Smart Nebraska Ladies (SNL): Molly Durham, Jenna Tederman, Reagan Uhlmann, Deanna Nelson

CSI: Crime Scene Investigation

Technology has helped shape the crime scene investigation process. Without computers, the work would have to be done by hand. Different technologies are used to develop methods for solving cases. Computers are important for the carbon dating, DNA analysis, ballistics, and reconstruction aspects of crime scene investigation.

Willard Libby, an American physical chemist, invented the method of radiocarbon dating in 1949 at Chicago University where he was a professor. Initially, he tested out his new invention on plant species. He won a Nobel Prize in Chemistry for his carbon dating ideas of how to find out the age of various organisms.

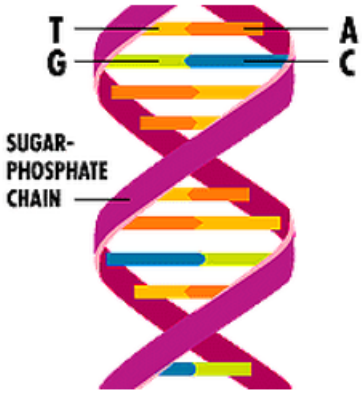
In carbon dating, scientists use computers to determine if there is carbon-14 or carbon-12 in an organism. Carbon dating is a method for determining when a previously living organism died, by calculating the amount of carbon-14 that is still in the organism. Carbon dating can be used on substances that are close to 60,000 years old. It is mostly used to find the age of animals or human beings. Carbon-14 is an atom that is radioactive and has 8 neutrons and 6 protons. It is used to find the age of a once living organism. An organism will absorb carbon-14 when it is alive. Scientists can determine when an organism died by how much carbon-14 is still in the organism. 5,730 years after the death of an organism, it would lose half of the carbon-14 that was in the organism.

An Accelerator Mass Spectrometry (AMS) is a machine that can tell the difference between carbon-14 and carbon-12. The AMS system uses a gas ionization detector to count ions. The ions are slowed down and the electrons are knocked off gas atoms. The electrons are

collected and read into the computer. The computer then measures the energy loss and figures the nuclear charge to analyze how much carbon-14 is remaining in an organism.

Carbon dating is significant in crime scene investigation because it is used to figure out how old the organism that died was, the date of the organism's birth, and the time or year of the death. Knowing the gender of the person is also helpful to the investigators at the scene of the crime. The error rate of carbon dating is very insignificant. These methods can also show the date of death of an unknown victim.

DNA is helping solve many mysteries today. DNA stands for deoxyribonucleic acid. It is the chemical blueprint of the body, and every person is different, with the exception of identical twins. DNA is not a living thing by itself, it's a molecule. DNA is a very long molecule.If it was stretched out it would be ten feet long, and that's just one piece! If all of someone's DNA was stretched out, it could go to Pluto and back twenty times. DNA is more important than bones, skin, and muscles. Itis even more important than a heart or a brain. It's what makes up a person. Genes are tiny bits of DNA. The fact that individuals have a mouth, two ears, and two eyes, is determined by genes. Genes also determine specific things like eye and hair color.



DNA is made up of two long strands. Short pieces (rungs) connect them, forming a spiral ladder. Each rung is formed from two parts called bases. DNA has four bases. They are Adeninine (A), Thymine (T), Guanine (G), and Cytosine (C). DNA holds information. The way that the bases are arranged is the key to how DNA copies itself.

Forensic DNA specialists help solve crimes by using DNA profiling. Because every person's DNA is different, it can provide clues on who a person is. DNA is in body fluids like saliva, blood, and urine. People leave trails of DNA evidence (or chemical fingerprints) everywhere.Anything touched, sweated on, sneezed on, or bled on has DNA on it. Forensic DNA specialists process DNA samples collected at crime scenes, so they can be compared with other samples. If DNA is kept under the right conditions, it can last a long time. That is why criminal cases are sometimes reopened years later when more evidence is found.

When DNA is found at a crime scene, investigators can compare it to known criminals in a data base called CODIS (Combined DNA Index System). CODIS is an online FBI database used to store DNA from sex offenders and murderers from all 50 states. DNA is easy to collect from criminals, by swabbing the inside of the cheek. CODIS can help investigators if the criminal has committed a past crime, but they still have to look for the perpetrators if there isn't a match.

