

UNITED STATES of America,

v.

Carlton EWELL and Jacob S. Adams, Jr., Defendants.

United States District Court,
D. New Jersey.
No. 00-697 GEB.

Robert John Haney, Ewing, NJ, Brian J. McMonagle, McMonagle, Perri & McHugh,
P.C., Philadelphia, PA, for Defendants.

Robert A. Farkas, Trenton, NJ, for United States of America.

MEMORANDUM OPINION

BROWN, District Judge.

This matter comes before the Court upon defendant Carlton Ewell's motion for a new trial regarding the Court's admission of the Government's DNA evidence at trial. For the reasons discussed below, defendant's motion is denied and the following findings and conclusions shall hereby supplement the Court's November 15, 2002 Order denying the defendants' motion to suppress the Government's DNA evidence and granting the Government's motion to admit the DNA evidence.

I. FACTS ¹

On April 25, April 26, and August 13, 2002, the Court held a *Daubert* ² hearing regarding the admissibility of the Government's DNA evidence.³ There the Court heard testimony from the Government's expert, Dr. Bruce Budowle, and defense expert Dr. Theodore Kessis. Based upon the testimony and the parties' submissions the Court makes the following findings.

¹ The parties to this action are thoroughly familiar with the background and procedural history of this matter and thus, the Court will confine its discussion of facts to those germane to the defendants' suppression motion. At the Court's request, the parties submitted proposed findings of fact and conclusions of law which have been incorporated herein.

² *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993).

³ For ease of reference, the Court will refer to the transcripts as follows:

1T April 25, 2002

2T April 26, 2002

3T August 13, 2002

A. TESTIFYING EXPERTS

1. Dr. Bruce Budowle

Dr. Budowle, the Government's expert at the *Daubert* hearing, is a Senior Scientist in the FBI Laboratory Division, Washington, D.C. 1T12. In nineteen years with the FBI, Dr. Budowle has been the unit chief of the FBI Research Unit and the program manager of the DNA Research Group as well as a research chemist. Id. Dr. Budowle holds a doctorate in genetics from Virginia Polytechnic and State University, and completed a postdoctoral fellowship at the University of Alabama. Id. at 13.

Dr. Budowle served as the chair of the Technical Working Group for DNA Analysis Methods, the chair of the International Society of Forensic Genetics DNA Commission, and the federal DNA Advisory Board. Id. at 14. In addition, Dr. Budowle has published approximately 300 publications in the field of genetics, forensic DNA analysis and molecular biology.⁴ Id. at 15. Dr. Budowle has worked first-hand with all stages of the forensic DNA analysis process, including extracting samples, RFLP typing, PCR amplification, sequencing, population genetic research and validation testing. Id. at 17.

2. Dr. Theodore Kessis

The defense expert, Dr. Kessis, is a self-employed consultant operating a business known as Applied DNA Resources. 3T3. Dr. Kessis holds a doctorate in molecular biology from the Johns Hopkins University School of Public Health in Baltimore and was post-doctoral fellow at Hopkins in the School of Medicine, Department of Pathology. Id at 4. Dr. Kessis has been published approximately 20 times in peer reviewed journals. Id. The majority of his published materials relate to PCR DNA testing, although only two of his articles specifically relate to PCR-STR DNA typing. Id. at 4, 6. Dr. Kessis has been accepted as a DNA expert in several prior cases, but he has never been deemed to be an expert in PCR/STR technology. Id. at 5, 7. Dr. Kessis was admitted here as an expert in PCR, DNA and molecular biology. Id. at 8.

B. BASIC CONCEPTS OF DNA

The following overview of the basic concepts of DNA, quoted from *United States v. Shea*, 957 F.Supp. 331, 333 (D.N.H.1997), aff'd, 159 F.3d 37 (1998), cert. denied, 526 U.S. 1077, 119 S.Ct. 1480, 143 L.Ed.2d 563 (1999), is in accord with the testimony of the instant experts:⁵

⁴ Approximately two-thirds of Dr. Budowle's publications appeared in peer-reviewed journals. 1T16-17.

⁵ The court in *United States v. Gaines*, 979 F.Supp. 1429, 1431- 1432 (S.D.Fl.1997), similarly relied on Judge Barbadoro's overview of DNA in *Shea*.

