STUDENT HANDOUT

FORENSICS TERMS AND FAQ SHEET

Q: What is forensic science, and how can it aid in criminal investigations?

A: Forensic science isn't limited to just criminal investigations. It is essentially the application of science to law in events subject to criminal or civil litigation. More commonly, though, it is applied to the investigation of criminal activity. The term "forensic science" includes a number of different technical fields, including (but not limited to) physics, chemistry, biology, engineering, psychology, and medicine. Forensic scientists might study the path a bullet took, DNA evidence found at a crime scene, or the mental and emotional state of a suspect. Investigators turn to forensic scientists to discover additional evidence that requires specialized training to analyze and interpret.

Q: How long have investigators been using forensic science?

A: Forensic science has been around for nearly 900 years. The first recorded application of medical knowledge to the solution of a crime was in the year 1248. The first known use of a forensic chemical analysis was in 1836 when James Marsh, a Scottish chemist, detected arsenic poisoning in connection with a criminal investigation. Techniques involving blood typing have been used since 1900, when Karl Landsteiner discovered human blood types. Developed only within the past 20 years, DNA tests are now commonplace, and are revolutionizing the field.

Q: What are some types of evidence that investigators look for?

A: A few clues that investigators look for are

- Fingerprints, palm prints, and footprints
- Shoeprints
- Fibers from clothes
- Blood spatters
- DNA samples (can be from hair, skin cells, blood, semen, saliva)
- Residue from accelerants (compounds used to speed up fires set by arson)
- Gunshot residue on hands and clothing
- Bullet casings
- Tool marks (marks left on a bullet by a gun when fired)
- Insect and mold growth in a body as well as body temperature (to determine time of death)
- Bullet residues around bullet holes
- Pattern of gunshot residue spray (can determine the distance the shooter was from the victim)
- Gunpowder burns

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Q: Why are fingerprints important?

A: If you look at the palm side of your hands and feet, you will see a maze of lines in your skin curving, breaking apart, and joining back together. The places where skin ridges break apart and join together are unique for every person. This unique pattern allows forensic investigators to trace a print found at the scene of the crime back to a specific person. Even identical twins will have different fingerprints!

Though one of the older forms of investigative techniques, fingerprint identification is not without some controversy. One recent court ruling declared that fingerprint examination and identification did not qualify as a "science," in part because an examiner subjectively decides if a set of prints match. There is no uniform set of requirements used by all analysts to determine a positive match, so critics argue that fingerprint identification should not be considered scientific evidence. It is important to note, however, that other court challenges to the science of fingerprint identification have been rejected.

Q: How long after a crime can DNA evidence be collected?

A: DNA is a wonderfully stable molecule. Researchers have been able to recover usable DNA from Egyptian mummies thousands of years old. Each individual strand of DNA is made of strong, unreactive bonds. The strands of DNA twist around each other to form the well-known double helix, concealing weaker hydrogen bonds in the middle of the molecule. There are so many billions of hydrogen bonds that even though one is not strong by itself, the cumulative effect is strong enough to keep DNA intact.

Q: How is the scientific method reflected in a criminal investigation?

A: The scientific method involves many steps: researching a problem, hypothesizing an answer, testing out the answer, and — if the answer is wrong — starting the process over. Investigators of a crime follow this same process by taking a general survey of the crime scene, hypothesizing who might have committed the crime based on the evidence present, and testing the evidence that they find to see if it implicates a suspect. The process continues until a theory can be proved with evidence. One pitfall that investigators try to avoid (but don't always succeed in avoiding) is forming conclusions too early in an investigation. By concentrating too soon on a particular theory or suspect, investigators can neglect or even miss evidence that is not part of their working theory.

Q: Are some forensic tests, by their nature, NOT conclusive?

A: Yes, not all tests performed by forensic investigators are conclusive. Some tests, such as luminol and phenolphthalein (used to indicate the presence of blood) and certain gunshot residue (GSR) tests, are presumptive, meaning they do not indicate absolute proof for what the investigator is testing. When investigators use presumptive tests, which are often quick, easy, and sensitive ways to initially screen evidence from a crime scene, they must then follow up with conclusive tests that provide concrete results.

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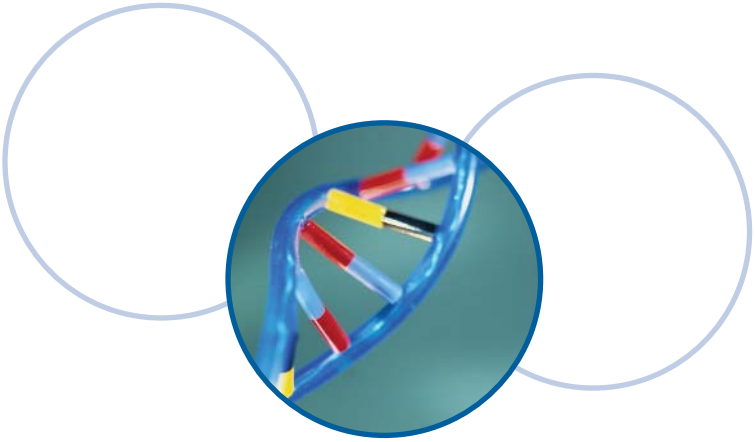
Q: What is the difference between a "suspect" and a "person of interest"?

