

# A history of dna typing and analysis criminology essay



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The discovery of DNA typing has changed the way crimes are investigated. DNA evidence can be found in blood, tissue, hair, saliva, semen, bone, and the list goes one and on. Every person has unique DNA with the exception of identical twins so being able to interpret this valuable information is incredibly useful. Without DNA typing this evidence could not be tested and interpreted. Many criminal cases would go unsolved and people who committed these crimes would still be unpunished for their actions. DNA typing has only been around since the mid 1980's, but has already had a big impact on the world. So, how did the remarkable tool come about?

DNA typing is the use of DNA evidence for identification. The DNA evidence found at a crime scene can either link a person to a crime or it can eliminate them as a suspect. It is based on the observation that the genome of each person and animal is unique. This technology has only been around since the mid 1980, but it has already become an essential part of the crime laboratories investigation of a crime. DNA evidence can be stored for long periods of time making old cases that were once thought to be unsolvable now have new leads. Also DNA evidence can be used to exonerate wrongfully convicted prisoners. DNA typing can be classified into two categories; restricted fragment length polymorphisms (RFLP) methods or Polymerase chain reaction (PCR) methods.

In 1985 an English geneticist named Alec Jeffreys first described DNA typing. Dr. Jeffreys was attempting to trace genetic markers between members of the same family. He was specifically looking for inheritance patterns for illness and disease. X-rays of mini satellite sections of DNA were taken and examined. On September 10, 1984 Dr. Jeffreys was examining several x-rays

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and noticed that the mini satellite section of each individual was unique from one person to another (web. mit). He developed a technique to measure the difference in the length of the DNA sequences. This allowed him to perform human identity tests. The technique Dr. Jeffreys created to examine these variable number of tandem repeats (VNTRs) was called restriction fragment length polymorphism (RFLP) (Butler).

Restriction fragment length polymorphisms are variation in the length of a stretch of DNA. DNA is cut by restriction enzymes and these pieces of DNA contain genes and non-coding DNA. The non-coding DNA is made up of regions of repeats of the same sequence of bases. These multiple regions are known as variable number of tandem repeats (VNTR). To develop a DNA profile-using RFLP is to first extract the DNA. Then cut the DNA into fragments by using restriction enzymes. Once the DNA is cut into fragments they are separated by size using gel electrophoresis. The fragments are then immobilized by transferring them into a nylon membrane. The fragments are identified and located by using a solution that contains the desired probes. To visualize the fragments requires long exposure to detection system. This step involves the probes specifically binding to their complementary VNTR fragments. After the solution is washed the RFLP profile is visualized (Butler). Many crime laboratories adopted this method of analysis and used it throughout the rest of the 1980's and for most of the 1990's, but there were some disadvantages to the RFLP analysis (Budowle). The process takes a lot of time and a lot of effort to. A large sample of un-degraded DNA is required to perform the test.

The first time DNA typing was used in a criminal case was in 1986. In the village of Narborough in Leicestershire, England two girls, Lynda Mann and Dawn Ashworth were sexually assaulted and murdered. The murders were done in a similar fashion leading to the suspicion that the two cases were connected in some way. One man confessed to the murder of a girl, but his DNA did not match that of the DNA recovered from semen found at the crime scenes. Blood was collected from more than 4000 men from three surrounding villages. The blood sample collected from Colin Pitchfork matched the semen from both murder scenes. He was convicted of both murders and was sentenced to life in prison (Wambaugh).

DNA typing evolved from the use of Dr. Jeffrey's method of analysis to the use of single locus variable number of tandem repeats by RFLP analysis. DNA typing then moved to the use of polymerase chain reaction (PCR) that was more sensitive, easier to perform, took less time, and can be automated. In 1983 Kerry Mullis discovered the polymerase chain reaction (PCR), which he later won the Nobel prize for. This development revolutionized forensic DNA analysis. PCR is used to amplify selected sections of DNA that contains either length or sequence polymorphisms. The DQ-Alpha test was one of the first PCR tests to be used in crime laboratories. The DQ-Alpha test was developed in 1991 and was based on the identification of human leukocyte antigens, which are proteins that have a known sequence. The next innovation was developed later in the 90s with short tandem repeats (STR). Short tandem repeats are kind of like VNTRs, but with very short sequences that vary from two to six base pairs. The advantage of using this method is that very small amounts of DNA are required to perform the test (Butler).

