Cybergenetics

June Newsletter

Better Justice Through Better Science ™

In this issue:

Alan Turing – genius and forensic pioneer

Note: In celebration of Pride Month, our June newsletter starts with Alan Turing. This story is an abridged version of Dr. Mark Perlin's ***DNA Matters*** *column on What Forensics Owes to Alan Turing published this month in "Forensic Magazine".*

British mathematician Alan Turing was born in June of 1912. Esteemed as the father of Computer Science, his Turing Machine revealed the full power of modern computation, while his Turing Proof showed its limits.

As portrayed by Benedict Cumberbatch in "The Imitation Game" movie, Turing's decrypting the German Enigma device helped the Allies win World War II. The British government prosecuted him in 1952 for homosexual acts, inflicting forced chemical castration. Two years later, in June of 1954,

Turing took his own life at age 41.

Turing also laid the foundation for modern Forensic Science. In cracking the Nazi's Enigma code, he introduced the likelihood ratio (LR) to measure digital information. The LR shows how much the support for a hypothesis is changed by an experiment. The LR is routinely used to measure identification information in DNA and other forensic evidence.

Advanced computer systems, like Cybergenetics' pioneering TrueAllele® technology, accurately assess the impact of new evidence. Examining data, the computer measures the change in the chance that someone left their DNA. The reported LR number – Turing's Statistic – can help find, convict, acquit or exonerate suspects.

In 2009, the British Prime Minister apologized for Turing's mistreatment. In 2013, the Queen pardoned the persecuted genius. In 2017, the Turing Law retroactively pardoned men for committing homosexual acts under past legislation.

Every year, an outstanding computer scientist receives the Turing Award – that field's Nobel Prize equivalent. And, every year, crime labs choose to not use Turing's effective LR methods. They mismeasure inaccurate information on millions of DNA items. Vital evidence is lost to criminal justice.

Turing was an Artificial Intelligence pioneer. In the "imitation game" he devised, a machine would pass the Turing Test when its behavior closely resembled a person's. But in Forensic Science, the AI situation is reversed. Smart computers now reliably measure information on complex DNA samples. Yet only on simple DNA can a human hope to pass the Turing Test.

The world needs a new Turing Law, one that pardons mistreated DNA. When data have been ignored, or LR values are wrong, justice should demand a second look at failed DNA evidence.

Full Forensic Magazine Article

No one is safe from gun violence

Everyone has a hero they look up to. Whether a mathematical genius of modern computing, or a talented football athlete.

In the 2021 off-season, NFL player Jimmy Smith of the Baltimore Ravens flew to Los Angeles with his family. In the hotel parking lot, he was approached by two hooded gunmen. A third man pressed a gun against his pregnant partner's belly. The robbers demanded money and jewelry.

"Terrifying," Smith said afterwards. "You feel helpless. Just some cowards running up on you with three guns. You don't know if you're going to lose your life in that moment." He added, "Glad we lived."

Gun violence is increasing in this country. Random violence is up. Just walking down the street, your safety isn't assured. Whether university student or NFL cornerback, no one is immune from gun violence. But when a criminal touches his handgun, he may leave behind his DNA. That DNA evidence can find him later on.

A handgun is often handled by many people – five or more – mixing together their DNA. Most software cannot unmix this complex DNA. But advanced TrueAllele computing can tease apart the genetic types of the gunmen. And match the gun to the criminal. With TrueAllele, what was once impossible is now routine.

Smith robbed at gunpoint

Getting full DNA profiles from handguns

Handguns are a hotbed of DNA evidence. Forensic DNA labs can detect tiny DNA amounts left on a handgun. Labs often pool together DNA taken from different areas of the gun, then amplify it all together to get more signal. But pooling swabs blurs distinctions, losing identification information.

Using smart software – first amplifying areas *separately*, then analyzing the data *jointly* – gets better results. When TrueAllele does this "joint" statistical

analysis, Cybergenetics software extracts more DNA information from the same gun.

In a study we conducted a dozen years ago, by combining the data from four different handgun areas**,** we essentially recovered the unique profile of the person handling the gun. We announced this innovation back then in conference talks, papers, and posters.

"How much more informative?", asked Cybergenetics scientist Dr. Mark Perlin in his 2010 ANZFSS talk in Sydney, Australia. "We went from no information with human review, to a unique profile with joint analysis that was a trillion times more informative." Dr. Perlin ended, "In conclusion, it is good to use all of the data, and we get more information when we do."

Why does crime lab software fail so often on handgun DNA? Because most handgun evidence has been handled by five or six people, sometimes more. Their DNA is all mixed together in ways most software cannot decipher. Too many people in the mix, and too little DNA in total, making it too hard for simple programs to handle.

Why does Cybergenetics TrueAllele work so well for solving handgun crime? Because TrueAllele has been solving mixtures correctly for over twenty years. The first and the best. Our technology reliably separates mixtures of ten unknown people. A unique capability.

Why does TrueAllele joint analysis succeed? Because we pioneered making good use of variation in DNA data. And handgun mixtures vary on different parts of a gun. TrueAllele exploits this DNA variation to get sharper genotypes for more information.

Australia Conference – 2010

TrueAllele handles guns touched by many people

On April 8, 2018, in Mansfield, Ohio, Terrence Harris was shot while sitting in the

passenger seat of a moving car. The fatal bullet entered his back, perforated his lung, and struck his heart.

The police recovered a Glock pistol. The county crime lab analyzed the gun. They found the DNA of *six different people* all mixed together on the Glock grip. Older manual interpretation methods can't handle DNA data that complex. Nor can most other probabilistic genotyping software. But TrueAllele readily solved the problem.

