

Forensic Science in Criminology: A Widely Respected and Highly Specialized Field of Science Essay

Although forensic science has a long history, it became a widely respected and highly specialized field of science in the 20th century. The use of forensic science in criminal investigations has developed over the years and played an important role in helping investigators figure out what happened at the scene of a crime.

When it comes to studying a case of crime, no matter the level of severity, nothing is more important to a criminal investigator than the use and implementation of forensic science. The results of such forensic examinations can be the difference between acquittal and conviction in a court of law. The single best aid that forensic investigators use is DNA, which has proven to be a great tool in the fight against crime. DNA evidence can identify suspects, convict the guilty, and acquit the innocent.

In *Criminalistics* (2007), Richard Saferstein discusses the role of physical evidence in the investigation of a crime which, he says, includes all objects that provide help in establishing that a crime has been committed. According to Saferstein, physical evidence provides a link between the crime and the criminal.

As the inexorable technology of our time evolves; it often makes you think that it could make our lives better or easier somehow. And to finally come to an understanding; what did not get accomplished before, still did not get done after technology. You still do not have sufficient time in the day to spend with your kids and get everything done. The investigation agencies that are enforcing laws, live this dream every day, not enough manpower or sometimes financial resources, not to mention having a heavy burden to prove when dealing with criminals who break the law.

What's unquestionable to understand is that the criminals today are more knowledgeable and believe it or not more educated than they were twenty years ago, or even ten years ago. Along with new technology comes a price, quicker service at the banks, faster lines at the grocery store, and the never-ending co-dependency that people have for the home computer. A criminal person that has knowledge of a banking system and can utilize a face of a machine to rob people of their hard-earned money. By taking the device and placing it over a real machine and then later stealing people's money. Now that's creative; imagine a criminal coming up with that idea 20 years ago, would not happen. Because of new technology identity theft is on the rise, and people are needing to protect themselves in another form, cyber-form.

Forensic science is used in every part of the criminal investigation, from crime scene investigation to prove the guilt of the perpetrator. The forensic procedure begins at the crime scene. The crime

scene investigation should be done in a vigilant and methodical manner. The crime scene is composed of any place in which the perpetrator or the victim was present. If there are drag marks, tire tracks, shoe prints, etc., these things must be an element of the crime scene, as would be anywhere in which the perpetrator moved the body, such as from a home to a river or wooded area. The examination begins at the outermost part of the crime scene working inward towards the body in an extremely careful manner in order not to disturb crucial evidence. The floor or ground around the body, and if inside, even the ceiling must be observed carefully for items of evidence or evidential value. A method often used by crime scene investigators is to shine a flashlight at an angle towards the ground in order to help reveal evidence such as footprints, fingerprints, stains, drag marks, glass shards, and anything else substantial to the search. Another method made popular by television is the use of luminol. Luminol is a compound used to spot bloodstains at a crime scene. It can ascertain any amount of blood by reacting with the blood's iron, even if the area has been wiped clean, and glows in the dark due to its fluorescent nature. All of the proof or potential evidence is then noted, bagged, and preserved for use later on. (Grimming 2007)

When investigators reach the body they pay close attention to wounds on extremities that could show proof of a struggle, as well as looking under the fingernails for any visible skin or blood. If a weapon or any hurtful object is found near the body or anywhere at the scene it is preserved for later use as well. Generally, an investigator tries to find out the cause of death only by a visual examination of the body. Even after one investigator has completed his/her hunt the crime scene remains blocked off for further investigation, if necessary. (Saferstein 2007)

The initial position of the body is noted, and then the body is very carefully transported to a coroner or medical examiner. The medical examiner is important in the success or failure of a forensic investigation. It is the medical examiner, a physician specializing in forensic pathology, who performs the autopsy on the corpse in the event that the victim has died in order to find out whether the death was natural, a suicide, or a homicide. An autopsy is done to inspect the internal organs of a dead body.

The body is first tagged and photographed, then x-rayed, weighed, and measured. Coroners always pay close attention to external wounds and injuries. It is very crucial that all trace evidence is collected off of the body before it is cleaned, such as hair, fibers, and any substances found underneath the fingernails (before the nails are clipped), which could be incriminating. Everything found on the surface of the body along with the cloth in which the body was wrapped in is sent off for further study. Fingerprints are taken off of the body if possible and in some instances, a rape kit is used to examine for seminal fluids or traces of latex. All of this must be done prior to the cleaning of the body. (Grimming 2007)

To investigate the inside of the body the coroner makes a Y incision, a cut from shoulder to shoulder meeting at the chest and down the abdomen into the pelvis. The collarbone and rib cage are cut open and lifted away from the organs, and using an x-ray to guide away from bullet trajectories, etc., the coroner removes and opens organs and intestines to inspect their contents. Finally, the head is cut open, the skin peeled away from the bone, and the bone is chiseled open

so that the brain can be removed and weighed. All of the internal organs and fluid samples are sent off for further examination.

