

Spotlight on a Discipline: Forensics

Forensics is an emerging field that applies science and law to solve crimes. When discussing forensics, the TV show, *Crime Scene Investigation* (CSI), is often mentioned. Shows like CSI have been a positive influence in the forensics field as they create an interest in the field. However, while CSI does portray aspects of forensic science, it is not always the most realistic. In some ways, it has negatively impacted the expectation of forensic science in criminal cases. Known as the *CSI-effect*; this occurs when juries expect real-life court cases to emulate CSI. There is an expectation that there should be detailed, easy-to-understand forensic evidence in every case. This causes issues with the way the jury processes the facts of a case. Forensic evidence will not be a part of every case, and when it is presented to the jury, it is presented by an expert witness—someone who has been studying and working with the subject matter for many years. At trial, he/she has to break down all his/her knowledge, learning, and training into layman's terms so it is easily understood by the jury. It is easy for this to get lost in translation, which can cause confusion.

There are many different branches of forensic science including digital forensics, forensic accounting, forensic toxicology, forensic odontology, and criminalistics. This brief introduction to the social science of forensics will go over an overview of various types of forensic science, hopefully giving readers a bit of insight beyond the *CSI-effect*.

Digital forensics, previously referred to as computer forensics, entails analysis of all electronic devices, including computers, cell phones, and even printers/fax machines. Digital forensics does not aim to prove someone's innocence or guilt. Rather, its purpose is presenting evidence found through digital forensics processes. When arriving at any crime scene, it is imperative for first responders to secure the scene; no unauthorized personnel should be allowed

onto the crime scene. The investigators must then thoroughly document and photograph the scene exactly how it is found. Every piece of evidence must be properly tagged and transported to a secure location and every piece of evidence must have a chain of custody. A chain of custody is a form that tracks the whereabouts of the evidence. This form is important in order to maintain integrity of the evidence, especially if a case is going to court. It has to be proven that the evidence can be properly accounted for and has not been tampered with. The chain of custody ensures legal requirements are satisfied, so that the results are admissible in court.¹ See Figure 1 for the full process of handling a new crime.

Before analyzing any digital evidence, an image must be taken of the evidence. An image is a forensically sound copy. The copy must be an exact replica of the original evidence. The image is validated by comparing hash values. A hash value is a string of characters that identifies data. The hash value is taken of the original evidence and then compared to the hash value of the copy made. If they match, the evidence has not been altered. If they do not match, something has been altered in the process. To prevent changes from happening, write blocks can be used. Write blocks are software or hardware products used to capture forensic images that do not allow data to be written to the evidence. It is never acceptable to work from the original evidence; it should be stored away in an evidence locker to maintain its integrity. Thanks to television shows, people are most familiar with this aspect of forensics.

Accounting forensics is about recording, classifying, summarizing, and interpreting financial transactions of an organization.² In other words, forensic accounting is a method to investigate financial transactions regarding fraudulent activities. A forensic accountant can be seen as a specialist in fraud detection; specifically related to documenting the type of evidence that would be required in a criminal and/or civil prosecution.³ Forensic accountants incorporate

their understanding of business information, financial reporting systems, accounting and auditing standards, proper procedures, evidence gathering and investigative techniques, and legal processes in order to effectively perform their work. Some forensic accountants may specialize in insurance claims or personal injury claims. Forensic accounting helps organizations analyze whether or not proper policies and procedures are being followed.

Forensic toxicologists focus on chemicals reactions and the human body. You may have heard about toxicology reports. They are reports that uncover what drugs and/or chemicals are present in the body, including but not limited to alcohol, illegal or prescription drugs, and poisons. The practice of forensic toxicology requires identification and quantification of the specific compound. Forensic toxicologists first perform a screening test. If the screening test is positive for one or more drug classes, the toxicologist proceeds to conduct additional tests in order to identify and quantify the specific compounds. The four areas of influence in forensic toxicology include:

1. Human Performance Technology: the identification and interpretation of substances that impair a person's ability to perform a task such as driving a car;
2. Postmortem Toxicology: the identification of substances in the body that aid in determining cause and manner of death;
3. Workplace Testing: screening individuals as it relates to employment such as applying for a job; and
4. Drug Courts/Probation and Parole: court-ordered testing relating to those who are a part of a program who must remain drug-free.⁴

Death alters the concentrations of compounds in the blood and tissue, mainly because blood stops circulating. Blood obtained from different parts of the body will provide different results.

