www.nationalafc.com/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Social Work

Forensic social work is the application of social work to questions and issues relating to law and legal systems. The broader definition of forensic social work includes social work practice and how it is related to legal issues and litigation. Forensic social workers may become involved in child custody issues and other family situations which may include separation, divorce, neglect, termination of parental rights, the implications of child and spouse abuse, juvenile and adult justice services, corrections, and mandated treatment.

<http://www.nofsw.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Soil Analysis

Soil scientists, or pedologists, examine soil which is composed of minerals from weathered rocks, decomposed biological material, and other man-made materials. Soil evidence can be useful for comparisons or contain impressions of shoe or tire imprints.



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Forensic Toxicology

Forensic toxicology encompasses other disciplines such as analytical chemistry, pharmacology, and clinical chemistry to assist medical or legal investigation of death, poisoning, and drug use.

<http://www.abft.org/>

<http://www.soft-tox.org/>



# Unit 1.4: Introduction to Forensic Science Evidence Types & Specialties

## Questioned Documents

The discipline of questioned documents relates to any forensic analysis of a document which may be in dispute in court. This specialty includes handwriting examinations.



<http://www.asqde.org/>





# Unit 1.5: Introduction to Laboratory Examination of Forensic Evidence

- Physical evidence is used to identify physical or chemical properties of a substance to link an offender to the crime scene.
- The identification process involves scientific testing in the forensic laboratory according to established procedures.
- The scientific testing should exclude other substances for the identification.
- In addition, scientific comparison is performed in the forensic laboratory, which may compare a suspect piece of evidence with a known standard.



# Unit 1.5: Introduction to Laboratory Examination of Forensic Evidence

- After examination, the forensic scientist forms a conclusion about the evidence.
- Forensic scientists in the laboratory associate evidence to a particular class of characteristics, and if possible, provide proof that evidence has individual characteristics.
- The examination in the laboratory can corroborate events of a crime which have been hypothesized by an investigator.
- Often, it is a determination in court that shows the evidence is useful for individualization rather than a class determination.



# End of Module 2A

Forensic Science Teacher Professional Development