A: Sometimes investigators designate people as "suspects," and sometimes they refer to them as "persons of interest." However, there is no published definition that distinguishes the difference between the two. Generally speaking, investigators consider someone a suspect once he/she becomes an official focus of an investigation. Initial evidence or circumstances make it clear that the person is a likely perpetrator of a crime. Further, once someone is deemed a suspect, police must follow certain rules for interrogation. For example, police must advise a suspect of his/her Miranda rights, and if a suspect requests a lawyer, the police must stop questioning until a lawyer is present. If someone is simply a person of interest, however, police can do some initial probing for information without such restrictions in place. If the investigation is to probe more deeply into someone's background and possible connection to a crime, the judicial system then insists that the police consider that person a suspect.

Q: What changes are occurring in the field of forensic science?

A: Experts believe forensic science will continue to evolve and provide new and exciting ways to help solve crimes. One current focus of the field is to scrutinize closely its many analytic techniques in order to strengthen their use in investigations, mainly by eliminating as many potential errors as possible. For example, by comparing cases from all over the world that involve similar uses of handwriting analysis or ballistics tests, investigators can establish improved practices from these many experiences. Many in the community of forensic science hope to improve on the techniques already in place by establishing standards and using careful error analysis.



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Autopsy: the internal and external examination of a body after death. An autopsy is performed to confirm or determine the cause of death and establish other pre-death conditions, such as the type of food last consumed and the time it was consumed.

Ballistics: the study of the motion of bullets and their examination for distinctive characteristics after being fired. Examiners can use this evidence to match bullets or bullet fragments to specific weapons.

Blood Spatter: the pattern of blood that has struck a surface. This pattern can provide vital information about the source of the blood. Blood spatter can help determine the size and type of wound, the direction and speed with which the perpetrator or victim was moving, and the type of weapon used to create the blood spill.

Bloodstain Interpretation: the interpretation of size, shape, orientation, and distribution of blood-stains on various surfaces. Information about the event can be derived from the proper interpretation of the stains.

Bullet Track: the path of a bullet or projectile as it passes through matter, such as a body or a wall.

Caliber: the diameter of the bore of a rifled firearm, usually expressed in hundredths of an inch or in millimeters. For example, a Colt 45 has a bore of .45 of an inch.

Catalyst: a substance that accelerates a chemical reaction but is not itself permanently changed by the reaction.

Composite Drawing: a sketch of a suspect produced from eyewitness descriptions of one or more persons.

Criminology: the study of criminal activity and how it is dealt with by the law.

DNA: deoxyribonucleic acid. Occurring in the form of double-helix strands, DNA contains genetic code. In each individual among the higher organisms, identical DNA occurs in the nucleus of every cell and serves to define that individual's characteristics. In addition to the portions of the DNA that encode the proteins making up all the individuals of a species, there are portions of "junk" DNA unique to each individual within the species. Often an individual's DNA appears in the blood and other body fluids. This provides a powerful technique for uniquely identifying the person or animal who left traces of such fluids at a crime scene. Indeed, this is the best method presently known for such identification.

DNA Electrophoresis: the technique by which DNA fragments are placed in a gel and charged with electricity. An applied electric field then separates the fragments by size, as part of the process of creating a genetic profile.

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DNA Profiling: the process of testing to identify DNA patterns or types. In forensic science this testing is used to indicate parentage or to exclude or include individuals as possible sources of bodily fluid stains (blood, saliva, semen) and other biological evidence (bones, hair, teeth).

Evidence: anything that has been used, left, removed, altered, or contaminated during the commission of a crime or other event under investigation.

Fingerprint: the unique patterns created by skin ridges found on the palm sides of fingers and thumbs.

Forensic Science: the application of science to law.

Gas Chromatograph (GC): a forensic tool used to identify the chemical makeup of substances used in the commission of crimes. The questioned substance is burned at high temperatures. The temperature at which this material becomes gas is then charted to determine its makeup.

Gene: a unit of inheritance consisting of a sequence of DNA that determines a particular characteristic in an organism.

Hemoglobin: a red blood cell protein responsible for transporting oxygen in the bloodstream. Also provides the red coloring of blood.

Latent Fingerprint: a fingerprint made by deposits of oils and/or perspiration, not usually visible to the human eye. Various technologies, including lasers, can be used to identify latent prints.

Lie Detector: also known as a "Polygraph." A machine that charts how respiration and other bodily functions change as questions are asked of the person being tested. An attempt to knowingly provide false answers can cause changes in bodily functions. Lie detector tests are usually not admissible in court because many scientists and others consider the results to be unscientific and inconsistent.

Luminol: a chemical that is capable of detecting bloodstains diluted up to 10,000 times. Luminol is used to identify blood that has been removed from a given area. It is an invaluable tool for investigators at altered crime scenes.

Physical Evidence: any object that can help explain an event under investigation. For example, physical evidence can establish that a crime has been committed, and sometimes it can provide a link between a crime and its victim or between a crime and its perpetrator.

Point-by-Point Analysis: when comparing a known object to one that needs to be identified, analysts will break down photos of each into small portions, and compare the respective similarities within those portions.

Ridge Characteristics: ridge endings, bifurcations, enclosures, and other ridge details, which must match in two fingerprints for their common origin to be established.

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Serology: a technology dealing with the properties and actions of serums in blood; also known as "blood analysis."

Super Glue Fuming: techniques used to develop latent fingerprints on non-porous surfaces. A chemical in the glue reacts with and adheres to the finger oils, and then exposes latent prints.

Toxicology: the study of poisons and drugs and their effect on human and animal populations.

Trace Evidence: material deposited at a crime or accident scene that can only be detected through a deliberate processing procedure. An individual entering any environment will deposit traces of his or her presence, and this material can be used as evidence. Common types of trace evidence are hairs and clothing fibers.

Trajectory: the path of a projectile.