Forensic DNA scientists study biology, criminal justice, and forensic science, with special training programs in forensic biology and DNA analysis. At the lab, several machines are used to analyze DNA samples. The **electrophoresissystem** separates short strands of DNA from long strands, to help find the part of the DNA they need to examine. The **DNA extraction system** takes the DNA from fluids, stains, or blood and turns it into a liquid for further tests. The **FMBIO** takes pictures of the DNA with x-rays or lasers, and produces a bar code-like image. The **polymerase chain reaction (PCR)** duplicates small samples of DNA.

DNA analysis is an essential part of crime scene investigation today.

Computers have helped people in the crime field for many years now. One thing that they've helped with is making ballistics more accurate and easier to understand. Ballistics is the

science or study of the motion of projectiles such as bullets, shells or bombs. Forensic ballistics is the analysis of bullets, shells or bombs and their impact to determine the information for court or for other legal use.

Until the 1970s people hadn't performed experimental studies on ballistics until some experts in medicine and ordnance experimented on ballistics. When a weapon is fired, the grooves in the weapon cause the projectile to spin making it faster and more accurate. The grooves make an imprint on the projectile which is called a ballistic fingerprint. The size of the projectile is also known as the caliber. If the caliber is known, it can be matched to the type of weapon. Experts can determine which weapon the projectile came from and whether it has matching grooves by firing the gun at ballistic gelatin. Ballistic gelatin is a solution of gelatin powder in water which simulates the density and viscosity of human and animal muscle tissue making it perfect for testing. Each firearm produces grooves on a projectile which are unique to that firearm, just like fingerprints are unique to each individual.

Computers in conjunction with the use of high speed cameras have made the identification of projectiles quicker and more accurate than traditional methods. Forensic Ballistic Scientists can fire a projectile in front of a background of calibrated measurements and photograph it with a high speed camera collecting the data on the computer. This data can then be analyzed using computer programs to determine the caliber and rifling of the projectile.

Computers can also scan data collected from the projectile to look for evidence of gunpowder, clothing, hair, and any other material the projectile passed through. This evidence gathered can be used with other evidence found at the crime scene to help solve the crime.

Previously people would have to exam the ballistics by hand. With today's computer technology police can digitally capture thousands of pieces of ballistic evidence, log them into

databases, and search these databases for matches or near matches. The information entered into a centralized data base can be used by law enforcement agencies and scientists throughout the world. Computers thus make the process quicker and easier to determine the origin of the projectile.

CSI uses computers to reconstruct the events surrounding a crime. Every crime scene investigator goes through the basic steps to solve a crime and reconstruction is one of them. Reconstruction is the process of working out a sequence of events before, during, and after a crime. Crime scene reconstruction sometimes makes no sense at all or could be a science project. In this case and all cases they would have to take not just a scientific approach but a logical one. Whether the crime is a shooting or a robbery the things that are important to the investigator and reconstruction are footprints, fingerprints, hair, and scuff marks. Footprints are especially helpful because the investigators can get a footprint from blood, sand, soil, snow, or wood (if the criminalleft one). The good thing about finding footprints are that investigators can run the print through a footwear database to determine the type of shoe. Now on to more complex crime scenes like shootings.

Shootings reconstruction is in simple steps (which are usually done on the computer).First,the investigator establishes a grid so everything can be placed and measured precisely. Second, bullet holes are located. Then thin metal dowels called trajectory rods are placed in the bullet holes to determine angles. Reconstruction also determines if the shooting happened in a house or a car. If the shooting occurs in a house, there are plenty of right angles, aligning measurements to a grid can be easier to find. If the shooting occurs in a car there are mostly rounded surfaces, which mean it’s hard to align measurements to a grid.

Investigators use many tools when reconstructing a crime scene. The simpler things include tape measures, protractors, and basic trigonometry (a form of math). They can also use fancier things like laser scanners, firearms, and fluorescent lights (example is luminol). Also if the crime is too hard to understand, they do most of the work on computers. They will create computer graphics to help them understand, and then they go on from there. Most evidence and reconstruction goes on in a forensic laboratory. The crime scene investigators will test multiple hypothesise, over and over again using reconstruction. Only when the hypothesis turns into a theory is the reconstruction complete. Crime scene investigators now have a before, during, and after of the crime.

Computers are significant in crime scene investigation. They are used for carbon dating, DNA analysis, ballistics, and reconstruction. Carbon dating finds the amount of carbon present in an organism, DNA analysis determines who someone is, ballistics discovers what weapon was used in a crime, and reconstruction is a used to determine what happened during a crime.

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