FILED COURT OF COMMON PLEAS
CUYAHOGA COUNTY, OHIO

STATE OF OHIO 2014 OCT 10 A 9:25

CLERK OF COURTS
CUYAHOGA COUNTY
Plaintiff

vs.

MAURICE SHAW

Defendant.

CASE NO.: CR – 13 – 575691

JUDGE: MAUREEN CLANCY

ORDER

* * * *

This cause is before the Court on Defendant's Motion in Limine, filed on July 10, 2014, and the State's Brief in Opposition, filed on July 23, 2014, and Defendant's Motion to Compel TrueAllele's source code, filed on June 6, 2014, and the State's Motion to Quash, filed on June 19, 2014, and all other supplemental filings related to these issues. In his brief in support of his Motion in Limine, Defendant requests that the Court exclude any and all evidence related to TrueAllele Casework System (hereafter referred to as "TrueAllele") pursuant to *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S. Ct. 2786, 125 L.Ed.2d 469 (1993). In his brief in support of his Motion to Compel, the Defendant is requesting an order that the State reveal TrueAllele's source code. Defendant requested a pretrial hearing on his Motion to Compel and his Motion in Limine. A hearing was held on Defendant's Motion to Compel on June 30, 2014. A hearing was held on Defendant's Motion in Limine (hereafter referred to as "Daubert

Hearing") July 28, 2014 through July 31, 2014 and on August 15, 2014. At the Daubert Hearing the State called two witnesses, Dr. Mark Perlin and Mr. Jay Camponera. The Defendant presented two witnesses as well, Dr. Chakraborty and Dr. Dan Krane.

After the conclusion of the Daubert Hearing, both the State and the Defendant submitted proposed findings of fact and conclusions of law.

FACTUAL AND PROCEDURAL BACKGROUND

The Defendant in the present case is under indictment for the following charges: Aggravated Murder, Murder, Felonious Assault, and Kidnapping. The alleged incident occurred on or about June 6, 2012, as stated in his indictment. The dispute before the Court developed based upon inconclusive DNA test results performed by both the Cuyahoga County Medical Examiner's Office (hereafter referred to as "ME") and Sorenson Genomics, LLC (hereafter referred to as "Sorenson") on two mixed samples of DNA evidence collected at the crime scene, namely from a doorknob and under the victim's fingernail. The ME performed the first comparison and Sorenson performed the following comparison. Both tests produced inconclusive results. The State then submitted the same DNA material from Sorenson to Cybergenetics for further analysis. Dr. Mark Perlin is the founder of Cybergenetics and the creator of TrueAllele Casework System (hereafter referred to as "TrueAllele"). Cybergenetics analyzed the data, and Defendant now seeks to prohibit the State from introducing the results of the Cybergenetics' testing.

STANDARD OF ADMISSIBILITY

"The admissibility of expert testimony is a matter committed to the sound discretion of the trial court." *State v. Wangler*, 3rd Dist. Allen No. 1-11-18, 2012-Ohio-4878, ¶ 56, citing *Valentine v. Conrad*, 110 Ohio St.3d 42, 2006-Ohio-3561, 850 N.E.2d 683, ¶ 9. Evidence Rules 402, 403, and 702 govern the admissibility of scientific evidence in Ohio. *State v. Williams*, 4 Ohio St.3d 53, 446 N.E.2d 444, 447 (1983). Evid.R. 402 provides:

> All relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by the Constitution of the State of Ohio, by statute enacted by the General Assembly not in conflict with a rule of the Supreme Court of Ohio, by these rules, or by other rules prescribed by the Supreme Court of Ohio. Evidence which is not relevant is not admissible.

However, Evid.R. 403(A) "mandates the exclusion of relevant evidence if its probative value is outweighed by danger of unfair prejudice, confusion of the issues, or misleading the jury." *Williams* at 447. Finally, Evid.R. 702 provides:

> A witness may testify as an expert if all of the following apply:
>
> (A) The witness' testimony either relates to matters beyond the knowledge or experience possessed by lay persons or dispels a misconception common among lay persons;
>
> (B) The witness is qualified as an expert by specialized knowledge, skill, experience, training, or education regarding the subject matter of the testimony;
>
> (C) The witness' testimony is based on reliable scientific, technical, or other specialized information. To the extent that the testimony reports the result of a procedure, test, or experiment, the testimony is reliable only if all of the following apply:
>
> (1) The theory upon which the procedure, test, or experiment is based is objectively verifiable or is validly derived from widely accepted knowledge, facts, or principles;

(2) The design of the procedure, test, or experiment reliably implements the theory;

(3) The particular procedure, test, or experiment was conducted in a way that will yield an accurate result.