DNA, an acronym for deoxyribonucleic acid, is the chemical blueprint for life. Most human cells other than reproductive cells contain identical copies of a person's DNA. Although 99.9% of human DNA does not vary from person to person, no two persons other than identical twins have the same DNA. (citation omitted).

Human DNA is organized into 23 pairs of chromosomes and each chromosome contains a DNA molecule. DNA molecules have a double stranded helical structure that can be envisioned as a spiral staircase. (citation omitted). Running between the two sugar-phosphate strands forming the handrails of the staircase are millions of steps comprised of two loosely bound nitrogen bases. Each step is referred to as a base pair. There are four types of bases: adenine (A), thymine (T), guanine (G), and cytosine (C). A's ordinarily pair only with T's, and C's ordinarily pair only with G's. Thus, if the sequence of bases on one side of a DNA molecule is known, the corresponding sequence of bases on the other side can be deduced. The arrangement of base pairs in chromosomal DNA comprises the genetic code that differentiates humans from non-humans and makes every person unique. (citation omitted).

In total, the DNA molecules in the 23 pairs of human chromosomes contain approximately 3.3 billion base pairs. Most of the base pairs are arranged in the same sequence in all humans. (citation omitted). However, every DNA molecule has regions known as polymorphic sites where variability is found in the human population. (footnote omitted). Each possible arrangement of base pairs that occurs at a polymorphic site is referred to as an allele. Alleles can result from differences in a single base pair, differences in multiple base pairs, or differences in the number of base pairs that comprise a site.

The combination of alleles from corresponding sites on a chromosome pair is sometimes referred to as the site's genotype. (footnote and citation omitted). One allele for each single locus genotype is inherited from each parent. If both parents contribute the same type of allele, the child's genotype is considered to be homozygous. If each parent contributes a different type of allele, the child's genotype is considered to be heterozygous. To illustrate, if only two alleles for a locus are found in the population, A and a, two homozygous genotypes, AA and aa, and one heterozygous genotype, Aa, will be found in the population. Although an individual's genotype consists of either two copies of the same allele or one copy of each of two different alleles, many different alleles may be found in the population for a single locus. (citation omitted).

C. PCR/STR DNA ANALYSIS⁶

⁶ This description is drawn from the Government's factual submissions, which were largely undisputed by the defendant, the testimony of Drs. Budowle and Kessiss, and with reference to the discussion of the topic in *United States v. Hicks*, 103 F.3d 837, 844-45 (9th Cir.1996), cert. denied, 520 U.S. 1193, 117 S.Ct. 1483, 137 L.Ed.2d 694 (1997); *United States v. Beasley*, 102 F.3d 1440, 1445 (8th Cir.1996), cert. denied, 520 U.S. 1246, 117 S.Ct. 1856, 137 L.Ed.2d 1058 (1997); *United States v. Trala*, 162 F.Supp.2d 336, 341-42 (D.Del.2001); *Gaines*, 979 F.Supp. at 1432-33.

Because there is no way to sequence and compare all 3 billion base pairs in a person's DNA, forensic DNA analysts seek to identify individuals through meaningful variations in their base-pair sequences at particular polymorphic loci. The method of DNA typing employed by the FBI laboratory in the instant matter is commonly referred to as PCR/STR typing.

1. Basic Concepts of PCR Amplification

PCR/STR typing begins with the PCR amplification process. PCR is not itself a method of DNA typing, but a technique of sample preparation. 1T34. PCR is a laboratory process for copying a short segment of DNA millions of times, thereby replicating the natural DNA duplication process. Id. This process allows labs to produce a substantial number of specific, targeted segments of DNA which exhibit genetic variation that can then be typed and compared from an original sample that may have been of a subanalytical quality. Id. The principle benefit of the PCR process is that it enables the forensic analysis of very tiny amounts of DNA. Id. at 33.

The PCR process has three steps. First, the double-stranded segment of DNA is separated into two strands by heating. Id. Because the bases along the DNA strand are always found in complimentary pairs, a heat-separated DNA strand forms a template that can allow the manufacture of a new strand identical to its former complimentary strand.

In the second step, each of the single strand segments are hybridized with short DNA segments known as primers, that are designed to bind with the single strand segments at particular loci. Id. at 34-35. The primers are designed to compliment a sequence just outside of a target sequence of bases.

