UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

UNITED STATES OF AMERICA, v. MIQUEL MORROW, *et al.*, Defendants.	Criminal Action No. 04-355 (CKK)

MEMORANDUM OPINION
(April 25, 2005)

Currently before the Court are several filings by the parties that relate to the Government's planned use of certain DeooxyriboNucleic Acid ("DNA") evidence in the trial. Specifically, the Court is confronted with: (1) Defendants' Joint Objections to the Government's Proposed DNA Evidence, filed on April 5, 2005; (2) Government's Opposition to Defendants' Joint Objection to the Government's Proposed DNA Evidence, filed on April 8, 2005; (3) Government's Supplemental Opposition to Defendants' Joint Objection to the Government's Proposed DNA Evidence, filed on April 11, 2005; (4) Defendant Malvin Palmer's Response to Government's DNA Pleadings, filed on April 13, 2005; (5) Defendant Miquel Morrow's Reply to the Government's Supplemental Opposition to the Defendant's Joint Objections to the Government's Proposed DNA Evidence, filed on April 14, 2005; and (6) Government's Reply to Defendant Palmer's and Morrow's Responses to the Government's Proposed DNA Evidence, filed on April 14, 2005.

These filings deal to a substantial degree with a question posed by the Court in an April 7, 2005 Scheduling Order. *See United States v. Morrow*, Crim. No. 04-355 (D.D.C. Apr. 7, 2005)

(scheduling order re: DNA evidence). In relevant part, the Court ordered legal briefing addressing two major issues:

> (1) whether the Government, in its direct case, may pro-actively present, through an expert, scientific evidence that does not conclusively identify a defendant, but also does not exclude a defendant as a possible match; and (2) whether the Government, if it cannot present such evidence in its direct case, may bring out such information during cross-examination or re-direct if the defense has opened the door by affirmatively arguing that the scientific evidence exonerates or provides no link to the defendants.

Id. at *1. Central to the Court's concerns was the impact of the Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), on DNA match probability data. Specifically, the Court was interested in the admissibility of DNA match probability information that fell below a certain level of statistical significance. In making this inquiry, the Court sought to establish the broad parameters for DNA evidence admission in the upcoming trial; it did *not* seek to make a final ruling concerning the admissibility of all DNA evidence. Upon a review of the legal briefing, some of the statistical probabilities involved in this case, and the relevant caselaw, the Court concludes that DNA evidence indicating a relatively low match probability significance may be introduced in the Government's presentation of its direct evidence, subject to certain parameters and restrictions.

I: BACKGROUND

On November 9, 2004, the Grand Jury in the above-captioned case returned a twenty-one count Superseding Indictment against the six remaining defendants in this case -- Miquel Morrow, Lionel Stoddard, Carlos Aguiar, Bryan Burwell, Aaron Perkins, and Malvin Palmer

(collectively, "Defendants").[1] Count I of the Indictment charges all six Defendants with a conspiracy to participate in a Racketeer Influenced Corrupt Organization ("RICO"), in violation of 18 U.S.C. § 1962(d), based upon alleged racketeering acts involving armed robberies of four banks in the District of Columbia (Acts 1-4) and two banks in the District of Maryland (Acts 5-6), as well as three acts involving murder (Acts 7-9). Count II charges all six Defendants with a conspiracy to commit offenses against the United States. Substantive charges involving armed bank robbery (Counts III, VIII, XII, and XVII), using or carrying a firearm during a crime of violence (Counts IV, IX, XIII, XVIII), unlawful possession of a firearm by a felon (Counts V-VII, X-XI, XIV-XVI, XIX), and assault with intent to kill (Counts XX-XXI), are charged against the specific defendants named in those counts. The armed robberies were allegedly accomplished while the Defendants brandished weapons and wore body armor, hoods, masks, bandanas, and heavy clothing to avoid identification. The assaults also involved the use of firearms.

As part of the planned prosecution of Defendants, the Government intends on introducing expert testimony connecting the DNA of certain defendants with DNA material left on specific items of evidence. *See* Gov't's Notice of Intention to Introduce Expert Testimony; Gov't's Suppl. Opp'n at 1. In January 2005, the Government submitted a large volume of DNA discovery materials to defense experts, including the results of testing done at the FBI Laboratory for DNA

[1] A substantially similar superseding indictment was returned on February 15, 2005, that deleted two of the previous counts, changing the numbering scheme. However, many of the motions concerning the validity of the Indictment were filed prior to this February date, and both the Government and the Defendants refer to the numbering scheme employed by the November 9, 2004 Superseding Indictment in their filings. As such, for purposes of clarity, the Court will refer to the numbering scheme used in the November 9, 2004 Indictment in this Opinion.

evidence. Gov'ts Opp'n at 1. As noted in the DNA discovery materials, the FBI Laboratory used the Polmerase Chain Reaction ("PCR") amplification method and analysis of Short Tandem Repeats ("STR") to test DNA samples in this case. Gov'ts Suppl. Opp'n at 2. To enable a fact-finder to understand the significance of the results, the FBI also calculated the coincidental, or "random match," probabilities that the DNA profile in the evidence sample would be found at random in the population based on population frequency data for four population groups -- that is, African-American, Caucasian, Southeastern Hispanic, and Southwestern Hispanic population groups. *Id.*

Each defendant in this case has a separate DNA expert, save for Defendants Perkins and Palmer, who share an expert. After the Government submitted its DNA discovery materials, these defense experts then conducted a review of the Government's DNA discovery. Upon such a review, Defendants have argued that "it is clear that some of the government's proffered DNA reports are of marginal statistical significance." Defs.' Joint Objections at 1, ¶ 2.