The standards for admitting expert testimony vary. "The earliest pronouncement on the admissibility of recently ascertained or applied scientific principles can be found in *Frye* v. *United States*:

> [j]ust when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs."
>
> *Williams* at 446, citing *Frye,* 54 U.S. App. D.C. 46, 47, 293 F. 1013, 1014 (1923):

The *Williams* court rejected the *Frye* standard, preferring a more flexible approach. "The 'Frye test' has been criticized ... by courts and commentators alike." *Williams* at 57. The court explained that it

> refused to engage in scientific nose-counting for the purpose of deciding whether evidence based on newly ascertained or applied scientific principles is admissible. We believe the Rules of Evidence establish adequate preconditions for admissibility of expert testimony, and we leave to the discretion of this state's judiciary, on a case by case basis, to decide whether the questioned testimony is relevant and will assist the trier of fact to understand the evidence or to determine a fact in issue. *Id.* at 58.

The United States Court of Appeals for the Second Circuit also rejected an invitation to adopt the *Frye* standard. *United States v. Jakobetz,* 955 F.2d 786, 1992 U.S. App. LEXIS 322. The Court stated:

> [a]lthough we realize that DNA evidence does present special challenges, we do not think that they are so special as to require a new standard of admissibility. Despite the difficulties involved in cases with novel, complex and confusing evidence, the jury must retain its fact-finding function. *Id. at 796.*

In determining whether the opinion of an expert is reliable under Evid.R. 702(C), a trial court, acting as a gatekeeper, examines whether the expert's conclusion is based on scientifically valid principles and methods. *Valentine* at ¶ 16, citing *Miller v. Bike Athletic Co.*, 80 Ohio St.3d 607, 616, 687 N.E.2d 735 (1998). "In evaluating the reliability of scientific evidence, several factors are to be considered: (1) whether the theory or technique has been tested, (2) whether it has been subjected to peer review, (3) whether there is a known or potential rate of error, and (4) whether the methodology has gained general acceptance." *Miller* at 611, citing *Daubert* at 593-94. Widespread acceptance can be an important factor in ruling particular evidence admissible, and "a known technique which has been able to attract only minimal support within the community," *United States v. Downing*, 753 F.2d 1224, 1238, 1985 U.S. App. LEXIS 298939 (1985), may properly be viewed with skepticism. Ultimately, the Court must also be "mindful" of the "danger of unfair prejudice, confusion of the issues, or [potential for] misleading the jury." *Daubert* at 595.

"The inquiry envisioned by Rule 702 is, we emphasize, a flexible one. Its overarching subject is the scientific validity -- and thus the evidentiary relevance and reliability -- of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate." *Daubert* at 594-95.

The Supreme Court of the United States has explained that not every factor of *Daubert* needs to be considered in determining the reliability of testimony. *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S. Ct. 1167, 143 L. Ed. 238, 1999 U.S. LEXIS 2189 (1999). The Court concluded that:

> a trial court may consider one or more of the more specific factors that Daubert mentioned when doing so will help determine that testimony's reliability. But, as the Court stated in Daubert, the test of reliability is "flexible," and Daubert's list of specific factors neither necessarily nor exclusively applies to all experts or in every case. Rather, the law grants a district court the same broad latitude when it decides how to determine reliability as it enjoys in respect to its ultimate reliability determination. See *General Electric Co. v. Joiner*, 522 U.S. 136, 143, 139 L. Ed. 2d 508, 118 S. Ct. 512 (1997). *Kumho Tire* at 141-42.

The Supreme Court of the United States has also explained that cross-examination of an expert witness and cautionary instructions to the jury are effective tools for attacking shaky, but admissible evidence. See *Rock v. Arkansas*, 483 U.S. 44, 61, 107 S. Ct. 2704, 97 L. Ed. 2d 37 (1987).

"Generally, 'courts should favor the admissibility of expert testimony whenever it is relevant and the criteria of Evid.R. 702 are met.'" *Wangler* at ¶ 57, citing *State v. Nemeth,* 82 Ohio St.3d 202, 207, 694 N.E.2d 1332 (1998).

EXPERT TESTIMONY

Dr. Mark Perlin testified for the State of Ohio. Dr. Perlin testified as to his credentials, background, work experience, and education. Dr. Perlin testified that he has a Bachelor's Degree in Chemistry, a Ph.D. in Mathematics, a Medical Degree and a Ph.D. in Computer Science. T. 35. Dr. Perlin testified that he is chief scientific officer and chief executive officer at Cybergenetics which he founded twenty years ago. T. 35,

36. He testified that about twenty to twenty-five years ago he moved into the area of applying computers and computation to solving problems involving the human genome. T. 36. His company uses computers and mathematics to analyze DNA data as opposed to human review. T. 37.