Lastly, each primer is the starting point for the replication of the target sequence. In the third step an enzyme known as a polymerase becomes active. The polymerase facilitates repeated additions of bases to the primer until a new complimentary strand of the targeted DNA locus is created. Id. at 37. Thus, the PCR process replicates the initial double stranded molecule into two copies.

The PCR process is repeated a number of times, thereby creating an exponentially increasing number of copies of the targeted area of the original DNA. After about thirty repeated cycles, millions of copies of the particular target sequence are created by the laboratory. To minimize the chance of human error and contamination, the laboratory can use a process called multiplexing. Id. at 40-41. Multiplexing allows the laboratory to type the DNA sample at multiple sites by adding additional primers which will bind simultaneously to their respective target sites. Id. at 39.

2. Short Tandem Repeats--STR Analysis

A tandem repeat involves multiple copies of an identical DNA sequence arranged in direct succession in a particular region of a chromosome. A short tandem repeat ("STR")

is a tandem repeat in which the core base units are just a few base pairs. Id. at 42. Loci containing potentially testable STRs are located throughout the chromosome in large numbers.

In PCR/STR typing, the forensic analyst seeks to determine the size of the repeat sequences by their migration in an electric field through a process known as electrophoresis. The primers applied during the PCR amplification of the STR fragments contain a fluorescent tag. Id. at 47. During the electrophoresis process, the amplified fragments pass through a gel and through a detection window at the end of the gel. Id. at 47-48. When the fragments pass through the detection window, a laser fires, striking the fluorescent tags and causing them to emit light. Id. at 48. A camera will detect the light and convert it into data. By measuring the amount of time it takes a particular fragment to reach the laser, the laboratory will be able to determine the size of the fragment, and thus, the number of sequence repeats. Id. at 47. The faster a fragment moves through the window, the smaller it is in size. Id.

The data generated as a result of electrophoresis is analyzed by a computer software program⁷ which determines the size of the alleles based on the rate at which they reach the detection window. Id. at 47. The software detects the light being emitted, and converts it into peaks of different sizes. Id. at 49. By analyzing the configuration of these peaks against known reference standards, the analyst can determine the alleles present at the target loci in a given sample. Id.

3. Profiler Plus and Cofiler Kits

In this case, the PCR process was used to amplify thirteen specific STR loci. To do so, the laboratory used two materials kits, "Profiler Plus" and "Cofiler," commercially manufactured by Perkin Elmer Biosystems. Id at 57. The kits contain the basic chemicals that are needed to conduct the PCR process, including the primers with fluorescent tags, the polymerase enzyme and the mix of chemicals necessary for the PCR process. Id at 59. The Profiler Plus and Cofiler kits have come into widespread use, such that the majority of laboratories in the U.S. and internationally use the two kits in PCR/STR analysis. Id. at 57.

4. Statistical Analysis

After a laboratory has typed and compared the two DNA samples and the samples are found to be sufficiently similar that they could have originated from the same source, the next step is for the analyst to perform a statistical analysis to determine the significance of the comparison, that is, to reach some inference about how common or rare the particular DNA profile is based on population frequency data. 1T130-31. The statistical frequency of the DNA profile at issue is calculated by multiplying the frequency of each of the alleles in the profile, and then correcting the

⁷ Genescan and Genotyper software was used here. Id. at 56.

result to account for inbreeding or substructuring effects in the population, as well as applying additional statistical qualifications.⁸ Id. at 131.

In order to calculate the allelic frequencies, the FBI has developed a series of databases used to approximate the actual frequencies of the alleles in various population groups.⁹ Id. at 135. In addition, the FBI laboratory has adopted the recommendation of the National Academy of Sciences and increases a calculated profile frequency by a factor of ten in order to correct for genetic or sampling variation that might occur. Id. at 151-52. Utilizing this analysis, the FBI will conclude that it is scientifically reasonable to attribute the source of a given DNA sample to an individual if the profile frequency of the ostensible source and the matching unknown sample is smaller than one in 280 million. Id. at 163-64.