In response, the Government explains that its various DNA reports "showed varying results for different items, from the conclusion that a specific defendant was the contributor of a sample to the conclusion that a respective defendant could or could not be excluded as a potential contributor." Gov'ts Opp'n at 1. According to the Government, "[t]he items to which defendant Morrow appears to be objecting, *see* Defendants' Motion, ¶ 3, are those items where defendant could not be excluded as a potential contributor." *Id.* Going into more detail in its Supplemental Opposition, the Government notes that it has obtained DNA evidence in this case that shows a spectrum of five different kinds of results. Gov'ts Suppl. Opp'n at 2. These results range from:

> (1) to a reasonable degree of scientific certainty, defendant was the contributor of the sample; (2) defendant is potentially the major contributor in a mixed sample, *e.g.*, DNA from more than one individual; (3) defendant cannot be excluded as a potential contributor of the sample; (4) defendant cannot be excluded as potential major or minor contributor in a mixed sample; and (5) defendant was excluded as a potential contributor of the sample.

Id. at 2-3. When there was a "positive result," i.e., when a DNA sample fit into categories 1-4, the FBI Laboratory's report provides a statistical estimate of the probability of selecting an unrelated individual at random from the four population groups that would have the same DNA profile as observed in the item of evidence at issue. *Id.* at 3. According to the Government, "[t]hese numbers range from 1 in 280 billion for the conclusion that the defendant was the contributor, to such numbers ranging from as high as 1 in 16 billion to lower ratios such as 1 in 2,400 where a defendant is potentially a major contributor in a mixed sample, to such numbers as 1 in 20, or even as low as 1 in 1, where a defendant cannot be excluded as a contributor of a sample." *Id.* The Government emphasizes that it does not intend to discuss any instances where a defendant could not be excluded as a potential contributor in its opening statement, but that it intends to introduce such evidence at a later point. *See* Gov'ts Response to Def. Palmer's and Def. Morrow's Responses at 2.

Specifically, Defendant Morrow objects to the admission of four DNA samples: (1) Q62, which apparently shows that Defendants Morrow and Perkins cannot be excluded as potential contributors, although the probability of selecting an unrelated individual is 1:3 in the African-American population; (2) Q219, which shows that Defendants Morrow, Palmer, and Burwell cannot be excluded, although the probability of selecting an unrelated individual is 1:6 in the African-American population; (3) Q279, which shows that Defendant Morrow cannot be

excluded, although the probability of selecting an unrelated individual is 1:12 in the African-American population; and (4) K5, which shows that Defendant Morrow cannot be excluded, although the probability of selecting an unrelated individual is 1:1 in *all* populations. *See* Def. Morrow's Reply at 1, ¶ 1. At this time, Defendant Palmer also objects to the admission of three DNA samples: (1) Q219, as noted above in Defendant Morrow's objections; (2) Q319, which apparently indicates presence of DNA from more than one individual, including possibly Defendant Palmer, although the probability of selecting an unrelated individual is 1:7 in the African-American population; and (3) Q104, which indicates the presence of DNA from more than one individual, including possibly Defendants Palmer and Perkins, who cannot be excluded as potential contributors to the mixture, although the probability of selecting an unrelated individual is 1:7 from the African-American population. Def. Palmer's Response at 4, ¶ 10. In addition, Defendant Palmer objects to "being included in the 'African-American' population of the United States since he is Jamaican by birth and does not share the population genetics characteristics of African Americans." *Id.* at 1-2, ¶ 3. In response, the Government notes that the FBI Laboratory will "also run the samples found that matched for defendant Palmer using the [sic] a Caribbean population group data base, which includes individuals from Jamaica, Trinidad and the Bahamas." Gov'ts Reply to Def. Palmer's and Def. Morrow's Responses at 1-2. According to the Government, the results from this comparison should "be done within a couple of weeks, but that the resulting ratios would be somewhat similar." *Id.* at 2.

II: DISCUSSION

Two central issues are before the Court, and an investigation of each is necessary to answer the questions posed by this Court in its April 7, 2005 Scheduling Order. First, the Court

must analyze whether the Government's PCR amplification method and STR analysis to test DNA samples in this case comports with the requirements concerning expert scientific testimony laid down by the Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), and *Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999). Second, the Court must examine whether DNA evidence indicating a relatively low level of statistical significance should be excluded from either direct presentation or introduction on cross-examination under either the principles inherent in *Daubert* or Federal Rule of Evidence 403, which excludes relevant evidence when its "probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence." Fed. R. Evid. 403. The Court shall conduct an inquiry into each issue in sequence.

A. The Use of the PCR/STR DNA Methodology Comports With the Requirements of Daubert

The specific DNA methodologies employed by the Government in this case -- using the PCR amplification method coupled with STR analysis to test available DNA samples -- have been extant for over a decade, and are widely used in criminal cases. In order to determine whether the Court even needs to conduct an analysis of the admissibility of DNA evidence with a low statistical significance, the Court must first determine the threshold question of whether the Government's PCR/STR methodology, as a general rule, meets the requirements of *Daubert*. As such, the Court shall (1) conduct a brief overview of the DNA typing methodology at issue in this case, and (2) then proceed to examine the general acceptance of the methodology in various

jurisdictions.

1. Overview

i. *The Basics*

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% does not vary from person to person, no two persons other than identical twins have the same DNA. *See* National Research Council, *The Evaluation of Forensic DNA Evidence* 63 (1996) ("NRC II"); *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).[2]

Human DNA is organized into 23 pairs of chromosomes and each chromosome contains a DNA molecule. DNA molecules have a classic double-stranded helical structure that can be envisioned as a spiral staircase. *See* National Research Council, *DNA Technology in Forensic Science* 2 (1992) ("NRC I"). 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

[2] Much of the Court's scientific discussion is taken almost verbatim from Judge Barbadoro's authoritative opinion in *United States v. Shea*, 957 F. Supp. 331 (D.N.H. 1997). Numerous courts in a multitude of jurisdictions have used *Shea* as a jumping off point for their scientific analyses, and have found its lucid examination nearly definitive on the subject. *See, e.g.*, *United States v. Ewell*, 252 F. Supp. 2d 104, 106 (D.N.J. 2003); *United States v. Gaines*, 979 F. Supp. 1429, 1431-32 (S.D.Fla. 1997). For a further analysis of this subject, see these decisions and also *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 (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); and *United States v. Trala*, 162 F. Supp. 2d 336, 341-42 (D.Del. 2001).

with G's. As such, if the sequence of bases on one side of the DNA molecule is known, the corresponding sequence of bases on the other side can be deduced. Importantly, the actual arrangement of base pairs in chromosomal DNA comprises the genetic code that differentiates humans from non-humans and makes every person unique. *See* Elaine J. Mange & Arthur P. Mange, *Basic Human Genetics* 19-20 (1994).

