

State of Missouri v. Marcellus Williams  
DNA Report  
Greg Hampikian, Ph.D.

DNA Analysis of the Y-STR profile obtained from the knife handle samples: CCB1536-0303-E03c1 and CCB1536-0303-E03b1.

The knife handle was swabbed and analyzed by Bode Cellmark Forensics, using a PowerPlex<sup>®</sup> Y-23 kit (Promega). The results were reported by analyst Jennifer Sampson Fienup in two reports dated April 8, 2016 and August 12, 2016. Those reports have been shared with me along with the electronic data, laboratory notes, and emails pertaining to this analysis.

**Conclusion:** Marcellus Williams is excluded as a possible contributor of the DNA profiles obtained from the knife handle swabs CCB1536-0303-E03b1 and CCB1536-0303-E03c1. This conclusion is based on the data supplied by Bode Cellmark. That laboratory followed appropriate techniques to produce the results, however, guided by their internal protocols, Jennifer Sampson Fienup was apparently restricted to call the results inconclusive. This may have to do with the lab's general practice of listing below-cut off alleles with only the designation "---= Possible Additional Alleles". This results in the loss of more specific information regarding those "possible extra alleles", which can be obtained from the electronic data or even the printed electropherograms (like those excerpted below). While I understand the need for general guidelines, the data supplied in this specific case gives clear results that exclude Marcellus Williams. In the report below, I detail those results.

### **Background**

The Y chromosome is inherited exclusively by a male from his father. Females do not have Y chromosomes. Thus, Y-STR analysis is used when an analyst wants to examine only DNA contributed by one or more males. A Y-STR profile may be used to exclude a male as a contributor of DNA, but it cannot identify a single male to the exclusion of all others. Inclusions should always be accompanied by statistics, but exclusions (elimination as a potential contributor) are absolute and thus do not require statistics.

When an incomplete Y-STR profile is obtained, as in this case, we can use whatever identifying DNA is obtained for the purpose of exclusion. It is akin to finding part of a social security card, with only a few of the numbers remaining. While such partial information cannot be used for a complete identification of an individual, it can still be used to narrow the pool of potential matches by excluding some people. For example, if only 4 numbers are visible on the hypothetical card, anyone whose social security number does not include those digits can be eliminated as a possible match.

DNA in our cells is found on structures called chromosomes. Y-STR testing is performed by identifying allele sizes (specific sizes of DNA) at particular loci (locations) on the male Y chromosome. These alleles are actually lengths of repeated DNA sequences, so that a called "10" allele is actually a length of DNA found at a particular chromosomal location that comprises 10 short tandem repeats (STRs) of DNA bases. These short tandem repeats of bases

are used in all the common forensic DNA tests employed by crime laboratories the world over. The Y-STR tests, ignore all female DNA, and examine only the male Y chromosome.

Alleles appear as peaks on electropherograms, which look much like EKGs. The Y-axis on an electropherogram is a measure of how much DNA is in a peak. The peak's height is measured in relative fluorescent units (RFU). Each laboratory determines a what is required for a peak to be considered reliable, which usually results in an "RFU cutoff." Peaks below this cut-off contain important information, but how the information is handled is specific to a lab's standard operating procedure. These laboratory-specific guidelines are not absolute, and computer programs can be used to analyze DNA below a laboratory's cut-off, from the raw data. We use such programs in our laboratory, though in this case the results are clear enough to be presented visually from the electropherograms (excerpted below).

### **Analysis of results**

#### CCB1536-0303-E03c1 (knife handle swab)

The profile yielded alleles sufficient for the purpose of exclusion. The Y-STR profile obtained from CCB1536-0303-E03c1 excludes Marcellus Williams, that is, he cannot be a contributor of the male DNA identified by Bode Cellmark from the knife handle.

From this sample, the laboratory was able to identify and call 4 alleles (see Table 1, from Bode report August 12, 1016). In order for a reference DNA to be a match to a Y-STR profile, the reference must match all the alleles in a major profile--since the Y chromosome loci are inherited as non-recombining whole. The called alleles from CCB1536-0303-E03c1 exclude Marcellus Williams as a possible contributor in the analyzed profile (see table below).

<b>Locus on Y Chromosome</b>	<b>STR alleles called from Knife Handle swab</b>	<b>Marcellus Williams Y-Chromosome profile</b>
DYS390	24	21
DYS391	10	10
DYS393	13	14
DYS458	17	18

**Table 1** From Bode report August 12, 1016

Specifically, the evidence profile is not consistent with Marcellus Williams, whose Y-Chromosome is a 21 at locus DYS390, a 10 at locus DYS391, a 13 at DYS393, and a 17 at DYS458. The electronic data provides more information, which falls below the Bode Cellmark cut-off. My examination of that data reinforces the obvious conclusion from the table above, Marcellus Williams is excluded. Marcellus Williams' Y-STR DNA profile is not found in the data from CCB1536-0303-E03c1.

#### CCB1536-0303-E03b1 (knife handle swab)

In table 2, I have aligned the results from the Bode Cellmark reports of April 8, 2016 and August 12, 2017. This table shows that the results are consistent, that is all of the alleles called from CCB1536-0303-E03c1 sample (the one with fewer alleles) are also seen in the DNA profile from the more complete results in CCB1536-0303-E03b1.

