Importance Of DNA Within Forensic Science

According to the U.S. National Library of Medicine, DNA or deoxyribonucleic acid, is the hereditary material in humans and almost all other organisms. In addition, the information within DNA is stored as a code based on four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). The human DNA consists of over 3 billion bases and the sequence of these bases determines the information available for maintaining and building. The bases within DNA pair up with each other to, for instance A pairs with T while C pairs with G, to form base pairs. Each of these bases is attached to a sugar molecule and a phosphate molecule, which is described as a nucleotide. These nucleotides are arranged in two stands that form a double helix, this structure is described as a ladder, within this ladder the base pairs form the rungs of the ladder whereas the sugar and phosphate molecules form vertically. A significant characteristic of DNA is its ability to replicate copies of itself, each strand of DNA within the double helix serves as a code for duplicating the sequences of bases. Moreover, this ability is vital when cells divide by reason of each new cell needs to have an identical copy of the DNA that was present in the old cell. Furthermore, DNA within forensic science is imperative due to its ability to identify individuals this process is referred to as DNA profiling or DNA fingerprinting. DNA profiling is a forensic technique within investigations that compare criminal suspects profiles to the DNA evidence present to determine the possibility of their involvement in the crime. Corresponding to DNA profiling, various high-profile cases have been solved based on DNA such as Ted Bundy. In addition, DNA has produced the ability to solve cold cases such as the murders of Jane Moron Antunez and Patricia Dwyer that were unsolved for over 40 years. Also, DNA profiling has exonerated innocent people who were persecuted prior to the advancements within DNA, such as the case of Joseph Lamont Abbitt. DNA has been essential to the field of forensic science; the discovery has aided in concluding the guilt or innocence of individuals within crimes.

DNA was discovered in 1869 by Swiss physiological chemist Friedrich Miescher, who first identified the “nuclein” or later known as deoxyribonucleic acid (DNA) inside the nuclei of human white blood cells. Miescher planned to isolate the protein components of the white blood cells, so in result he was sent pus-coated patient badges from a surgeon and planned to filter out the white blood cells and extract the proteins within those cells. However, Miescher discovered a substance that did not have chemical properties different than other proteins that contained higher phosphorous content. Miescher concluded that he discovered a new substance from his experiments. In 1881, Albrecht Kossel a German biochemist helped in understanding the basic building blocks of “nuclein”. Kossel identified nuclein as nucleic acid and provided its known name as, deoxyribonucleic acid. Kossel also isolated the five bases of DNA and RNA: adenine, cytosine, guanine, thymine, and uracil. Furthermore, in the middle of the nineteenth century, Walther Flemming, a German anatomist discovered a fibrous component within the nucleus of cells in which he named “chromatin”, but later it is discovered that he initially discovered chromosomes. However, starting in the early 1980’s the technological advancements allowed the usage of DNA as a mechanism for identification. In 1983, Dr. Jeffrey Glassberg filed the first patent covering the new processes of DNA profiling which became a common phenomenon within forensic science. The process within DNA profiling has various methods such as buccal swabs, blood, saliva, semen, vaginal lubrication, tissue or fluid from personal items, or stored samples such as banked sperm or biopsy tissue.

Also, samples obtained from biological relatives such as parents or siblings can help identify an individual due to their genetic match, as well as previous human remains. When a sample is obtained, it must be extracted from the cells and be purified. There are numerous ways this can be done but all methods all follow the same procedure which is the breakdown of cell and nuclear membranes to allow the DNA to be ‘free’ within the solution. The methods are RFLP analysis, PCR analysis, STR analysis, AFLP, DNA family relationship analysis, Y-chromosome analysis, and mitochondrial analysis.

The field of forensic science or criminalistics is the application of science, criminal, and civil laws during a criminal investigation. Forensic scientists are trained to collect, preserve, and analyze evidence at a crime scene. Within the past decade, forensic technology has greatly advanced and became more efficient. Forensic scientists have utilized drones, laser scanners, and photogrammetry to assess a crime scene. There are numerous subdivisions of forensic science which include: bloodstain pattern analysis, forensic DNA analysis, forensic pathology, forensic psychology, forensic toxicology, and even computational forensics. The first known case of DNA profiling was late July 1986, by genetic professor Alec Jeffreys who discovered some patterns in an individual’s DNA. Jeffreys put his DNA pattern technique to attempt to solve the rape and murder of 15-year-old Dawn Ashworth which was successful which was the catalyst for DNA profiling today. In the early 2000’s, Marcus Smith, a researcher in Australia discovered that sexual-assault cases involving DNA evidence were twice as likely to reach trial and over 33 times likely to result in a guilty verdict; whereas homicide cases were over 14 times as likely to reach trial and 23 times likely to end in a guilty verdict with the presence of DNA.