In total, the DNA molecules in the 23 pairs of human chromosomes contain roughly 3.3 billion base pairs. While most of these base pairs are arranged in the same sequence in all humans, every DNA molecule has regions known as "polymorphic sites" where variability is found in the human population. *See* NRC II, *supra*, at 62-63. Each possible arrangement of base pairs that occurs at a polymorphic site is referred to as an "allele." Alleles can result from a difference in a single base pair, differences in multiple base pairs, or differences in the number of base pairs that comprise a site.[3]

ii. *PCR/STR Typing*

Because there is no way to sequence and compare all 3.3 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

[3] The combination of alleles from corresponding sites on a chromosome pair is often referred to as the site's "genotype." *Id.* at 216. 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"; however, 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. *Id.* at 15.

FBI Laboratory in the instant matter is commonly referred to as PCR/STR typing.[4] PCR/STR typing begins with the PCR amplification process. PCR is not itself a method of DNA typing, but is instead a technique of sample preparation. PCR is a laboratory process for copying a short segment of DNA millions of times, thereby replicating the natural DNA duplication process. 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 sub-analytical quality. The principal benefit of the PCR process is that it enables the forensic analysis of very tiny amounts of DNA.

The PCR process has three steps. First, the double-stranded segment of DNA is separated into two strands by heating. 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. Second, each of the single strand segments are hybridized with short DNA segments known as "primers," that are designed to bind with single strand segments at particular loci. These primers are designed to compliment a sequence just outside of a target sequence of bases. Third, each primer is the starting point for the replication of the target sequence. At this point, an enzyme known as "polymerase" becomes active, facilitating repeated additions of bases to the primer until a new complimentary strand of the targeted DNA locus is created. Accordingly, the PCR process replicates the initial double-stranded molecule into *two* copies.

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[4] At this point, the Court's Opinion begins closely tracking the recent decision in *United States v. Ewell*, 252 F. Supp. 2d 104 (D.N.J. 2003), that concerned many of the same evidentiary issues currently before this Court.

This PCR process is repeated numerous times, 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 may use a process known as "multiplexing." Multiplexing allows the lab to type the DNA sample at multiple sites by adding additional primers which will bind simultaneously to their respective target sites.

At this point, STR analysis comes into play. 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. 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. During the electrophoresis process, the amplified fragments pass through a gel and through a detection window at the end of the gel. When the fragments pass through the detection window, a laser fires, striking the fluorescent tags and causing them to emit light. At that moment, 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. The faster a fragment moves through the window, the smaller it is in size.

The data generated as a result of electrophoresis is analyzed by a computer software program, which determines the size of the alleles based on the rate at which they reach the detection window. The software detects the light being emitted, and converts it into peaks of different sizes. 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.

iii. *Use of PCR/STR Typing in Criminal Cases*

The PCR method is different in nature than the older Restriction Fragment Length Polymorphism ("RFLP") DNA testing. RFLP testing involves a much more detailed analysis of long strands of DNA, and seeks to establish a "match" between a sample and a particular individual. *See United States v. Chischilly*, 30 F.3d 1144 (9th Cir. 1994), *cert. denied*, 513 U.S. 1132, 115 S.Ct. 946, 130 L.Ed.2d 890 (1995) (approving the admission of RFLP evidence under the *Daubert* test). The amount of DNA required for testing varies between the different procedures -- RFLP analysis, which often generates specific results and statistical "matches" of a sample to a particular individual, requires a relatively large sample with a high quality in order to generate viable results. However, because forensic evidence is sometimes old, degraded, or of smaller quantity than RFLP requires, the newer PCR testing method is frequently employed by forensic scientists.

The PCR method can test much smaller samples than the RFLP procedure. However, because it is an amplification process and not a genetic test, PCR testing is generally not used as a method to establish a statistical "match" between a sample and an individual. Rather, it is used as a technique to *exclude* certain individuals as possible contributors to a particular sample. *See Hicks*, 103 F.3d at 845; *State v. Grayson*, Crim. No. K2-94-1298, 1994 WL 670312, at *2 (Minn.

Dist. Ct. Nov. 8, 1994) ("PCR analysis is not as discriminating. The narrow scope of the test limits potential donors to a few percent of the population and therefore is a means to exclude possible defendants rather than identify."); *State v. Penton*, Crim. No. 9-91-25, 1993 WL 102507, at *2 (Ohio Ct. App. Apr. 7, 1993) ("Unlike RFLP/DNA analysis, PCR/DNA can not get you down to one person but excludes a percentage of the population."); *see also* NRC II, *supra*, at 178 & n.33 ("[T]he individual loci used in current PCR-based tests are less polymorphic than VNTR loci; as a result, the multilocus genotype frequencies from PCR-based tests typically are not as small as those in VNTR testing.").

Each individual has a particular "type" that appears following PCR testing, called an "HLA-DQ alpha genotype."[5] There are only 21 possible "types" that can be found in humans. The frequency of occurrence for each PCR type varies throughout the human population. In this way, PCR testing can be compared to the more traditional methods of forensic testing, including the use of blood evidence (under the ABO system) or hair sample evidence. Neither of the traditional methods singles out a particular individual as matching a particular sample, but both methods can exclude individuals as possible contributors if they are not within the blood type or hair sample type. As a concept, the use of PCR typing to exclude individuals as possible contributors to a particular DNA sample is strikingly similar.

Accordingly, after a laboratory has typed and compared the two DNA samples -- i.e., the sample from a crime scene or item of evidence and the sample from a defendant -- and the samples are found to be sufficiently similar that they could have originated from the same source,

[5] This subsection of the Opinion relies almost verbatim on the Ninth Circuit's decision in *United States v. Hicks*, 103 F.3d 837 (9th Cir. 1996).

the next step is for an analyst to perform a statistical analysis to determine the significance of the comparison. That is, the analyst will reach some inference about how common or rare the particular DNA profile is based on population frequency data. 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 result to account for inbreeding[6] or substructuring[7] effects in the population, as well as applying additional statistical qualifications. In other words, the statistical frequency of the DNA profile is calculated using a statistical concept known as the "product rule."