In 1999 he began working on the DNA mixture problem where two or more people contributed their DNA to a sample. T. 40. TrueAllele Casework was started in 1999 which was designed for evidence mixtures and less certain evidence. T. 40. The TrueAllele System uses a computer to assess evidence objectively. In this system, the computer writes down its results and then makes comparisons with whatever standards are appropriate. T. 311. It is computer analysis of the same data that a human analyst reviews. T. 245. His system, TrueAllele, is based on Bayesian Theory and Markov Chain Monte Carlo, two established scientific models, to determine the probabilities to attach to each allele pair. T. 89, 90.

Dr. Perlin testified that the TrueAllele System is able to determine error rates under different conditions for false positives and negatives regardless of whether they were two, three, or five contributors or high or low template. T. 265. Other validation studies exist that test the system's specificity, sensitivity, reproducibility, which pertain to error rates. T. 287.

Dr. Perlin has testified in about twenty criminal trials and hearings and has worked on about two hundred cases and filed about one hundred-fifty reports. T. 43, 45. He testified in criminal cases in Pennsylvania, in Federal Court, Virginia and California. T. 43. He has been qualified as an expert in DNA evidence interpretation and the likelihood ratio. T. 43. He has also testified in the United Kingdom and Australia. T.

44. He testified in cases involving mixture evidence using his TrueAllele System. T. 44. Over a ten year period, up until five years ago, TrueAllele has gone through twenty-five versions of expanding the probability model, testing it and waiting for a point when it was giving appropriate answers on large test sets. T. 109.

Dr. Perlin's probabilistic genotyping and DNA analysis of mixtures is different from human interpretation. The difference is only the interpretation and not the collection. T. 45, 46. The computer looks at the information differently than human review. T. 82. He further testified that whether it is a person or a machine, interpretation then begins to determine the nature of the genetic contributors that match logistics that are present in data. T. 46.

In the present case, Dr. Perlin was given the data from Sorenson for TrueAllele to interpret. T. 46. Dr. Perlin testified that there are many different methods of human interpretation and there are different methods of computer interpretation. T. 46. Thresholds used in human review are not used with a computer. Rather, every last possibility is examined. T. 82. The TrueAllele System considers approximately one hundred variables, but it depends on the amount of data that it is presented. T. 385.

Dr. Perlin has written papers that have gone through a peer review process and published in scientific journals. T. 117. A validation paper is a validation study that has been submitted to a scientific journal for approval in the peer review process and ultimately published in a journal. T. 117. He has been published in well-regarded journals. T. 118. TrueAllele has been validated and there are five published peer-reviewed validation papers on the TrueAllele Casework System. T. 119, 167, 177. Dr. Perlin described each paper. T. 1-177. The five papers "go beyond an internal

validation." T. 178. Dr. Perlin began validating his system from its inception. T. 109. He received a grant from the National Institute of Justice to test the system on data generated from ten different laboratories or from his own laboratory including samples of known composition and casework. T. 109. Known compositions and casework samples are types of evidence used in validations. T. 110. Dr. Perlin has been involved in studies and prepared reports other than peer reviewed papers. T. 117.

In one paper, the results showed that the computer is more sensitive in being able to detect lower quantities of DNA whereas human review essentially stopped working at around one hundred picograms of DNA which is just the beginning of a low template region. T. 124. Unlike the human review, TrueAllele computer interpretation extended all the way through low template range.

Dr. Perlin testified that "specificity is the extent to which the interpretation doesn't misidentify and get the wrong person. That it finds true exclusions without falsely including somebody." T. 184.

TrueAllele is in use in Curran County, California where the analysts test the system report cases using the system. T. 202. It is also used in Virginia by the State Department of Forensic Science with trained analysts who conduct their own studies and their own validations and it is used in casework. T. 202. There have been over twenty studies done on the system's reliability.

Dr. Perlin testified that there have been five admissibility hearings where TrueAllele was admitted into evidence, although he was not sure of the exact number of admissibility hearings because the California and Virginia groups are not keeping statistics on it. New York State has purchased the TrueAllele System but is not currently

live with the system. TrueAllele is also being used in the middle-eastern country of Oman, and is being used in Australia, England and Ireland. T. 203.

Cybergenetics was awarded various grants from the National Institute for Justice specifically for testing software interpretation systems, and the FBI has purchased the TrueAllele databank system. T. 332, 333.