The highest profiled criminal case in history is the case of Ted Bundy. Theodore Bundy was born in Burlington, Vermont on November 24, 1946 and was deemed an illegitimate child, who was raised as the adopted son of his grandparents who was informed his mother was his sister. However, Bundy was described as intelligent, handsome, distinguished, and charismatic. Bundy attended the University of Washington and obtained a degree in psychology, and was accepted to a law school in Utah, however he did not obtain his degree. Bundy was a serial killer who kidnapped, raped, and gruesomely murdered young women and girls during the 1970’s. Bundy confessed to over 36 homicides he committed in seven states between the years of 1974 and 1978, however the true number is unknown but is possibly much higher. Bundy would approach his victims in public places, often faking injuries or impersonating an authority figure like a police officer. Bundy decapitated at least 12 victims on record, and practiced necrophilia. One of Bundy’s most noted killings was at the Chi Omega sorority house at Florida State University where he attacked four young women in their sleep and killed two. The most incriminating evidence was Bundy’s bite marks on one of the bodies, which were forensically identified to belong to Bundy. Bundy eventually was sentenced to death row on February 10, 1980 for numerous cases of homicides. On January 24, 1989, Bundy was executed at the Florida State Prison in an electric chair known as “Old Sparky”.

One of the various cold cases that were solved using DNA profiling are the cases of: Jane Morton Antunez and Patricia Dwyer. The two homicides were in Atascadero, California in 1977 and 1978. On November 11, 1977, Antunez’s body was found in the backseat of her own car on a deserted road in Atascadero. Antunez’s throat was slit and had been sexually assaulted. Antunez was planning on visiting her friend, and she inevitably never made it. The second victim Patricia Dwyer was found dead at her home on January 11, 1978. Dwyer was stabbed in the chest with one of her own kitchen knives and had been sexually assaulted as well. Dwyer last informed a friend that she was going to a store and planned to stay home for the day. The two

victims were also found with both of their arms bounded behind their back and bindings were found at both scenes. The now known murder, Arthur Rudy Martinez worked at a welding job in the area and moved to Spokane, Washington where he was arrested for other cases of robberies and two cases of rape. Martinez was given life in prison on November of 1978, however Martinez escaped prison and fled to Fresno, California. Martinez lived as a free-man for over 20 years, but eventually turned himself in because he had terminal cancer and knew he could receive free health-care in prison. Martinez was taken back to Washington and died shortly after.

However, over 41 years later with the discovery of DNA profiling, San Luis Obispo County Sheriff's Office were able to identify, Arthur Rudy Martinez for both murders and rapes of Jane M. Antunez and Patricia Dwyer that he previously committed.

DNA profiling not only indicts criminals, but it also frees those who are innocent and have been falsely accused. One of the thousands of cases of this scenario is the exoneration of Joseph Lamont Abbitt. In the early morning of May 2, 1991 two teenage girls woke up to get ready for school and discovered an intruder was in their home. The intruder sexually assaulted both girls at knifepoint. The two girls did not have a clear look at the intruder but stated that he resembled Abbitt, who was a man that previously lived in their neighborhood. Rape kits were collected from both girls along with other DNA evidence present at the crime scene. Despite the DNA testing conducted, the tests were concluded as inconclusive. Abbitt was tried before a jury in 1995 where both victims testified that Abbitt was indeed the man who sexually assaulted them. Abbitt had a concrete alibi, affirming that he was at work at the time of the attack and although his employer did testify to this alibi, he could not provide a time card. Abbitt was convicted of rape, burglary, and kidnapping and was sentenced to two consecutive life sentences plus an additional 110 years. In 2005, Abbitt applied to the North Carolina Center on Actual Innocence and his case was accepted and looked for any evidence that could be tested by DNA because at that time, police were not required to preserve any evidence after being convicted. Furthermore, at the Winston-Salem police department the rape kit and some other items were found. The tested all for DNA and the rape kit concluded that Abbitt was innocent. Abbitt was set free and was officially exonerated September 2, 2009 where he already served 14 years in prison over crimes he did not commit. Today, Abbitt lives with his family and is trying to make up for the loss of those 14 years.

DNA within forensic science is vital due to its ability to find individuals guilty or innocent for crimes. Not only has DNA been beneficial to solving criminal cases, but it has impacted many social aspects such as the economy. With the discovery of DNA, it has found many individuals innocent whereas without this technology, thousands would be falsely accused just based off testimonials which is a contributing factor in 75 percent of wrongful convictions. The cost of running a prison and providing inmates with necessities and even health-care can be costly to the economy. In addition, the cost for trials and lawyers cost thousands of dollars. Also, another social aspect that has been impacted is the numerous subdivisions of forensic science as technology still advances which leads to more job opportunities and more adequate resources. Lastly, a huge social impact DNA produces is the ability to keep society as safe as it possibly can because those who actually committed crimes are being found guilty rather than getting away with it. DNA has greatly impacted society and has aided significantly within forensic science through, DNA profiling. Based on the three cases I mentioned: Ted Bundy, the cold cases of Jane Morton Antunez and Patricia Dwyer, and the exoneration of Joseph Lamont Abbitt the common factor of either incriminating or freeing an individual is the advancements of

DNA. Bundy was found guilty for one of his many cases due to DNA profiling which specified his unique teeth, the murders of Antunez and Dwyer were solved due to the technology of DNA within databases and the evidence from the crime scenes, and on the other hand Abbitt was given back his life because of DNA proving he did not conduct these crimes. All things considered, DNA defines individuals based on their own unique genetic makeup, which differentiates each person from the 7.53 billion others in this world.