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. In addition, the FBI Laboratory has adopted the recommendation of the National Academy of Sciences in NRC II and increases a calculated profile frequency by a factor of ten in order to correct for genetic or sampling variation that might occur.[8] 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

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[6] "Inbreeding" refers to the mating of two persons who are more closely related than if they were chosen at random. *See* NRC II, *supra*, at 98.

[7] "Substructuring" refers to the tendency toward decreasing genetic heterogeneity and allelic independence exhibited by ethnically homogenous, non-randomly mating populations. In other words, "a substructured population may be defined as one in which the probability of a random match between two of its members is greater than the likelihood of such a match between two members of the population at large." *Chischilly*, 30 F.3d at 1153 n.10.

[8] The general concept of using the theta inbreeding coefficient correction has been known since the 1950s. As noted, the FBI uses a theta value of 0.01, which it deems is "highly conservative."

smaller than 1 in 280 million. If the frequency is higher than this ratio, then the defendant will fall into one of the remaining four categories of results, depending on the exact size of the ratio -- i.e., "potentially the major contributor in a mixed sample," "cannot be excluded as a potential contributor of the sample," "cannot be excluded as a potential major or minor contributor in a mixed sample," and "excluded as a potential contributor of the sample."

2. PCR/STR Testing Under a *Daubert* Analysis

Federal Rule of Evidence 702 governs the use of expert testimony in federal courts. In relevant part, Rule 702 provides: "[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue," an expert "may testify thereto." Fed. R. Evid. 702. In other words, Rule 702 has three requirements as to expert opinions: (1) the witness must be an expert; (2) the witness must testify to scientific, technical, or other specialized knowledge; and (3) the testimony must assist the trier of fact. *See United States v. Velasquez*, 64 F.3d 844, 849 (3d Cir. 1995) (citations omitted). The Supreme Court's decision in *Daubert v. Merrell Dow Pharmaceuticals*, 509 U.S. 579, 113 S.Ct. 2786, 125 L.Ed.2d 469 (1993), established a gatekeeping role for trial court judges in determining the admissibility of expert testimony on scientific evidence.

> [T]he trial judge must determine at the outset, pursuant to Rule 104(a), whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology can be applied to the facts in issue.

Id. at 592-93, 113 S.Ct. 2786. As such, *Daubert* directs district courts to ensure that evidence presented by expert witnesses is relevant, reliable, and helpful to the jury's evaluation of such

evidence. *Id.* at 597, 113 S.Ct. 2786; *see also Kumho Tire Co. v. Carmichael*, 526 U.S. 137, 119 S.Ct. 1167, 143 L.Ed.2d 238 (1999) (extending gatekeeping obligations to non-scientific testimony as well as scientific testimony).

When an expert bases opinion testimony on scientific knowledge, the testimony will not be admitted unless it is derived by the scientific method and is supported by "appropriate validation." *Daubert*, 509 U.S. at 590, 113 S.Ct. 2786. Importantly, this standard of evidentiary reliability focuses on the scientific validity of the expert's methods rather than the soundness of his specific conclusions. *Id.* at 589, 113 S.Ct. 2786 ("[the] inquiry into the reliability of scientific evidence . . . requires a determination as to its scientific validity"). An expert's opinion is reliable if it is based on the "methods and procedures of science" rather than on "speculative belief or unsupported speculation" -- i.e., the expert must have "good grounds" for his or her belief. *Id.* To aid a district court's analysis, the *Daubert* Court established the following non-exclusive list of factors to guide the assessment of the reliability of scientific evidence: (1) whether a scientific theory or technique can be (and has been) tested; (2) whether the theory or technique has been subjected to peer review and publication; (3) the known or potential rate of error and the existence and maintenance of standards controlling the technique's operation; and (4) whether the technique is generally accepted. *Id.* at 593-94; 113 S.Ct. 2786. As noted above, the inquiry is "a flexible one" focusing on "the principles and methodology underlying the proffered evidence rather than the conclusions they generate." *Chischilly*, 30 F.3d at 1152. Ultimately, the Court must also be "mindful" of the "danger of unfair prejudice, confusion of the issues, or [potential for] misleading the jury." *Daubert*, 509 U.S. at 595, 113 S.Ct. 2786 (quoting Fed. R. Evid. 403).

Over the past decade, numerous federal courts in a variety of jurisdictions have analyzed whether the introduction of DNA evidence garnered from the FBI Laboratory's use of PCR/STR analysis comports with the requirements laid down in *Daubert*. These courts have been virtually unanimous in finding that the use of PCR DNA testing is admissible, and many of these courts have taken judicial notice of the general reliability of such tests. *See, e.g.*, *United States v. Wright*, 215 F.3d 1020, 1027 (9th Cir. 2000), *cert. denied*, 531 U.S. 969, 121 S.Ct. 406, 148 L.Ed.2d 313 (2000); *Hicks*, 103 F.3d at 846-47; *Beasley*, 102 F.3d at 1448 (taking judicial notice of general reliability of PCR testing); *Shea*, 957 F. Supp. at 338-39; *Ewell*, 252 F. Supp. 2d at 106 (looking specifically at PCR/STR testing and listing twelve state appellate court cases finding PCR/STR DNA testing to be scientifically reliable); *United States v. Cuff*. 37 F. Supp. 2d 279, 282 (S.D.N.Y. 1999); *Gaines*, 979 F. Supp. at 1433-36 n.4 (collecting at least twenty state appellate court cases finding PCR DNA testing to be scientifically reliable); *Trala*, 162 F. Supp. 2d at 351 (looking specifically at PCR/STR testing); *United States v. Lowe*, 954 F. Supp. 401, 416-17, 420-21 (D. Mass. 1997) (collecting approximately twenty state appellate court cases finding that PCR testing methodology comports with *Daubert*). As the district court in *Shea* explained in 1997,

> although PCR is a relatively new technology, it is based on sound scientific methods and it has quickly become a generally accepted technique in both forensic and non-forensic settings. Perhaps the strongest evidence on this point is the conclusion reached by the National Research Council's Committee on Forensic DNA Science that "the molecular technology [on which PCR is based] is thoroughly sound and . . . the results are highly reproducible when appropriate quality-control methods are followed." NRC II, *supra*, at 23; *see also* Mange, *supra*, at 287 (noting PCR's "widespread and growing applications [in the field of molecular biology]").