Locus on Y Chromosome	CCB1536-0303-E03c1 From 8.612.1 report	Marcellus Williams	CCB1536-0303-E03b1 From 4.8.16 report
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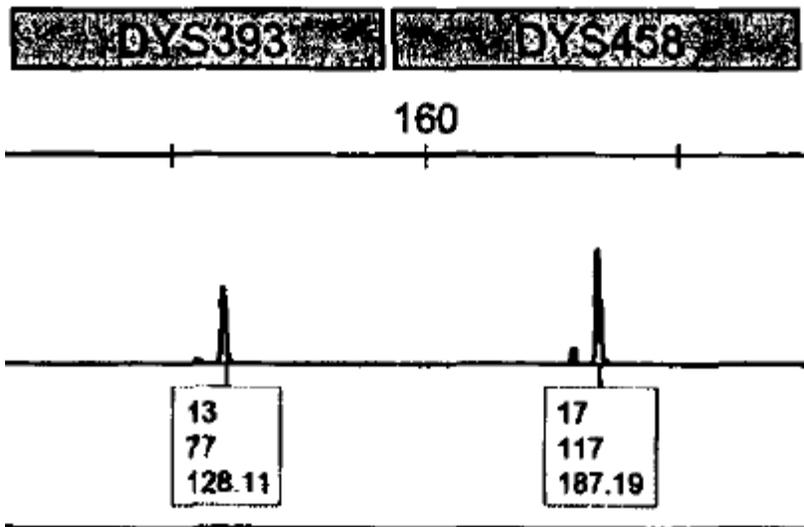
DYS576	No Results	16	20, ---
DYS389 I	No Results	13	13, ---
DYS448	No Results	20	No Results
DYS389 II	No Results	29	No Results
DYS19	No Results	14	No Results
DYS391	10, ---	10	10
DYS481	No Results	26	23, ---
DYS549	No Results	11	No Results
DYS533	No Results	12	13, ---
DYS438	No Results	11	No Results
DYS437	No Results	14	15, ---
DYS570	No Results	19	16, ---
DYS635	No Results	23	23
DYS390	24, ---	21	24, ---
DYS439	No Results	12	12, ---
DYS392	No Results	11	13, ---
DYS643	No Results	13	No Results
DYS393	13, ---	14	13, ---
DYS458	17, ---	18	17, ---
DYS385 a/b	No Results	15, 16	11, 14
DYS456	No Results	15	No Results
Y-GATA-H4	No Results	11	No Results

---= possible additional alleles

**Table 2.** Screen images of Bode Cellmark tables from reports April 8, 2016, and August 12, 2017.

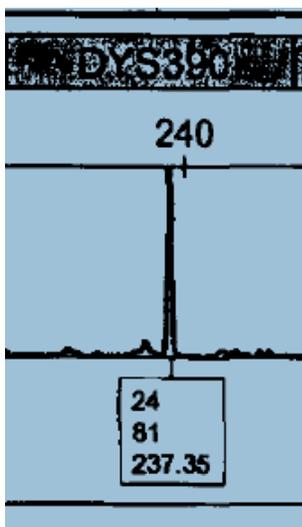
From the data in Table 2, it is clear that Marcellus Williams' Y Chromosome is not a match to the profiles from the knife handle swabs CCB1536-0303-E03b1 and CCB1536-0303-E03c1. A careful examination of the electropherograms makes this conclusion even clearer. Specifically, there is no indication of Marcellus Williams alleles at several loci.

Figure 1 is a screenshot from one electropherogram from CCB1536-0303-E03b1, it covers two loci: DYS393 and DYS 458. One allele is identified at each locus. The height of the 13 allele peak at DYS393 is 77 relative fluorescent units (RFU), as indicated by its height on the Y-Axis. The height indicates the amount of DNA represented by this allele. Marcellus Williams is a 14 at this locus. If there had been a 14 allele in this electropherogram, it would appear to the right of the 13 peak and would have been labelled by the software. But there is no peak to the right of the 13 allele, and thus Marcellus Williams is eliminated as a possible contributor of a Y chromosome by this locus. The DYS458 locus (also in this figure) confirms this conclusion. It shows a 17 allele with 117 RFU. Marcellus Williams is an 18 at DYS458. There is no 18 peak to the right of the 17. Marcellus Williams is eliminated as a possible contributor of a Y chromosome by locus DYS458.



**Figure 1** Portion of the electropherogram from CCB1536-0303-E03b1. Marcellus Williams is excluded as a possible contributor of the Y chromosome profiled here, because he is a 14 at DYS393, and an 18 at DYS458.

Figure 2 shows the electropherogram for CCB1536-0303-E03b1 locus DYS 390. The data has one labeled peak, a 24 allele that is 81 RFU units high (y-axis). At this locus, Marcellus Williams is a 21. Marcellus Williams is excluded as a possible contributor of the Y chromosome profiled here, because he is a 21 at DYS390.



**Figure 2** DYS390 Locus from the electropherogram of sample CCB1536-0303-E03b1, showing only one called allele, 24. Marcellus Williams is excluded as a possible contributor of the Y chromosome profiled here, as he is a 21 at DYS390.

**Summary:** The analyst at Bode Cellmark may be restricted in her conclusions by their standard operating procedures whenever there are results of “other potential alleles”, below that laboratory’s cut-off. However, I have examined all of the peaks (even those below Bode

Cellmark's cut-off), and there is a clear exclusion of Marcellus Williams from the knife handle samples CCB1536-0303-E03b1 and CCB1536-0303-E03c1.

A handwritten signature in cursive script, appearing to read "G. Hampikian", with a long horizontal flourish extending to the right.

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