A study from the National Institute for Science and Technology ("NIST") on stochastic thresholds indicated that the probabilistic genotyping is moving forward in the field. T. 339. NIST considered probabilistic genotyping a permissible approach to DNA interpretation. T. 176. NIST has its own in-house TrueAllele computer. They have used it to characterize the standard reference materials as mixtures in developing the materials for the forensic community. Through the use of TrueAllele, NIST knows what is in the mixture that they give to other labs. T. 281. NIST conducted its own independent study concerning TrueAllele. T. 285. A "Forensic czar" at NIST indicated in a presentation that the community will be moving forward with probabilistic genotyping. T. 339.

Dr. Perlin testified that employing a stochastic threshold method for DNA interpretation is a generally accepted practice amongst crime labs and is uniformly rejected by the community of scientists who develop the methods as something that is antiquated and cannot work. T. 331. The push for probabilistic genotyping has started in the last year from NIST and Scientific Working Group on DNA Analysis Methods (hereafter "SWGDAM"). T. 341. Ten labs have purchased TrueAllele and three are using it. T. 342.

TrueAllele started in the State of New York in 2010 and gained approval from DNA subcommittee of the New York State Forensic Science Commission for its use for

forensic casework. T. 206. Dr. Perlin testified in great detail the steps necessary for approval for forensic casework in New York. T. 220.

When a lab purchases TrueAllele, it must perform some form of validation on the equipment to be in compliance with the FBI quality assurance standards; they should be measuring how well the system works under a variety of different mixtures. T. 277. Other independent studies have been conducted by other people on the TrueAllele System. T. 278.

Dr. Perlin testified that only ten labs are using TrueAllele at this time. T. 290. He explained that crime labs change very slowly and unless there is a push from the top they are fairly comfortable with the methods that they have. He further testified that it was actually quite good to get ten labs interested in testing and using the system.

Dr. Perlin testified that the direction of the scientific community is moving toward using computers in developing or in analyzing DNA mixtures. T. 298. Regarding general acceptance, TrueAllele was used in mass casualty identification of victims through DNA analysis. T. 299. TrueAllele System was used for the identification of victims in the 9/11 and World Trade Center disasters. T. 301. In addition, probabilistic genotyping and use of computers in interpreting DNA mixtures is a topic at conferences and a subject discussed amongst scientists. T. 298.

TrueAllele has also been involved in over ten defense cases, about half or more involving innocence project cases. Defense attorneys have written about TrueAllele. T. 289.

Dr. Perlin testified that it is his understanding that the FBI and all of the DNA testing laboratories throughout the country will be moving toward some sort of

probabilistic genotyping system but the laboratories are not using any probabilistic genotyping system at this time. T. 335.

Dr. Perlin testified that a scientist can get very close to duplicating his work by reading his work. But, if the scientist has not purchased the system he cannot duplicate it because he does not have all of the engineering details. T. 434.

Dr. Perlin testified that the TrueAllele System has a closed source code. T. 360. The source code is about 170 lines. T. 353. He further testified that the reliability of the source code is determined by testing and validation studies, not by looking at the source code. T. 360. The validity of the source code is assessed by how the program operates, not be reading the text. T. 361. About half a dozen other systems exist that are similar to TrueAllele and some are open source. T. 113. Other closed-source systems exist. T. 115. Dr. Perlin believed the commercial closed-source systems have been validated. T. 115.

Jay Camponera (hereafter referred to as "Camponera") testified for the State. He testified that he works for the New York State Police Forensic Investigation Center as a forensic scientist working in the DNA section where he does research and validation for his lab. T. 656, 657, 658. He has testified approximately 60 times and has been deemed an expert. T. 659. Camponera has a Bachelor's Degree and a Master's of Science Degree with an emphasis on molecular and evolutionary biology. Prior to his current employment, he was a forensic analyst for the University of Maine Molecular Forensic Laboratory. T. 657. Currently his lab uses an interpretation process based on thresholds where they apply a threshold to their data and they do not use anything below that threshold for statistical purposes. They then calculate statistics with a program called

Pop Stats. T. 660. In his role in his lab, he has looked at other technology, such as TrueAllele. T. 660. Camponera testified that his lab validated TrueAllele and it has been approved for use in casework in the State of New York. T. 660. TrueAllele was approved by the New York State DNA Subcommittee in May, 2011. T. 660. TrueAllele has not gone live as they are in the process of finalizing the protocols and doing training for staff. T. 662.

Camponera testified that the trend of the forensic science community, which NIST, who is considered the "scientific wing of the United States Department of Commerce," T. 667, and essentially leads the community in forensic science, is moving towards probabilistic genotyping methods, and TrueAllele is one of those methods. T. 672. The trend is not just in the United States but also internationally. T. 674. Camponera testified that other labs have purchased TrueAllele and 13 states have received TrueAllele reports. T. 676. Two states are actively using TrueAllele and issue their own reports. T. 677. With TrueAllele, a lab can either purchase their equipment or can use the services of TrueAllele by sending them their data. T. 677.