Shea, 957 F. Supp. at 338-39; *see also Gaines*, 979 F. Supp. at 1435 ("the PCR method of

analysis for these general markers had been tested extensively, and, when the FBI Protocol is followed, the analysis consistently generates true results").

Given the weight of this authority, this Court concludes that, as a general matter, PCR/STR DNA testing meets the strictures of *Daubert* and is admissible. Moreover, none of the Defendants have argued, to date, that PCR/STR testing is not generally reliable. However, as the Eighth Circuit emphasized in *United States v. Martinez*, 3 F.3d 1191 (8th Cir. 1993), "[t]he fact that we have taken judicial notice of the reliability of the technique of DNA profiling does not mean that expert testimony concerning DNA profiling its automatically admissible under *Daubert*. A number of courts have required that the trial court further inquire into whether the expert properly performed the techniques involved in creating the DNA profile." *Id.* at 1197; *cf. United States v. Perry*, Crim. No. 92-474, 1994 U.S. Dist. LEXIS 20463, at *4 (D.D.C. Jan. 11, 1994) ("Having carefully reviewed the relevant case law, the Court continues to hold that it is proper to take judicial notice of the FBI's DNA profiling techniques."). As such, there must be "a preliminary showing that the expert properly performed reliable methodology in arriving at his opinion." *Id.* at 1197-98. As the *Martinez* court explained,

> the court should make an initial inquiry into the particular expert's application of the scientific principle or methodology in question. The court should require the testifying expert to provide affidavits attesting that he properly performed the protocols involved in DNA profiling. If the opponent of the evidence challenges the application of the protocols in a particular case, the district court must determine whether the expert erred in applying the protocols, and if so, whether such error so infected the procedure as to make the results unreliable.

Id. at 1198 (emphasizing that this inquiry "is of necessity a flexible one").

For the purposes of this dispute, the Court finds that the Government's use of PCR/STR testing is likely to be admitted as evidence. Of course, the admission of such evidence will be

contingent upon a showing by the Government that the techniques, methods, and practices used in the testing in this case, as well as the expert's qualifications, meet with the generally accepted and established protocols. Assuming *arguendo* that Defendants do not challenge this area of inquiry or that if challenged, the Government can make such a showing, and therefore satisfy *Daubert* generally, the Court shall turn to the second question posed, and inquire into whether DNA evidence indicating a relatively low level of statistical significance should be excluded from either direct presentation or introduction on cross-examination under either the principles inherent in *Daubert* or Federal Rule of Evidence 403.

B. DNA Evidence Resulting in a Relatively Low Level of Statistical Significance May Still Be Admissible Under Daubert and Fed. R. Evid. 403

As identified by Defendants Morrow and Palmer, certain DNA evidence in this case appears to have a relatively low level of statistical significance, ranging from a 1:12 probability of selecting an unrelated individual in the relevant population to a 1:1 probability of selecting an unrelated individual. The Court, in its April 7, 2005 Scheduling Order, asked the parties to examine whether such evidence may be pro-actively presented in the Government's direct case, despite the fact that it does not conclusively identify a defendant, or whether it could be presented during cross-examination or re-direct. Defendants Morrow and Palmer essentially note two problems with DNA evidence that has such a low statistical significance. First, Defendant Morrow suggests that he "has been unable to find any case law on the admissibility of statistical probabilities as low as those stated herein." Def. Morrow's Reply at 3. Defendant Morrow, through his expert, Professor Moses Schanfield, goes on to indicate that "the statistical probabilities in the above evidence is [sic] below the accepted industry standards." *Id.*, Ex. A

(4/14/05 Schanfield Memo) at 1 ("none of the evidence above would meet standards of certainty required for civil parentage testing"). Second, both Defendant Morrow and Defendant Palmer object to the significant "prejudicial effect of the scientific color of the evidence as presented." *Id.* at 3. Defendants claim that (1) "the jury will be overawed by the small numbers and ignore other aspects of the case"; (2) "the jury will misconstrue the probability of a random match . . ., i.e., [by wrongly concluding that the ratio means] that there is a 1:6 chance that he is not the source of the DNA so there must be a 5:6 chance that he is the source of the DNA"; and (3) "the probability ignores the possibility of false positives findings due to sample mishandling or other blunders." Def. Palmer's Response at 3, ¶ 9.

1. Case Law, DNA of a Low Statistical Significance, and *Daubert*

The Court begins by noting that the best practice is to include statistical data on the frequency of the matching characteristics in the relevant reference population when admitting DNA evidence. *See* NRC I, *supra*, at 74-75 ("DNA 'inclusions' cannot be interpreted without knowledge of how often a match might be expected to occur in the general population"); NRC II, *supra*, at 192 ("[i]t would not be scientifically justifiable to speak of a match as proof of identity in the absence of underlying data that permit some reasonable estimate of how rare the matching characteristics are"); *see also Cuff*, 37 F. Supp. 2d at 282 ("Without statistical data on the frequency of the matching characteristics in the relevant reference population . . . the jury was left to speculate about the value of the DNA evidence."). However, Defendants are correct in their argument that many of the published cases dealing with DNA evidence have concerned evidence that was much more statistically significant than is the case here -- i.e., the chances of a "random match" with another member of the population reference group was significantly lower