DNA profiles are also very useful because they can be electronically entered into databases. The Combined DNA Index System or CODIS is a collection of databases of DNA profiles obtained from evidence samples from unsolved crimes and from known individuals convicted of particular crimes (Butler). The FBI who oversees the database started CODIS in 1998. The main goal of the CODIS system is to allow local and national law enforcement laboratories to be able to compare DNA profiles to each other electronically and to be able to link crimes to each other. The system is made up of three database levels: local, state, and national levels. The convicted offenders index qualifications for submitting a sample are determined by state legislation. Convicted offender profiles make up most of a states database. The forensic index is the second most common entry. Forensic profiles consist of forensic evidence in cases. There main purpose is to generated leads in the investigation and possibly connecting cases to each other. Some states are required to maintain other indices such as a suspect database The National DNA Index currently contains more the seven million offender profiles and almost 269, 000 forensic profiles. CODIS has produced over 90, 900 hits and has help solve more than 89, 600 cases (Butler).

DNA analysis has evolved of the past twenty-five years and now it can be used in many different ways. A big way in which DNA is used is in the identification of individuals in mass disasters. One example is the September 11th attacks on the World Trade Centers. DNA was collected from the bone and tissue the unknown bodies, put into a database, and compared with reference samples that were collected. Only 1585 of the 2792 known deaths have been identified, but the database was reopened in 2007 and further

investigations are going on. Another effort to identify unknown victims in the DNA Shoah Project, which is a database of family members of people who were in the Holocaust. The main effort of the database is to reunite families who were separated and help identify buried Holocaust victims. DNA analysis isn't just used in solving criminal cases or identifying unknown people, it is also used to check and see if something is authentic. The National Football League uses DNA technology to mark balls used in the Super Bowl to ensure authenticity and stop counterfeit merchandise. The football is marked with an invisible strand of synthetic DNA that can be read by a special laser. A similar thing occurred in the 2000 Olympic games. DNA was taken from unknown athletes and added to ink that was used mark all of the official Olympic gear (DNA Forensics).

Without this remarkable tool many of the criminal investigations going on right now would go unsolved. According to Locard's Exchange Principle every time a person enters any kind of environment something is left behind and something is taken away. This means that every time a criminal enters a crime scene evidence is left behind and evidence is taken away. An example is a criminal leaves behind fingerprints, pieces of hair, or semen behind at the crime scene. The offender also takes away hair and possible blood from the victim on his clothes or shoes. Without DNA typing this evidence would not be able to be linked to the crime scene. There have also been several cases where DNA evidence has been used to pardon the wrongfully accused. As the technology becomes more advanced and new methods of testing DNA are being created DNA typing will continue to revolutionize the way criminal

investigations are solved as well as the creation of more new and exciting ways DNA can be used.

## **DNA Typing Timeline**

1980-Ray White describes first polymorphic RFLP marker.

1985 - Alec Jeffreys develops multi-locus RFLP probes

1986-DNA testing goes public with cell mark and life codes in United States.

1988-FBI begins DNA casework with single-locus RFLP probes.

1989- TWGDAM established; NY v. Castro case raises issues over quality assurance of laboratories

1990- population statistics used with RFLP methods are questioned; PCR methods start with DQA1.

1991-Fluorescent STR markers first described; Chelex extraction.

1992-NRC 1 report; FBI starts casework with PCR-DQA1.

1993-First STR kit available; sex typing (amelogenin) developed.

1994- Congress authorizes money for upgrading state forensic labs; DNA wars' declared over; FBI starts casework with PCR-PM

1995- O. J. Simpson saga makes public more aware of DNA; DNA Advisory Board setup; UK DNA Database established; FBI starts using 1S80/amelogenin.

1996-NRC Report; FBI starts mtDNA testing; first multiplex STR kits become available

1997-“ Core” 13 STRs defined; Y chromosome testing with STRs described.

1998-FBI Launches Combined DNA Index System:

-CODIS USA’s database of DNA profiles.

-Only convicted criminals.

Thomas Jefferson and Bill Clinton implicated with DNA.

1999- Multiplex STR kits of 13 core STRs and gender markers are validated: FBI stops testing DQA1, PM, D1S80.

2000-FBI and other labs stop running RFLP cases and convert to multiplex STR; PowerPlex 16 kit enables first single amplification of CODIS STRs.

2001-Identifier STR kit released with 5-dye chemistry; first Y- STR kit became available.

2002-FBI mtDNA population database released; Y-STR 20plex published.

2003-50th anniversary of Watson and Crick’s discovery of DNA; The final draft of the Human Genome Project is released; US Database has 1 million DNA profiles of convicted offenders; The UK National DNA Database passes the 2 million sample mark.

(Timeline taken from Table 1. 1 of Forensic DNA Typing by John M. Butler)