5. FBI Quality Control and Quality Assurance

The FBI maintains detailed quality control and quality assurance procedures to regulate the performance of forensic PCR/STR typing in its laboratory. As to quality control, the FBI has established a protocol to be followed in performing the PCR amplification and typing of the thirteen core STR loci using the Profiler Plus and COfiler kits. Id. at 121. The protocol provides a procedure for performing each stage of the of the amplification and typing process. Id. at 122. The testimony indicates that if an analyst follows the FBI protocol and uses properly calibrated instruments, there is essentially zero rate of error, i.e., obtaining a wrong result, within established measurement conditions. Id. at 124-125. The Government concedes, however, that this result is subject to human error. In addition, the Government has not offered evidence as to how often the laboratory actually reaches the wrong result, that is, including human error and the failure of an analyst to follow the protocol.

In addition, the FBI laboratory maintains a Quality Assurance Program Manual for the forensic case working unit, as well as an audit process.¹⁰ Id. at 126.

⁸ The National Academy of Sciences/National Research Council Report (NRC II) has recommended the use of a variable known as theta valued at .01 to correct for the inbreeding effect. The FBI Laboratory follows this recommendation in its analysis. Moreover, the testimony of Dr. Budowle indicated that empirical studies have shown that the theta value of .01 is a conservative estimate.

⁹ The databases are generated from convenience samples drawn from various sources, such as paternity testing laboratories. The FBI Laboratory generally tests profile frequencies for an unknown sample from four major population group databases: (i) U.S. Caucasian, (ii) African-American, (iii) Southeastern Hispanic, and (iv) Southwestern Hispanic. 1T135. These databases contain more than a statistically sufficient number of samples to permit the calculations of valid allelic frequencies at the thirteen core STR loci. Id. at 137-38.

¹⁰ The quality assurance procedures include maintaining separate rooms with dedicated equipment for pre and post amplification samples; use of hoods and safety sheeting with

II. DISCUSSION

A. STANDARD FOR THE ADMISSIBILITY OF EXPERT TESTIMONY

The admissibility of expert testimony is governed by Rule 702 of the Federal Rules of Evidence, which provides:

If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of opinion or otherwise.

In *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 597, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), the United States Supreme Court held that the Court must exercise a gatekeeping function when determining the admissibility of proposed expert testimony under Rule 702. The standards of admissibility under Rule 702 and the Court's gatekeeping function are applicable not only to scientific expert testimony, but also to any expert testimony that is based on " 'technical' and 'other specialized' knowledge." *Kumho Tire Co., Ltd. v. Carmichael*, 526 U.S. 137, 141, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999). The proffered expert testimony is admissible only if it is based on a reliable foundation and is "relevant to the task at hand." *Daubert*, 509 U.S. at 597.

As framed by the Third Circuit, the expert must be qualified as an expert based on a broad range of specialized knowledge, skill or training. See *In re Paoli R.R. Yard PCB Litig.*, 35 F.3d 717, 741 (3d Cir.1994), cert. denied, 513 U.S. 1190, 115 S.Ct. 1253, 131 L.Ed.2d 134 (1995). While the level of expertise may affect the reliability of a particular expert, the Third Circuit generally has taken a policy of liberal admissibility with respect to an expert's qualifications. See *id.*

"The second requirement of Rule 702 is that the expert must testify to 'scientific, technical or other specialized knowledge [that] will assist the trier of fact.' " *Id.* at 742 (quoting Fed.R.Evid. 702); see also *Kimho Tire*, 526 U.S. at 141. The testimony is admissible so long as the "process or technique the expert used in formulating the opinion is reliable." *Id.* at 742. The test of reliability is a flexible one, and "the law grants the district court the same broad latitude when it decides how to determine reliability as it enjoys in respect to its ultimate reliability determination." *Kimho Tire*, 526 U.S. at 142 (citing *General Electric Co. v. Joiner*, 522 U.S. 136, 143, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997) (emphasis in original)).

chemical operations; use of gloves, masks, and pipettes; separation of the extraction of the question and reference samples; use of positive and negative controls in the amplification process; and technical peer review and administrative review of case work.
1T125-26.