than here. *See, e.g.*, *Ewell*, 252 F. Supp. 2d at 113 n.12 ("the probability of a random DNA match is one in 280 million"); *Gaines*, 979 F. Supp. at 1431 (probability of random match ranged from 1 in 6.1 million to 1 in 170 million); *Lowe*, 954 F. Supp. at 403 (match probability ranged from 1 in 11 billion for the Caucasian population to 1 in 810,000 for the same population); *Shea*, 957 F. Supp. at 335 (probability of random match in Caucasian population was 1 in 200,000); *United States v. Bonds*, 12 F.3d 540, 551 (6th Cir. 1994) (random match probability was 1 in 35,000); *Martinez*, 3 F.3d at 1193 (probability of a random match from the American Indian population was 1 in 2600); *People v. Givens*, 53 Cal.App.4th 554, 61 Cal.Rptr.2d.816, 818 (1999) ("Testing determined that the DNA from the towel was consistent with the pattern of appellant's DNA, and that it could be expected to occur in 1 out of every 30 African-Americans."). However, other courts have apparently allowed DNA evidence into admission when the statistical significance of the data was relatively low and the probability of a random match in the relevant population was rather high. *See, e.g.*, Cuff, 37 F. Supp. 2d at 280 ("The test is said to prove that tissue found under Shine's fingernails contained DNA not his own, and that Cuff cannot be excluded as the source of that foreign DNA."); *Hicks*, 103 F.3d at 844 ("none of the three perpetrators could be excluded as a contributor to the sample").

The Court begins its analysis by noting a principal laid down by the D.C. Circuit in *Ambrosini v. Labarraque*, 966 F.2d 1464 (D.C. Cir. 1992). In *Ambrosini*, the D.C. Circuit reminded trial courts that "[w]hen a court denies the right to have a jury decide a disputed issue, especially one of a scientific nature, its reasons for doing so must be strong." *Id.* at 1469 (citing *Ferebee v. Chevron Chem. Co.*, 736 F.2d 1529, 1535 (D.C. Cir. 1984) (expert opinion based on sound scientific methodology presents "a classic battle of the experts, a battle in which the jury

must decide the victor")). Given this dominant perspective, courts have been loathe to exclude DNA evidence in any way, as long as the methods used to gather such evidence comport with *Daubert*. As the *Daubert* Court itself stressed, exclusion of conclusions based on sound methodology is not the proper course; rather, "[v]igorous cross-examination, presentation of contrary evidence, and careful instruction on the burdens of proof are the traditional and appropriate means of attacking shaky but admissible evidence." *Daubert*, 509 U.S. at 596, 113 S.Ct. 2786. Indeed, "[i]n a real trial setting, the parties are given the opportunity to explain the significance of statistical evidence through expert testimony. Further, if a trial judge concludes that jurors could be confused by statistical evidence, the judge can deliver carefully crafted instructions to insure that the evidence is properly understood." *Shea*, 957 F. Supp. at 345.

Two cases are particular relevant to the Court's current inquiry. First, in *United States v. Bonds*, 12 F.3d 540 (6th Cir. 1994), the Sixth Circuit, in conducting a Rule 403 balancing of certain DNA evidence, found that the evidence was "clearly probative" because it "linked [defendant] to the murder scene when no direct evidence existed to do so." *Id.* at 567. The Sixth Circuit found that "[t]he aura of reliability surrounding DNA evidence does not present the prospect of a decision based on the perceived infallibility of such evidence, especially in a case such as this where the evidence is largely circumstantial." *Id.* at 567-68. This case is similar: the DNA evidence in question here has probative value because it shows that certain defendants cannot be excluded from a connection to particular articles of evidence. With these same circumstances, the Sixth Circuit determined that the evidence was admissible under Federal Rule of Evidence 403, because (1) "the theory of matching DNA patterns and the FBI's procedures were scientifically valid," and (2) "[d]efendants 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 not infallible." *Id.* at 568. Importantly, the *Bonds* court stressed that "defendants' concern that the jury relied unduly on this circumstantial DNA evidence cannot be resolved by excluding the evidence under Rule 403." *Id.* Rather, "[t]heir concern is accommodated through a Rule 29 motion for judgment of acquittal to assure that the Government produced enough evidence, circumstantial or direct, to support a jury verdict." *Id.* (citing *Daubert*, 509 U.S. at 596, 113 S.Ct. 2786 ("the court remains free to direct a judgment and likewise to grant summary judgment") (citations omitted); *United States v. Reifsteck*, 841 F.2d 701, 703 (6th Cir. 1988)).

Second, the Ninth Circuit's decision in *United States v. Hicks*, 103 F.3d 837 (9th Cir. 1996), is also particularly relevant. Similar to the instances of low statistical DNA significance identified by Defendants Morrow and Palmer, "the PCR testing [in *Hicks*] did not result in a statistical probability that Hicks contributed to the sample; it *only* concluded that Hicks could not be excluded as a contributor to the sample." *Id.* at 846 (emphasis in original). Upon a Rule 403 analysis of the evidence, the Ninth Circuit found:

> Besides the doubtful prejudice that the single PCR result produced in this case (since none of the three perpetrators could be excluded as possible contributors to the sample), the evidence had the probative value of helping to identify the carjackers. It was almost certainly not sufficient evidence to identify Hicks as one of the carjackers, but it helped to corroborate other evidence of identity to build a wall of evidence supporting that conclusion. The probative value of the PCR results was not substantially outweighed by the prejudice to Hicks of the evidence.

Id. Likewise, the particular DNA matches identified by Defendants Morrow and Palmer do not show a significant statistical probability that they contributed to those samples; however, they do show that the defendants cannot be excluded as contributors. As such, the DNA evidence

remains probative, and helps to corroborate other evidence and support the Government's case as to the identity of the relevant perpetrators. Indeed, the low statistical significance actually benefits Defendants, as Defendants can argue that having random match probabilities running between 1:12 and 1:1 means that hundreds, if not thousands, of others in the Washington, D.C. area cannot be excluded as possible contributors as well. *See Cuff*, 37 F. Supp. 2d at 282 ("Here, it seems likely, in view of Cuff's submissions, that at least on cross-examination it will be brought out that non-exclusion of Cuff means also non-exclusion of tens if not hundreds of thousands of others in the New York area alone."). Given this avenue of attack, Defendants may significantly reduce any prejudice from the introduction of low-value DNA evidence.