Three admissibility hearings have been held and in all three cases, TrueAllele has been admitted. T. 679. Camponera testified that TrueAllele is much more sensitive to identify the correct person. T. 681. He further testified that the movement in his field is towards probabilistic genotyping which TrueAllele is one method. T. 707.

Camponera testified that "the best way for him to evaluate source code if you want to call it that, is to look at the actual data, the results, and to show that it is specific and sensitive and accurate and so forth." T. 719.

All of the mixtures that Camponera looked at and the single source data were created in his laboratory by him. T. 730.

Camponera's studies have not been published and have not been subject to peer review outside of his laboratory. T. 735, 736.

Dr. Raj Chakraborty testified on behalf of the Defendant. T. 5. Chakraborty testified to his credentials and all of the work that he has performed in his field. T. 5 – 9. He testified that he is currently employed with the University of North Texas Health and Science Center and a professor in the department of molecular and medical genetics. He is also the director of the Center for Computational Genomics at the Institute of Applied Genetics at the same institution. T. 6. He published over 300 papers that relate to DNA forensics. T. 9. He was a faculty member for the Scientific Working Group on DNA Analysis Methods (hereafter referred to as "SWGDAM"). T. 9. SWGDAM sets forth guidelines for laboratories across the country. T. 9. Dr. Chakraborty has been qualified as an expert over 150 times. T. 10.

Dr. Chakraborty testified that he reviewed the lab results in the instant case from Sorenson. T. 11. He testified that the items contained relatively low quantities of DNA. T. 13. He referred to such amounts of DNA as low copy number or low input DNA. T. 13. It is complicated further if there is a mixture. T. 13.

From his research, he has to be very careful about typing low copy number DNA or low input DNA samples particularly if these samples contain DNA mixture for multiple individuals. T. 13.

The criticisms that Dr. Chakraborty has of TrueAllele applies to all types of studies whether it be three person, two person, mixtures, high template, and low template. T. 59.

On direct examination, Dr. Chakraborty testified while a member of SWGDAM, he approved TrueAllele for case work in New York State labs in 2011 that consisted of DNA from a single individual called single source and included DNA of enough quantity. T. 21. On cross examination, he acknowledged that the samples were mixtures of up to three people; some known and some unknown. T. 61. He acknowledged that there were multiple types of mixtures but the use of the word complex is subjective. T. 61. The samples that he evaluated for approval of TrueAllele in 2011 did not mimic the complexity of the sample in the present case. T. 21.

Another study was done in 2010 prior to its approval and for use of TrueAllele in New York. T. 63. The studies were two-person and three-person mixtures and the evidence items were classified as simple, intermediate, and complex. T. 63. Dr. Chakraborty testified that he did not believe that these samples included low template DNA from the contributors. T. 66.

Dr. Chakraborty testified that TrueAllele is not generally accepted in the scientific community and has not been subject to rigorous peer review. T. 51, 52. He also testified that the source code is necessary to evaluate the efficacy of the system. T. 53.

He further testified that none of the validations done on TrueAllele, in his opinion, are proper because they do not give full details of the scenarios of the cases examined, the list of variables and so on. So he would not call them proper validation, rather partial validation. T. 58

Dr. Chakraborty testified that of all of the laboratories only three laboratories are using TrueAllele on a regular basis. The rest of the community uses other probabilistic genotyping or other methods of interpretation.

General acceptance is revealed by the expert opinion. Dr. Chakraborty testified "for example a person of my experience of 40 years of DNA research who testified for prosecution very frequently do no longer approve of TrueAllele. These are indications of lack of general acceptance." T. 84.

NIST is a federal agency which would advise the Federal Bureau of Investigation and thus far the FBI has not adopted TrueAllele for case work. T. 130. Dr. Chakraborty testified that it is his opinion as of now, probabilistic genotyping for those types of cases with closed source and unknown application of variables still need to be worked out. T. 130.

Dr. Chakraborty testified that in his opinion with respect to TrueAllele it is impossible to recreate results that are rendered without the source code. T. 143. He further testified that without the source code it is impossible to validate the answer. T. 143. Dr. Chakraborty testified that there is no way to validate TrueAllele without having the source code. T. 145. Dr. Chakraborty testified that Plus One is a highly regarded scientific journal and he is "intrigued as to how TrueAllele papers got in Plus One without" revealing the source code. T. 71.