"[The] inquiry into the reliability of scientific evidence under Rule 702 requires a determination as to its scientific validity." *In re Paoli*, 35 F.3d at 742. Relying upon *Daubert*, the Third Circuit has identified a list of eight non-exclusive factors that the Court may consider in determining whether a particular scientific methodology is reliable:

(1) whether a method consists of a testable hypothesis; (2) whether the method has been subjected to peer review; (3) the known or potential rate of error; (4) the existence and maintenance of standards controlling the technique's operation; (5) whether the method is generally accepted; (6) the relationship of the technique to methods that have been established to be reliable; (7) the qualifications of the expert witness testifying based on methodology; and (8) the nonjudicial uses to which the method has been put. *Id.* at 742 n. 8; accord *Elcock v. Kmart Corp.*, 233 F.3d 734, 745 (3d Cir.2000).

Lastly, the proffered testimony must assist the trier of fact in resolving a disputed relevant factual issue in the case. See *In re Paoli*, 35 F.3d at 742-43. In other words, the proffered testimony must "fit" a particular issue of the case. See *id.* at 743.

The proponent of the expert testimony has the burden of proving its admissibility by a preponderance of the evidence. See *United States v. Van Wyk*, 83 F.Supp.2d 515, 519 (D.N.J.2000), *aff'd*, 262 F.3d 405, *cert. denied*, 534 U.S. 826, 122 S.Ct. 66, 151 L.Ed.2d 33 (2001); *Diaz v. Johnson Matthey, Inc.*, 893 F.Supp. 358, 372 (D.N.J.1995).

B. APPLICATION OF THE DAUBERT/PAOLI FACTORS

1. Testable Hypothesis

There is little doubt that the methodology at issue has a testable hypothesis. "The hypothesis of PCR/STR DNA typing is that with proper procedures an expert can determine the allelic types of given DNA samples at the thirteen core STR loci." *Trala*, 162 F.Supp.2d at 346 n. 11. As noted by the Government, this hypothesis can be tested by any laboratory with the proper equipment to perform the PCR process.

Defendant's argument here is focused on the Profiler Plus and Cofiler kits. Defendant maintains that there are no validation studies of either kit from which one could determine their reliability.

The Court is not persuaded that the claimed lack of validation of the efficacy of the kits has any effect on whether PCR/STR typing has a testable hypothesis. Contrary to defendant's assertions, the Cofiler and Profiler kits merely provide the materials necessary to perform the PCR amplification process, and thus, the kits need not independently meet the Daubert standard of admissibility. See *Trala*, 162 F.Supp.2d at 346 (quoting *People v. Shreck*, 22 P.3d 68, 81 (Colo.2001)). Accordingly, challenges as to the efficacy and reliability of the materials kits go to the weight of the evidence and not to admissibility. See *id.*

Moreover, even if the kits were independently subject to *Daubert*, defendant's argument is not well-founded. The Government produced as exhibit 7 a peer reviewed article reporting a study of various commercially available amplification kits. The article concludes, inter alia, that Profiler Plus and Cofiler kits "can be used to amplify and type STR loci successfully from DNA derived from human biological specimens. The current study demonstrates that the procedures used to type STR loci using these commercial kits are robust and valid." Gov't Exhibit 7 at 659. Additionally, Dr. Budowle testified that the Profiler Plus and Cofiler kits are generally accepted in the scientific community as valid and reliable to perform the PCR amplification of the thirteen STR loci. 1T119.

2. Peer Review and General Acceptance

The Government has submitted significant evidence indicating that the PCR/STR typing process at issue has been subjected to peer review and has been generally accepted. First, the Court notes that the PCR amplification process has received widespread acceptance in the federal and state courts such that its validity as a methodology is virtually beyond reproach.¹¹ See *U.S. v. Wright*, 215 F.3d 1020, 1027 (9th Cir.), cert. denied, 531 U.S. 969, 121 S.Ct. 406, 148 L.Ed.2d 313 (2000); *Hicks*, 103 F.3d at 844-47; *Beasley*, 102 F.3d at 1447-48 n. 4 (permitting courts in the Eighth Circuit to take judicial notice of the reliability of PCR DNA typing and collecting at least eighteen appellate cases from various state courts sustaining the admission of DNA evidence derived from the PCR method); *Trala*, 162 F.Supp.2d at 346; *Gaines*, 979 F.Supp. 1429, 1433-36 n. 4 (collecting at least twenty state appellate court cases finding PCR DNA testing to be scientifically reliable); *Shea*, 957 F.Supp. 339-40.