On May 17, 2019, Cybergenetics analyst Jennifer Hornyak Bracamontes drove out from Pennsylvania, through the cornfields of Ohio, to testify before the Richland County jury. She explained how she had used TrueAllele technology to interpret the DNA gun data.

She said, based on the computer's thorough and objective analysis of the DNA evidence, "a match between the Glock grip and defendant Deshawn Dowdell was 41.5 million times more probable than coincidence." TrueAllele had found useful information in handgun DNA data – results that no one could find before.

On May 21, the jury found Mr. Dowdell guilty of murder. On May 29, 2019, the judge sentenced him to 26 years to life in prison. On April 13, 2020, the Ohio appellate court affirmed his conviction.

Ohio v Dowdell

DNA matching database solves car theft

In the second half of 2015, a rash of car thefts struck multiple Cleveland, Ohio westside suburbs. Believed to be the work of a gang, the Cuyahoga County Regional Forensic Science Laboratory (CCRFSL) was tasked with processing the large amount of DNA evidence. Their goal was to find DNA connections that could help stop these crimes.

The police collected over 100 evidence items from 37 separate incidents. This evidence would be challenging to interpret. For example, some steering wheel swabs contained little DNA (low level data) and many contributors (too complex).

CCRFSL was still bringing its TrueAllele Casework system onboard. Without

TrueAllele, they were forced to interpret their DNA data using older manual methods. A gang round up provided a set of 38 suspect references for comparison.

Expending great human effort, the lab was able to issue reports for all cases in two months, with an additional month for some supplemental reports. However, they knew several samples were either *inconclusive*, due to too little data, or *uninterpretable*, due to a high number of contributors.

CCRFSL asked Cybergenetics to conduct an automated property crime study. Cybergenetics would process the same car theft DNA data using their TrueAllele Casework technology, unmixing complex data into simple genotypes. Their TrueAllele Database would automatically compare these genotypes to find DNA connections.

CCRFSL sent Cybergenetics their electronic DNA data. The TrueAllele supercomputer got to work. TrueAllele Casework automatically transformed complex data into probabilistic genotypes. TrueAllele Database automatically compared all evidence and reference genotypes. Cybergenetics finished the project in under a month.

The TrueAllele Database produced highly informative DNA match results. It didn't discard samples because of too little DNA or too many contributors. TrueAllele found more matches to more suspects than before. The Database linked multiple suspects to the same crime scene, and linked several suspects to multiple cases, finding new leads.

For thirty mixtures initially reported as inconclusive, TrueAllele found a DNA association. With twelve initial exclusions, TrueAllele returned informative DNA matches. TrueAllele wasn't just faster and easier to use. The computer also extracted the full measure of DNA information from the evidence, leaping over the limitations of simpler methods.

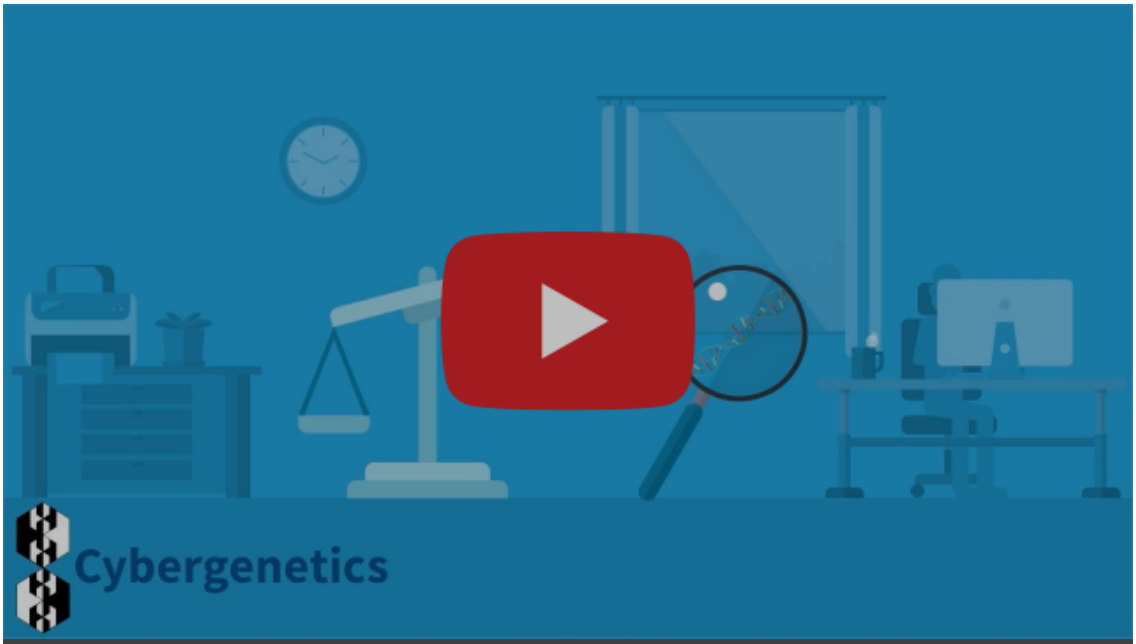
Our automated matching database, together with automated genotype separation, lets users to find more DNA information with less effort. Property crime DNA data is complex, with low peak heights and many contributors. But the automated TrueAllele system empowers the investigator to easily get all the DNA information.

The TrueAllele Database system can interpret and match any complex DNA

evidence – handgun evidence, degraded mass disaster samples, or retail theft touch data. TrueAllele database leads further an investigation, while TrueAllele casework reports inform scientist testimony.

Cleveland database study – Dr. Butt

Cleveland database study – Dr. Perlin



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Free TrueAllele Screening

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