Other systems exist that do not reveal the source code. T. 71. Genemapper is a software that calls alleles from experiments done on specific sequencer machines. T. 72. It has been validated without revealing the source code. T. 72, 147, 148. Dr. Chakraborty testified that it can be validated with compromised samples, pristine samples

mixtures and so on. T. 148. Thus, a way to validate the system without the source code is "by using it and testing it, when you have knowns and you can compare the results with what you know." T. 148.

Dr. Dan Krane testified that he is the president and CEO of a consulting company that does business as forensic bioinformatics and a full professor in the Department of Biological Sciences at Wright State University. He also has an affiliate appointment in the computer science department at Wright State University. T. 5. Over the years he has published approximately 40 research papers in the peer review journals. T. 6. Dr. Krane has given over hundreds of presentations over the years and DNA profiling is frequently the topic. T. 6. He has testified as an expert witness over 100 times over the course of the past 23 years and in many jurisdictions. T. 7.

Dr. Krane testified that the scientific community is unified in its opinion that there is no generally accepted means of attaching a statistical weight to low-template DNA where there is a possibility of allelic drop-out. T. 7.

Dr. Krane testified that a very important part of the scientific method is reproducibility and the idea of the peer review process. T. 14. He further testified that the process is valuable because once a scientist publishes their results they describe how they got those results in the materials and methods section of the paper in a way that other scientists should be able to independently confirm those conclusions. Dr. Krane testified that he has not seen that type of disclosure in the materials and methods sections or in any other documents that he has been privy to regarding TrueAllele. T. 15.

Dr. Krane testified that he reviewed the report from the Sorenson lab and he suggested that there is empirical evidence to support the conclusion that there are at least three, not two, but at least three contributors in the mixture. T. 18.

Dr. Krane testified that with the test results for TrueAllele he simply does not know how they got the answer. T. 33.

Dr. Krane testified that probabilistic genotyping in general has promise and that there is a utility for expert systems like TrueAllele to the extent which they are used as a tool to assist analysts in speeding up their review of case work, but he is concerned in this case where "Sorenson Forensic declines to attach a statistical weight; they decline to say whether [Shaw, the Defendant in this case], is included or excluded as a possible contributor." T. 36. His concern is in this particle case where there is a marginal sample, small amounts of DNA, a complicated mixture and a lot of overlap between two possible contributors. T. 38

Dr. Krane testified that there is not general acceptance within the scientific community with respect to TrueAllele in such complicated situations as the present case. T. 39, 40.

Dr. Krane testified that it is conservative to walk away at some point rather than to take a chance with arriving at an incorrect conclusion. T. 66.

Dr. Krane has not written any papers or peer reviewed any papers regarding probabilistic genotyping methods for determining DNA mixtures. T. 68.

Dr. Krane testified that it is possible that TrueAllele can do things that human catalysts cannot do. T. 72. 73.

Dr. Krane testified that his concern is where TrueAllele arrives at a conclusion that is different from the conclusion of the other independent reviewers. T. 84.

Dr. Krane testified that the source code for TrueAllele is necessary for confrontation and accountability but may be separate from validation. T. 85. His business, Forensic Bioinformatics, works with a closed source system, Genophiler and Genostat. Neither of these systems that he relies on are open source. T. 35. Dr. Krane testified that the difference is that his systems are used as tools, unlike TrueAllele that is a "surrogate for a human expert." T. 35.

Dr. Krane testified that probabilistic genotyping in general looks promising, but he did not state that Dr. Perlin's program is correct, especially for samples where there are clear, obvious, and confounding, complicating features. T. 86.

ANALYSIS

In the instant case, the analysis to determine the admissibility of the evidence begins under Evid.R. 701. In light of Evid.R. 701, and the testimony and evidence presented, there is no dispute that the subject about which Dr. Perlin testified is beyond the knowledge or experience of lay persons and that Dr. Perlin's credentials, experience, training and education qualify him to testify as an expert. The question that must be examined is whether his method for testing DNA is reliable under Evid.R. 702(C). To determine whether his method is reliable, the Court considers the factors as enunciated in *Daubert*.

The first factor to consider is whether the theory or technique has been tested. Dr. Perlin testified that he has five published peer review articles and prepared other internal

validation studies that have not been published. Both the internal validation studies and peer review articles support the position that the TrueAllele Casework System has been tested. Dr. Perlin testified that his system can be replicated if it is purchased. Without purchasing his TrueAllele System, a scientist cannot obtain identical results, but may obtain similar results.