PCR/STR typing is a fairly new technology and thus, has not been considered by the same number of cases as PCR amplification technology. This Court's research has uncovered only one federal case addressing the admissibility of PCR/STR technology. See *Trala*, 162 F.Supp.2d at 351. In *Trala*, the court issued a thorough, well-reasoned and persuasive opinion concluding that PCR/STR technology is reliable and admissible under *Daubert*. 162 F.Supp.2d at 351. Although federal case law on the issue is somewhat limited, numerous state courts have determined that PCR/STR technology is reliable and admissible. See *State v. Traylor*, 656 N.W.2d 885 (Minn.2003); *People v. Shreck*, 22 P.3d 68, 83 (Colo.2001); *State v. Butterfield*, 27 P.3d 1133, 1143 (Utah 2001); *State v.*

¹¹ The defendant appears to argue that this Court should turn a blind eye to the bevy of legal precedent concluding that PCR amplification technology and to a somewhat lesser extent, PCR/STR typing technology, are admissible under *Daubert*. While this Court must of course reach its own conclusions based upon the evidence submitted, the decisions of other courts presented with similar questions are clearly relevant to the inquiry and will inform this Court's conclusion. Defendant additionally suggests that this precedent is of little use here specifically because his claim that the Government has failed to provide an "actual error rate" based upon human errors in testing and the occasional failure to follow protocol has never been raised effectively and addressed. As will be discussed in Section II.B.3., a review of the precedent indicates that this assertion has been previously raised and rejected. See *Trala*, 162 F.Supp.2d at 350; *Shea*, 957 F.Supp. at 340.

Jackson, 255 Neb. 68, 582 N.W.2d 317, 325 (Neb.1998); *Commonwealth v. Rosier*, 425 Mass. 807, 685 N.E.2d 739, 743 (Mass.1997); *Overstreet v. State*, 783 N.E.2d 1140 (Ind.App. Feb. 24, 2003); *State v. Salmon*, 89 S.W.3d 540 (Mo.App.2002); *Lemour v. State*, 802 So.2d 402, 408 (Fla.Dist.Ct.App.2001); *State v. Rokita*, 316 Ill.App.3d 292, 249 Ill.Dec. 363, 736 N.E.2d 205, 211 (Ill.App.2000); *People v. Allen*, 72 Cal.App.4th 1093, 85 Cal.Rptr.2d 655, 658-660 (1999); *State v. Deloatch*, 354 N.J.Super. 76, 804 A.2d 604 (Law Div.2002); *People v. Owens*, 187 Misc.2d 838, 725 N.Y.S.2d 178, 180-81 (N.Y.Sup.Ct.2001).

In addition, the Government has submitted significant evidence indicating that the PCR/STR typing process, specifically with regard to the thirteen STR loci at issue here, has been substantially peer-reviewed and has gained acceptance in the forensic community. Aside from Dr. Budowle's testimony, the Government has submitted an article from a scientific journal known as *Nucleic Acids Research* which provides:

STR systems and multiplexes routinely used in human identity testing have been extensively validated by many groups, as any new system must be in the future.... The abundance of literature available on the use of STRs for forensic DNA typing shows that it has become an established technology worthy of being used as court evidence. Gov't Exhibit 2a at 321-22. The Government has also submitted a National Institute of Standards and Technology database of over 1000 articles on STRs, including numerous validation studies performed on STR systems. Gov't Exhibits 2b, 2c.

Lastly, the Government has established that the thirteen STR loci used here have undergone significant scrutiny as a result of their selection for use in the nationwide CODIS felon databank. 1T136. In selecting the thirteen loci for use in CODIS, a consortium of twenty-one laboratories performed a series of tests and ultimately determined the thirteen loci to be the most robust STR loci. 1T61-62, 137.

Defendant does not appear to dispute that the methodology of PCR/STR testing was subjected to peer review and accepted, but instead appears to challenge the motives of the peerreviewers. Defendant asserts that the community of forensic DNA scientists is a relatively closed community which peer review one another's articles and have ties, financial and otherwise, to the FBI. Therefore, defendant argues, the peer reviewers evaluation of PCR/STR analysis may be biased.