Testing of internal organs and intestines and their contents could potentially put a case over the edge. When used in the correct proportion, almost any natural substance can become a poison, many of which act like common diseases causing an examiner to think that death was accidental. The branch of forensic sciences that studies poisons and foreign substances are called toxicology. Common poisons used in homicide or suicide are arsenic, carbon monoxide from car engines, and cyanide, all of which can be traced. For many centuries poisoning has been used in murder, arsenic being the all-time leader. In the early 1800's scientist, M. Orfila found that arsenic spread throughout all organs of the body, and thus when the organs were removed the poison could be found easily. A relatively simple test used on substances found in the organs to determine the presence of poisons such as arsenic is the Marsh test in which material is treated with sulfuric acid and zinc.

The use of forensic science is most common in the testing and analysis of evidence collected at the crime scene, along with the organs and intestinal contents of the victim. Blood found at a crime scene can be very rich in information. It can find out a vast amount of things about its owner. By testing a very small sample of blood one can find out if the originator has a disease such as sickle cell anemia, blood type can be determined, and by examining bacteria in blood one can even find out a series of events in a crime. However, before the age, sex, and blood type of the originator can be determined, it must first be confirmed that the stain is in fact blood. In order to reach this substantiation, modern forensic investigators use the Kastle-Meyer test, in which a small sample is extracted from the stain and mixed with a solution of phenolphthalein and potassium hydroxide. If the solution shows no color change, the stain is not blood, however, if the solution turns pink (showing the presence of enzyme peroxides), the stain is most definitely blood. Once it has been determined that a substance is blood, species, sex, age, and blood type of the proprietor can also be exposed. Blood tests are a relatively simple way to narrow down a list of suspects. For instance, if the blood sample taken from the crime scene has blood type A and the prime suspect has blood type O, the suspect cannot be the perpetrator. On the other hand, if the suspect has type A blood as well, he cannot be eliminated.

When rape is thought to have occurred in a crime a rape kit (as mentioned previously) is used on the victim (dead or alive). Vaginal, oral, and/or anal swabs are obtained from the victim as soon as possible because bodily fluid evidence degrades somewhat quickly. Smear slides must then be prepared from these swabs and viewed under a microscope in order to identify the presence of motile sperm, indicating recent sexual activity, thus, proving in most cases that rape did in fact occur. If no sperm is evident the fluid swab can also be tested for traces of latex indicating that the perpetrator used a condom, thus, the condom can be traced back to its user. If a sperm sample is found it can be used for later DNA testing to compare to samples from suspects.

DNA profiling is a contrivance used for the comparison of DNA samples. All bodily fluids, tissues, hair roots, and bones contain DNA, thus, samples collected from the crime scene can be used for analysis and comparison. Recently it has been discovered that DNA can be obtained from objects

touched by the skin, providing a powerful new tool for investigation. DNA profiling is still in the developmental stages and can be used only when there is a sample from a suspect for comparison.

The first step in creating a genetic outline or a DNA “fingerprint” is to extract and purify the nuclear DNA from cells. To recover the DNA a sample may be boiled with a detergent that breaks down proteins but not DNA, and then the proteins can be separated from the DNA. Restriction enzymes can be used to cut DNA into fragments at specific places, which differ from individual to individual, however, this process involves a very large quantity of DNA. The more modern approach is to use PCR or Polymerase Chain Reaction. In PCR, certain sequences called tandem repeats are rapidly multiplied and tagged with a fluorescent material. The PCR method only calls for small amounts of DNA such as that from the root of a single hair or even a fingerprint from the inside of a glove. The new DNA fragments are then placed into wells in a gelatin-like substance for separation by electrophoresis in which a current is run through the gel causing the fragments to move through the gel at different speeds depending upon their size, smaller pieces moving faster and thus further, larger pieces moving slower and staying closer to the well. Using the restriction enzyme technique the actual DNA print is formed when x-ray film is placed over the bands, which have been transferred to a membrane, thus duplicating the pattern like carbon paper. In the PCR method, a laser, causing them to glow and make a picture of the bands, excites the fluorescent tags. When the prints are compared to samples taken from suspects and an investigator finds a match, that suspect is most likely the perpetrator. (Saferstein 2007)

Even though DNA is a new, very steadfast technique for pinning suspects, there are other older methods that are also reliable. Fingerprinting, although only widely accepted as a mode of evidence for about 70 years, has been being used in the criminal investigation since around the 19th century. The underside of hands and feet are covered with minutiae, a unique connection of papillary lines and ridges. Unlike DNA, each and every individual, including identical twins, have a unique minutia. Each ridge of the outer skin is anchored to the inner skin by a double row of pegs like protuberances, or papillae. When a person touches any surface the fingers and even toes leave readable impressions due to the mixture of sweat and amino acids from the body that dots the papillae. Touching any surface transfers the perspiration present on the minutiae, leaving an impression of the details. Even the smallest amount of a print can be sufficient enough to provide a lead. Fingerprints fall into three categories; visible prints, three-dimensional prints, and latent or hidden prints. Latent prints can be made visible quite simply by dusting. Prints are dusted with a fine aluminum powder which makes them noticeable and can then be photographed and compared via a computer system for identification. Fingerprints provide a 100 percent positive identification and remain the most reliable method of pinning a suspect.

References

Grimming, R. & Goodman, D. (2007). *Criminal justice – A collection of true crime stories*. New Jersey: Pearson Education

Saferstein, R. (2007). *Criminalistics (9th Ed.)*. New Jersey: Pearson Education, Inc.