In *U.S. v Bonds*, 12 F.3d 540, 1993 U.S. App. LEXIS 32574, 1994 FED App. 0085P (6th Cir. 1993), the Court examined the issue of testability and determined that "...the FBI's principles and methodology have in fact been tested. The FBI performed internal proficiency testing as well as validation studies and environmental insult studies to determine whether the lab could produce reliable, reproducible results." *Bonds* at 558. Moreover, the Court held that the fact that a dispute exists regarding the methodology proves that it can be tested. The Court stated:

> Defendants vociferously dispute the accuracy of the match results and the adequacy of the testing done, and in refutation have presented evidence about deficiencies in both the results and the testing of the results. Thus, it appears that by attempting to refute the FBI's theory and methods with evidence about deficiencies in both the results and the testing of the results, the defendants have conceded that the theory and methods can be tested. *Bonds* at 559.

Here, despite the testing that has been performed on the TrueAllele System through the validation studies and peer review publications, it is apparent that a conflict exists regarding the methodology of the TrueAllele Casework System for mixtures with low copy DNA. Such conflict amongst experts, including the inadequacies and deficiencies of the system, continues to support the conclusion that the system can be tested. In addition, Dr. Perlin has performed internal proficiency testing as well as validation studies making his system testable. Moreover, similar results can be obtained

without using the TrueAllele System, but comparable and identical results can be obtained using the TrueAllele System.

Thus, the first *Daubert* factor for consideration has been satisfied.

The next factor to consider is whether the theory or technique has been subject to peer review. Dr. Perlin testified that TrueAllele has been subject to peer review; he has five published peer review articles. In addition, Dr. Perlin has prepared other internal validation papers. Although Dr. Perlin has five published peer review articles, "... the existence of publications (or lack thereof) is not dispositive when assessing the reliability of a scientific method." *Wangler* at ¶ 68, citing *Daubert* at 594. Therefore, this Court finds that the second *Daubert* factor has been met.

The third factor to consider is whether there is a known or potential rate of error. TrueAllele's error rate has been calculated in the validation papers. The error rate for technology such as TrueAllele is expressed in terms of sensitivity, specificity and reproducibility. In *Wangler*, the court found "the lack of a known error rate is not fatal to the methodology's reliability." *Wangler* at ¶ 70. Here, however, the testimony and briefs submitted have established the error rate for TrueAllele.

The final factor that a court may consider to determine whether a method or theory is reliable under *Daubert* is whether the methodology has gained general acceptance.

In *Bonds,* the court found that general acceptance encompasses both the theory of DNA profiling and the methodology for conducting DNA testing. See *United States v. Brown*, 557 F.2d 541, 556, 1977 U.S. App. LEXIS 12945 (1977). ("'There must be a demonstrable, objective procedure for reaching the opinion and qualified persons who

can either duplicate the result or criticize the means by which it was reached.'" (emphasis added) (quoting *United States v. Baller*, 519 F.2d 463, 466, (4th Cir.) cert. denied, 423 U.S. 1019, 46 L. Ed. 2d 391, 96 S. Ct. 456 (1975)). *Bonds* at 562. "This view is consistent with *Daubert's* requirement that we determine whether the 'reasoning or methodology underlying the testimony is scientifically valid,' *Daubert* at 2796, and its acknowledgement that a 'known technique that has been able to attract only minimal support in the scientific community may properly be viewed with skepticism.' id." *Id.*

The court further explains the theory of general acceptance:

> [o]ur precedent demonstrates that while ordinarily the principles and procedures must be accepted by a majority of those in the pertinent scientific community, the absence of a majority does not necessarily rule out general acceptance. The general acceptance test is designed only to uncover whether there is a general agreement of scientists in the field that this scientific data is not based on a novel theory or procedure that is 'mere speculation or conjecture.' *Brown* at 559. In some instances, there may be several different theories or procedures used concerning one type of scientific evidence, all of which are generally accepted. None may have the backing of the majority of scientists, yet the theory or procedure can still be generally accepted. And even substantial criticism as to one theory or procedure will not be enough to find that the theory/procedure is not generally accepted. Only when a theory or procedure does not have the acceptance of most of the pertinent scientific community, and in fact a substantial part of the scientific community disfavors the principle or procedure, will it not be generally accepted. See, e.g., *Novak v. United States*, 865 F.2d 718, 725 (6th Cir. 1989) (theories were neither "widely accepted" or "generally accepted" in the medical community). *Bonds* at 562.

The court found that the Government's experts indicated that the FBI's DNA procedures were generally accepted although the defendants' experts criticized the Government's theory of DNA profiling and the basic procedures used by the lab in that case. The court found that the defendants' experts only showed a "substantial controversy over whether the results produced were reliable and accurate," *Bonds* at 562, and that they did not

show that the procedures were not generally accepted. *Id.* Finally, the court held that "questions about the accuracy of results are matters of weight, not admissibility." *Bonds* at 563.