The Court is not persuaded by this argument. First, the evidence presented by the Government indicates that the forensic DNA community is not as small as the defendant argues. Even assuming, however, that the community is as small as the Defendant argues, the Court finds that *Daubert* does not require the Court to assess the credibility of peer-reviewers of a scientific method to determine whether the method is sufficiently reliable to be admissible. Moreover, defendant has offered no evidence of impropriety by any of the peer reviewers and has instead relied on vague assertions of what can only be referred to as friendship between peers involved in forensic DNA science and the financial connection between Dr. Budowle and the FBI. These assertions are insufficient to cast doubt on the reliability of the peer-reviewing process.

Accordingly, the Court concludes that PCR/STR technology has been subject to peer review and has been generally accepted in satisfaction of *Daubert/Paoli*.

3. Known or Potential Error Rate

The testimony introduced at the hearing demonstrated that the FBI has established protocol to be followed in performing the PCR amplification and typing of the thirteen core STR loci using the Profiler Plus and COfiler kits in order to produce consistently reliable results. 1T121. The protocol provides a procedure for performing each stage of the of the amplification and typing process. *Id.* at 122. The testimony indicates that if an analyst follows the FBI protocol and uses properly calibrated instruments, there is essentially zero rate of error, i.e., obtaining a wrong result, within established measurement conditions. *Id.* at 124-25. The Government concedes, however, that this result is subject to human error.¹²

The defendant argues that the Government has not offered evidence as to how often the laboratory actually reaches the wrong result due to human errors, instrument errors and errors due to the failure to follow FBI protocol. Defense expert Dr. Kessis has broadly estimated this rate of error at 1 in 200, but admitted that it could be somewhere in between 1 in 20 and 1 in 20,000. 3T39; 3T81. Therefore, defendant claims that the Government has not satisfied this criterion.

Laboratory error may only form the basis for exclusion of an expert opinion if "a reliable methodology was so altered ... as to skew the methodology itself..." *Paoli*, 916 F.2d at 858; accord *Beasley*, 102 F.3d at 1448. As noted, however, the defendant's argument is not based on evidence of actual errors by the laboratory, but instead has simply challenged the Government's failure to quantify the rate of laboratory error. To the contrary, the Government has demonstrated the scientific method has a virtually zero rate of error, and that it employs sufficient procedures and controls to limit laboratory error and thus, maintain the integrity of the method.

Defendant's argument on this score exhibits a fundamental misunderstanding of the principles of *Daubert*. The Court's concern under Rule 702 and *Daubert* is the reliability of the scientific methodology at issue, not the reliability of the laboratory performing the test. Put simply, "[a] laboratory's error rate is a measure of its past proficiency and is of little value in determining whether a test has methodological flaws." *Shea*, 957 F.Supp. at 340. What the defendant has sought to do here is challenge the proficiency of the tester rather than the reliability of the test. Such challenges go to the weight of the evidence, not its admissibility.¹³

¹² In the event that there is in fact no laboratory error, the Government has demonstrated that the probability of a random DNA match is one in 280 million. Contrary to the defendant's argument, the Government has not, however, argued that the probability of a random match is in fact the rate of error.

¹³ The Court is also persuaded by the NRC II's conclusion that

4. Standard's Controlling the Technique's Operation

The FBI maintains detailed quality control and quality assurance procedures to regulate the performance of forensic PCR and STR typing in its laboratory. As to quality control, the FBI has established a protocol to be followed in performing the PCR amplification and typing of the thirteen core STR loci using the Profiler Plus and COfiler kits. 1T121. The protocol provides a procedure for performing each stage of the amplification and typing process. *Id.* at 122. The FBI protocol was developed following research and validation studies on the methodology by members of both the FBI research unit and the case working unit. *Id.*

Dr. Budowle testified persuasively that the techniques set forth in the FBI protocol are valid and reliable for performing STR typing. *Id.* at 122-23. Dr. Budowle maintained that the protocol has been widely disseminated to the scientific community, and to his knowledge no peer-reviewed articles have concluded that the protocol is invalid or inadequate. *Id.*

In addition, the FBI laboratory maintains a Quality Assurance Program Manual for the forensic case working unit, as well as an audit process. *Id.* at 126. The quality assurance procedures include maintaining separate rooms with dedicated equipment for pre and post amplification samples; use of hoods and safety sheeting with chemical operations; use of gloves, masks, and pipettes; separation of the extraction of the question and reference samples; use of positive and negative controls in the amplification process; and technical peer review and administrative review of case work. *Id.* at 125-26.