The Court notes several important flaws within defendants' present lines of attack. First, Defendant Morrow's expert, Professor Schanfield, admits his lack of experience in this area. Professor Schanfield candidly states, "I am not aware of industry standards for the presentation of statistical evidence in forensic cases." Def. Morrow's Reply, Ex. A (4/14/05 Schanfield Memo) at 1. Despite his lack of experience or awareness, Professor Schanfield notes that, "in paternity cases it is currently accepted practice that the exclusionary power of the test, i.e. the likelihood that you will exclude a false accused father has to be 99.9% or greater." *Id.* (emphasizing that "none of the evidence above would meet standards of certainty required for civil parentage testing"). However, Professor Schanfield is conflating two very different concepts in his analysis. DNA testing for parentage often allows experts to compare two very long strands of DNA and conduct an extremely detailed analysis; this is largely because the sample (i.e., the child) and the individual tested for a match (i.e., the potential father) are both present and are compelled to submit to extensive testing. Accordingly, scientists, because they have more to

compare, can have greater certainty in their conclusions.

In contrast, *see supra* Section II(A)(1)(iii), experts must resort to PCR/STR testing when the evidence sample is old, degraded, or in insufficient quantity to conduct an analysis using another DNA methodology -- such as the RFLP method. PCR testing, by its very nature, is not a test of "inclusion," or certainty. Rather, PCR is a technique to *exclude* certain individuals as possible contributors to a particular sample, much like blood or hair sample testing. Instead of having specific accuracy cutoffs, PCR testing admits its basic potential for error: it is founded upon random match probabilities. As compared to parentage testing, which seeks to answer "yes" or "no" in a definitive manner, PCR testing presents the jury with a sliding scale wherein the evidence's probative value depends, in large part, on its random match probability. Indeed, as numerous courts have realized, because PCR testing creates a sliding scale of evidence, it is improper for a court to step in and demarcate some arbitrary random match probability ratio, above which evidence will be hidden from the jury. Instead, the DNA evidence should be presented to the jury, which -- after cross-examination and careful consideration -- may afford it the weight that it is due. As the *Chischilly* court described, "statistical evidence derived from sample processing and match analysis, with established, peer-reviewed laboratory protocols, is certainly probative of the defendant's guilt or innocence. Where the district court provides careful oversight, the potential prejudice of the DNA evidence can be reduced to the point where this probative value outweighs it." *Chischilly*, 30 F.3d at 1158. Given this framework, DNA evidence of a low statistical significance may remain proper under a Rule 403 analysis. The Court does note that Defendants shall certainly have another opportunity to address all issues relating to DNA evidence once their experts have reached their conclusions. Indeed, the Court

itself may make further inquiry into certain DNA-related issues, e.g., the probative value of a 1:1 random match probability in all populations, before issuing its final DNA-related decision.

2. Other Issues in DNA Testing

As noted above, Defendant Palmer makes three general arguments relating to the Government's announced DNA evidence: (1) "the jury will be overawed by the small numbers and ignore other aspects of the case"; (2) "the jury will misconstrue the probability of a random match . . ., i.e., [by wrongly concluding that the ratio means] that there is a 1:6 chance that he is not the source of the DNA so there must be a 5:6 chance that he is the source of the DNA"; and (3) "the probability ignores the possibility of false positives findings due to sample mishandling or other blunders." Def. Palmer's Response at 3, ¶ 9. While Defendant Palmer is right to point out certain broad issues with DNA testing that could arise, the simple potential for problems does not entail that all DNA testing should be inadmissible.

First, while Defendant Palmer claims that the "jury will be overawed by the small numbers and ignore other aspects of the case," Def. Palmer's Response at 3, ¶ 9, such a contention is incongruent with his underlying argument. Here, Defendant Palmer complains about DNA evidence with a random match probability between 1:6 and 1:7. *Id.* at 4, ¶ 10. Given the size of the African-American population in the greater Washington, D.C. area, these ratios are not particularly significant, as tens of thousands of other individuals could be a random match to the samples in question. As such, it is highly unlikely that the jury will be "overawed" and vote to convict based on such evidence alone.

Second, Defendant Palmer also cites to what is more formally called "the fallacy of the transposed conditional, or the prosecutor's fallacy." *Id.* at 3, ¶ 9; *see also Shea*, 957 F. Supp. at 345. This fallacy represents incorrect reasoning -- i.e., when the jury "will confuse the probability of a random match with the potentially very different probability that the defendant is not the source of the matching samples." *Shea*, 957 F. Supp. at 345. As the Ninth Circuit stressed in *Chischilly*, the Government must be "careful to frame the DNA profiling statistics presented at trial as the probability of a random match, not the probability of the defendant's innocence that is the crux of the prosecutor's fallacy." *Chischilly*, 30 F.3d at 1158. While this is a very real danger, the courts that have dealt with this potential problem have found that careful oversight by the district court and proper explanation can easily thwart this issue. *See Chischilly*, 30 F.3d at 1158; *Shea*, 957 F. Supp. at 345.

Third, and finally, Defendant Palmer points to the fact that "the probability ignores the possibility of false positives findings due to sample mishandling or other blunders." Def. Palmer's Response at 3, ¶ 9. The Court notes that there are three kinds of errors that may be relevant vis-á-vis DNA testing: (1) a laboratory's past error rate; (2) the error rate that results if an analyst follows the FBI protocol and uses properly calibrated instruments in the specific case at hand; and (3) the possibilities of human error in the specific test at hand. At this point, Defendants have not attacked the Government's proposed DNA evidence under a theory that the results were the product of any of these three kinds of error; however, the Court shall identify the relevant legal framework for each type of error in the event that Defendants attempt to undermine the evidence at a later point.

First, the district court in *Ewell* dealt with a challenge relating to the first kind of possible error, i.e., a laboratory's past error rate, and found:

> 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.