For example, blood obtained from a peripheral site, such as the femoral veins (located in the thigh) is less likely to show a high concentration of a substance caused by decomposing liver. There are also different autopsies that can be performed. A chest autopsy provides access to blood for analysis, an autopsy restricted to the abdomen provides access to blood, liver, bile, and urine (if present), and a head only examination allows access to blood, cerebrospinal fluid, and brain.

Forensic odontologists are also known as forensic dentists. They use dental tissues to determine age, sex, and the ethnicity of a person even if he/she is decomposed, burnt, or dismembered.⁵ Teeth are the hardest tissues of the body; they are resilient and unique to every individual. Dental identification is usually dependent upon the availability and accuracy of pre-death dental records. In cases where previous dental records are not available for comparison, an alternate aid called radiograph is used for identification. Dental radiographs show characteristics such as the shape of teeth and roots, teeth present and missing, and fractures. Identification via dental analysis plays an important role similar to fingerprint analysis. Forensic odontology has been used in three main areas:

1. Examination and evaluation to injuries to jaws, teeth, and oral soft tissue,
2. Identification of individuals, especially casualties in mass disasters and/or criminal investigations, and
3. Identification, examination, and evaluation in bite marks, which occur more frequently in sexual assaults and child abuse cases.

According to Jeddy, Ravi, and Radhika, advancements such as tongue prints, denture identification, and facial reconstruction have been introduced into the field of forensic odontology.

Criminalistics focuses on physical evidence found at crime scenes. Criminalists analyze, compare, identify, and interpret physical evidence.⁶ Physical evidence can widely range to include hair, fibers, blood, drugs, glass, soil, footwear impressions, and bullet casings. In most cases, the amount of the evidence to be tested is very small, such as a drop of blood, a hair, or a piece of glass, but can be a vehicle or other large object. Once the evidence has been analyzed, it is then interpreted into facts. Those facts have to be conveyed to others within the criminal justice system such as attorneys and jurors as written reports and expert testimony in a way that is understood by those outside of the field.

Forensic professionals never stop learning due to technology always evolving. Digital forensics, forensic accounting, forensic toxicology, forensic odontology, and criminalistics are only a few areas of forensics. Forensics is not just what is shown on CSI. There are many other areas of forensics such as forensic psychology and forensic linguistics with the common theme being that these areas are used to help solve crime.

ENDNOTES

1 Davis, G. G. (2012). Forensic toxicology. *Clinical Laboratory Science*, 25(2), 120-124.

2 Mishra, S., & Singh, G. (2017). Forensic accounting: An emerging approach to deal with corporate frauds in India. *Global Journal of Enterprise Information System*, 9(2), 104-109. doi:10.18311/gjeis/2017/15922

3 Poonam, & Dhayal, N. (2017). Forensic accounting: A tool for detecting and preventing frauds. *International Journal of Multidisciplinary Approach & Studies*, 4(3), 97-102.

4 Middleberg, R. A. (2014). Forensic toxicology: Meeting the demands of two slaves— Science and the law. *American Laboratory*, 46(1), 41-43.

5 Jeddy, N., Ravi, S., & Radhika, T. (2017). Current trends in forensic odontology. *Journal Of Forensic Dental Sciences*, 9(3), 115-119. doi:10.4103/jfo.jfds_85_16

⁶ AAFS. (n.d.). Types of forensic scientists: Disciplines of AAFS. Retrieved from American Academy of Forensic Sciences: <https://www.aafs.org/students/choosing-a-career/types-of-forensic-scientists-disciplines-of-aafs/>

7 Varol, A., & Sönmez, Y. Ü. (2017). Review of evidence collection and protection phases in digital forensics process. *International Journal of Information Security Science*, 6(4), 39-46.

Appendix A



Figure 1. Digital Forensics Cycle Model⁷