In the present case, after considering the testimony of the witnesses for the State and the Defendant, this Court finds that the general acceptance factor has been satisfied. Ten laboratories have purchased the system, three of which are using it, and it has been admitted in other jurisdictions. See *Commonwealth of Pennsylvania v. Foley*, 38 A.3d 882, 2012 PA Super 31. Dr. Chakraborty testified that while on staff with SWGDAM, he was part of the team that validated the use of the TrueAllele Casework for mixtures. In addition, NIST purchased the TrueAllele System and is using it. Moreover, NIST has recognized probabilistic genotyping.

In *Commonwealth of Pennsylvania v. Foley*, 38 A.3d 882, 2012 PA Super 31, the court admitted the DNA-related testimony of Dr. Perlin. The sample was tested in an FBI laboratory and three experts analyzed the data, including Dr. Perlin who used the TrueAllele System in his analysis. The experts agreed that Foley's DNA profile was consistent with DNA found in the sample, but differed in their estimates of the probability that someone other than Foley would possess DNA matching the DNA found in the sample. The trial court found that Dr. Perlin's methodology was generally accepted. The Superior Court of Pennsylvania found "no legitimate dispute regarding the reliability of Dr. Perlin's testimony," and upheld the ruling of the trial court in admitting Dr. Perlin as an expert witness at trial. *Foley* at 888.

Similarly, this Court finds that Dr. Perlin's methodology is generally accepted; therefore, the final factor of the *Daubert* test has been satisfied.

This Court must also determine whether the probative value is substantially outweighed by the danger of unfair prejudice, of confusion of the issues, or of misleading the jury. In making the Evid.R. 403 determination, this Court finds that the evidence and testimony presented are clearly probative because there is a connection between the Defendant and the crime scene where the evidence was collected. In *United States v. Morrow*, 374 F.Supp. 2d 51, 2—5 U.S. Dist. LEXIS 8327, the court found the DNA evidence had probative value because it showed that certain defendants could not be excluded from a connection to particular articles of evidence. The court explained the evidence was admissible under Fed.R.Evid. 403 because the FBI's theory of matching DNA patterns and procedures were scientifically valid, and because the "'defendants had an opportunity to cross examine all of the Government's witnesses to show why the results were unreliable, the procedures flawed, and the DNA evidence infallible.'" *Morrow* at 64, citing *Bonds* at 568. In *Bonds*, the court explained that "the damaging nature of the DNA evidence to defendants and the potential prejudice does not require exclusion." *Bonds* at 568.

In *United States v. McCluskey*, 954 F. Supp. 2d 1224, 2013 U.S. Dist. LEXIS 88728, the court acknowledged that courts have liberally allowed admission of DNA evidence of relatively low statistical significance. It explained that those cases "properly acknowledge the liberal standard of admission under *Daubert* and the Federal Rules, and the general presumption in favor of admission of 'shaky evidence' with the danger of

undue weight being countered by vigorous cross-examination, presentation of contrary expert witnesses, and the possibility of jury instructions to explain the issues." *McCluskey* at 1274.

In allowing the State's witness to testify at trial in this matter, the Defendant will be provided an opportunity to vigorously cross-examine the State's witness, present contrary evidence and expert witnesses to show why the results of the TrueAllele Casework System are unreliable, the procedures flawed, and the DNA evidence infallible. The Court anticipates that the jury will be extensively educated by both parties on statistical issues and DNA testing and methodologies. If this Court concludes that jurors could be confused by the evidence presented, the Court may deliver "carefully crafted instructions to insure the evidence is properly understood." *Morrow* at 64.

Based on its consideration of the liberal factors set forth in *Daubert* and *Kumho Tire,* and Evid.R. 402, 403 and 702, this Court finds that the State's expert witness and the TrueAllele System are reliable and, therefore, admissible. Further, the expert's testimony is a matter of weight for the jury to consider. Therefore, Defendant's Motion in Limine to exclude any and all evidence related to TrueAllele, filed July 10, 2014, is denied.

Furthermore, the Court is in consideration of Defendant's Motion to Compel the True Allele source code, filed June 6, 2014. Based on the State's Motion to Quash the discovery of the source code, filed June 19, 2014, the Defendant's Reply to the Motion to Quash, filed June 26, 2014, the Defendant's Supplemental Motion to Compel the source code, filed August 14, 2014, and the State's Brief in Opposition to Defendant's

Supplemental Motion to Compel, filed on August 21, 2014, and the oral arguments presented to the Court, the Defendant's Motion to Compel the TrueAllele source code is denied. This Court has previously established that the TrueAllele methodology and the State's witness are reliable without the use of the source code.

IT IS SO ORDERED:

DATE: 10/9/2014

JUDGE MAUREEN CLANCY