Ewell, 252 F. Supp. 2d at 114; *cf. Shea*, 957 F. Supp. at 344 n.42 (discussing the possibility that the laboratory or industry error rate might be inadmissible propensity evidence). Accordingly, while it is possible that the FBI Laboratory's past error rate in other tests may not be admissible in this case, as it could be considered illegitimate propensity evidence, it is also possible that such evidence, if admitted, would go to the weight of the Government's results and not its exclusion.

Second, while Defendants have not challenged the adequacy of the FBI's DNA testing protocols at this point, it is possible at a hearing or at trial that Defendants may assert that the basic PCR/STR protocols employed across the board by the FBI contain a certain risk of error. The Government would then have to introduce testimony and evidence relating to their general protocols and discuss the error rate resulting from a perfect application of their guidelines. In *Ewell*, the court held a hearing relating to this type of issue, and concluded that, in the context of the FBI's PCR/STR DNA testing protocols, "[t]he 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." *Ewell*, 252 F. Supp.

2d at 113. Accordingly, assuming that Defendants challenge the actual PCR/STR protocols employed by the FBI, it may well turn out to be the case that -- as numerous courts have concluded -- the FBI's protocols easily meet the reliability concerns inherent within *Daubert* by containing a negligible or nonexistent error rate.

Third, there is also the type of error that Defendant Palmer specifically singles out: human error in the laboratory that may produce "sample mishandling." Def. Palmer's Response at 3, ¶ 9. As the Eighth Circuit noted, "[i]n every case, of course, the reliability of the proffered test results may be challenged by showing that a scientifically sound methodology has been undercut by sloppy handling of the samples, failure to properly train those performing the testing, failure to follow the appropriate protocols, and the like." *Beasley*, 102 F.3d at 1448. The Court emphasizes two considerations as to this type of error. First, Defendants, at a potential hearing or in trial, may well (1) cross-examine the Government's DNA experts in order to discover the Government's estimated rate of human laboratory error or uncover actual human error in a specific test, and/or (2) have their DNA experts estimate the possibilities of human error. However, it is important to stress that under *Daubert*, "[l]aboratory 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* . . . ." *Ewell*, 252 F. Supp. 2d at 113 (quoting *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)) (emphasis added); *see also Beasley*, 102 F.3d at 1448. As such, in order to exclude probative DNA evidence, Defendants will have to show that the FBI Laboratory's alleged deficiencies in a specific test so altered the PCR/STR methodology as to make the test inadmissible. *Beasley*, 102 F.3d at 1448. If actual or potential human errors do not rise to this

level, they simply go to the weight of the DNA evidence proffered. *See* NRC II, *supra*, at 6-12 ("Most courts have decided that [criticisms about contamination potential of forensic PCR analysis] are pertinent to assessing the weight of the evidence, but do not warrant the wholesale exclusion of PCR-based tests.") (footnotes omitted).

Moreover, based on the phrasing of Defendant Palmer's objection -- "the probability ignores the possibility of false positives findings due to sample mishandling and other blunders," Def. Palmer's Response at 3, ¶ 9 -- it appears as though Defendant Palmer is objecting to the fact that the random match probabilities announced by the Government do not include the possible error rate. In other words, it seems as though Defendant Palmer takes issue with the failure of the Government to produce a single ratio that merges the error rate with the random match probability ratio into one final figure so that the jury can look at one equation and ask: "Based on the relevant population group that a defendant falls into and the possibility for error in testing, what is the chance that another, random individual was a source of the DNA found?". Problematically, it is impossible to accurately combine the potential for error into the random match possibility ratio -- exactly the step Defendant Palmer appears to be requesting. *See* NRC II, *supra*, at 85-86 ("[t]he risk of error in any particular case depends on many variables (such as the number of samples, redundancy in testing, and analysts proficiency), and there is no simple equation to translate these variables into the probability that a reported match is spurious") & 199 (noting that "[t]he argument that jurors will make better use of a single figure for the probability that an innocent suspect would be reported to match never has been tested adequately"). As such, in any situation where the jury considers DNA evidence, the jury has to look at and weight two different figures that cannot be combined into one: (1) the possibility of error, and (2) the

possibility of a random match. Given the ameliorative potential of cross-examination, counter-experts, and clarifying jury instructions, undue prejudice or confusion on this issue may well be prevented.

III: CONCLUSION

For the reasons set forth above, the Court concludes that (1) PCR/STR DNA testing, as a general rule, is in accordance with the Supreme Court's guidelines set forth in *Daubert* and may lead to admissible DNA evidence at trial; and (2) even DNA evidence with relatively low statistical significance may be admitted as probative evidence, provided that certain safeguards are afforded. Accordingly, Defendants' Joint Objections to the Government's Proposed DNA Evidence are DENIED to the extent that the objections represent a generalized challenge to the PCR/STR method or to the extent that they claim that DNA matches with relatively low statistical values must be excluded under *Daubert* or Federal Rule of Evidence 403.

However, the Court emphasizes certain aspects of its holding. Importantly, the Court is making such conclusions based on the present record. As such, while the Court's ruling finds that PCR/STR testing, in the abstract, comports with *Daubert*, and that DNA evidence with low statistical significance may be admitted, the Court has not determined that all of the Government's DNA evidence may now be introduced into evidence. Here, Defendants have not yet received their own DNA expert reports, have not contested the FBI's protocols, have not argued that the protocols were not followed, and have not singled out any laboratory errors that may rise to sufficient significance that exclusion of DNA evidence is warranted. Moreover, the Court has not had an opportunity to inquire about certain aspects of the Government's DNA evidence, including the purported probative value of a 1:1 random match probability in all

populations. At most, Defendants have made a Rule 403 challenge to some DNA results, a challenge that the Court has denied based on the present record. However, a DNA hearing may well be necessary on these other issues before the Court determines which DNA evidence, if any, must be excluded. As such, the Court ORDERS that, upon receipt of their own DNA experts' reports, Defendants notify the Court as to precisely what challenges, if any, they shall make to the admissibility of the Government's DNA evidence so that the Court can determine what issues, if any, will require a hearing before presentation of that evidence to the jury. An Order accompanies this Memorandum Opinion.

Date: April 25, 2005

/s/
COLLEEN KOLLAR-KOTELLY
United States District Judge