Although the defendant does not challenge the existence of these procedures or their satisfaction of current industry standards, he relies upon his expert's testimony that the FBI procedures are inadequate under the procedures espoused in NRC I, which were changed in NRC II to the current standards. Therefore, it appears that defendant's qualm is with the current industry standards. The Court finds this argument to be wholly unpersuasive. The evidence clearly indicates that the FBI has imposed standards controlling its PCR/STR testing in accordance with standards set by the industry. The fact that the defendant thinks that the industry has promulgated insufficient standards is not a sufficient basis to challenge the admissibility of the PCR/STR methodology.

5. Relationship of the Technique to Established Reliable Methods

It is difficult to arrive at a meaningful and accurate estimate of the risk of such laboratory errors. For one thing, in this rapidly evolving technology, it is the current practice and not the past record of a laboratory that is relevant, and that necessarily means smaller numbers and consequent statistical uncertainty. For another, the number of proficiency tests required to give an accurate estimate of a low error rate (and it must be low to be acceptable) is enormous and would be outlandishly expensive and disruptive. *Trala*, 162 F.Supp.2d at 350 (citing NRC II at 24-25).

The Government has presented testimony demonstrating that PCR/STR typing is materially similar to other forms of DNA typing methods such as RFLP/VNTR, DQ-alpha and Polymarker which have been accepted as reliable. 1T28, 39. The Government has established that multiplex amplification and typing of STRs is related to earlier forms of PCR-based and RFLP-based multiplexing. Id. at 42-43. In addition, the method of typing STRs is similar to VNTRs in that both forms of typing are based on length variation. Id. STRs are merely a smaller subset of VNTRs, which allows for testing of smaller samples of DNA.

6. The Qualifications of the Government's Expert

There is no dispute that the Government's Expert was qualified to testify as such. As stated by defendant, "the quality of the expert witnesses on both sides has been very high[.]" Defendant's sole objection appears to be that, in light of the role the FBI has played in developing forensic technology, the Government's expert is biased in favor of the FBI. Defendant's vague assertions, however, do not provide a sufficient basis for the Court to deny admissibility of the expert's testimony. Questions of bias go to the credibility and weight of the evidence rather than its admissibility.

7. Nonjudicial Uses to which the Method Has Been Put

Lastly, the Government has demonstrated that PCR/STR technology is used outside the judicial context. The Government has shown that PCR methodology in general is used in such fields as medical research, agriculture and husbandry. 1T57, 78. Specifically, PCR/STR technology is used in paternity testing, husbandry, plant and bacteria identification of human remains from mass disasters. Id.; Government's Exhibit 4.

Defendant does not dispute that the PCR/STR technology employed here has found use outside the judicial context. However, defendant maintains that this factor should not weigh in favor of admissibility because the Profiler Plus and Cofiler materials kits which are used in the PCR/STR process include a disclaimer which provides "For research purposes only" and "Not for use in diagnostic systems." Thus, defendant argues, because the manufacturer is unwilling "to stand behind the results" in a context in which they might be subject to liability, the product's use outside the judicial context does not indicate that it is reliable. This argument lacks merit. The Court is unwilling to conclude that the use of disclaimer in an effort to avoid potential civil liability negates the fact that the testing is relied upon for various purposes outside the judicial context.

III. CONCLUSION

For the reasons discussed above, defendant's motion for a new trial is denied and the following findings and conclusions shall hereby supplement the Court's November 15, 2002 Order denying the defendants' motion to suppress the Government's DNA evidence and granting the Government's motion to admit the DNA evidence. An appropriate form of order is filed herewith.

ORDER

This matter comes before the Court upon defendant Carlton Ewell's motion for a new trial regarding the Court's admission of the Government's DNA evidence at trial; and the Court having considered the parties' submissions and having heard argument on the matter; and for the reasons stated in the Memorandum Opinion filed herewith;

IT IS this _____ day of _____, 2003;

ORDERED that the defendant's motion for a new trial is DENIED; and it is further ORDERED that the following findings and conclusions shall hereby supplement the Court's November 15, 2002 Order.