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Mitochondrial Forensic DNA Case Report

December 30, 2005

To: John Philipsborn
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BodeCase # 2S04-114
Agency ID# 1993-WVS-05716;
93-05-0666

List of Evidence Received on July 7, 2004 for DNA analysis:

Code #	Item ID	Description
2S04-114-01	93-05716 FP2	Labeled as "Left hand nail scrapings from M. Moore."
2S04-114-02	93-05716 FP3	Labeled as "Right hand nail scrapings from M. Moore."
2S04-114-03	93-05716 FP6	Labeled as "Hair from M. Moore ligature."
2S04-114-03A		Slide with two hairs (-03Aa and -03Ab).
2S04-114-03B		Slide with one hair.
2S04-114-04	93-05716 FP6-Q39	Labeled as "Possible tissue from ligature from M. Moore."
2S04-114-05	93-05716 Q1 - Q4	Labeled as "Swabs from M. Moore."
2S04-114-05A		Three "oral" swabs.
2S04-114-05B		Three "rectal" swabs.
2S04-114-05C		Two "nasal" swabs.
2S04-114-05D		Two "penile" swabs.
2S04-114-06	93-05717 FP3	Labeled as "Left hand nail scrapings from S. Branch."
2S04-114-07	93-05717 FP4	Labeled as "Right hand nail scrapings from S. Branch."
2S04-114-08	93-05717 FP5	Labeled as "Two dark Caucasian hairs from S. Branch."
2S04-114-08A		Slide with one hair.
2S04-114-08B		Slide with two hairs (-08Ba and -08Bb).
2S04-114-09	93-05717 FP6	Labeled as "Hair from ligature from S. Branch (skin, tissue, hair from ligature)."
2S04-114-10	93-05717 K1, Q1 - Q4	Labeled as "Blood sample and swabs from S. Branch."
2S04-114-10A		Stained string.
2S04-114-10B		Three "oral" swabs.
2S04-114-10C		Three "rectal" swabs.
2S04-114-10D		Three "nasal" swabs.
2S04-114-10E		Two "penile" swabs.
2S04-114-11	93-05718 FP3	Labeled as "Hair found on C. Byers's body."
2S04-114-11A through -11Z		Slide with 26 hairs (-11A through -11Z).
2S04-114-12	93-05718 FP4	Labeled as "Left hand nail scrapings from C. Byers."
2S04-114-13	93-05718 FP5	Labeled as "Right hand nail scrapings from C. Byers."
2S04-114-14	93-05718 FP6	Labeled as "Hair from lower body of C. Byers."
2S04-114-15	93-05718 FP8	Labeled as "Hair from C. Byers ligature."
2S04-114-16	93-05718 Q4	Labeled as "Possible tissue from C. Byers ligature (skin, tissue, hair from ligature)."
2S04-114-17	93-05718 FP9	Labeled as "Hair from perineum of C. Byers ligature."

List of Evidence Received on July 7, 2004 for DNA analysis, cont.:

Bode #	Item ID	Description
2S04-114-18	93-05718 FP10	Labeled as "Negroid hair from white sheet." [slide with 9 hairs]
2S04-114-18A		Hair from sheet, described as "Negroid hair frag."
2S04-114-18B		Hair from sheet.
2S04-114-18C		Hair from sheet.
2S04-114-18D		Hair from sheet.
2S04-114-18E		Hair from sheet.
2S04-114-18F		Hair from sheet.
2S04-114-18G		Hair from sheet, described as "animal hair."
2S04-114-18H		Hair from sheet.
2S04-114-18I		Hair from sheet.
2S04-114-19	93-05718 Q1-Q3	Labeled as "Swabs from C. Byers
2S04-114-19A		Three "oral" swabs.
2S04-114-19B		Three "rectal" swabs.
2S04-114-19C		Three "nasal" swabs.
2S04-114-20	93-05716 E3	Labeled as "Hair from E3."
2S04-114-20		Slide with two hairs (-20A and -20B).
2S04-114-21	93-05716 E5	Labeled as "Hair from scout cap."
2S04-114-21		Slide with two hairs (-21A and -21B).
2S04-114-22	93-05716 E126	Labeled as "Hair from knife."
2S04-114-23	93-05717 E127 LS1-QH	Labeled as "Hair from tree stump."
2S04-114-24	93-05716 E147	Labeled as "Hair from knife."
2S04-114-24		Slide with two hairs (-24A and -24B).
2S04-114-25	93-05716 E3 Q10	Labeled as "Cutting from blue pants."
2S04-114-26	93-05716 E7 Q6	Labeled as "Cutting from jeans."
2S04-114-27	93-05717 FP7	Labeled as "Dyed hair from white sheet used to cover S. Branch."
2S04-114-28	93-05716 E27	Labeled as "Hair from knife."
2S04-114-29	93-05716 E28	Labeled as "Hair from butterfly knife."
2S04-114-30	93-05716 E134	Labeled as "Hair from knife."
2S04-114-31	93-05716 E178	Labeled as "Kershaw folding knife."
2S04-114-32	93-05716 E1A	Labeled as "Bag of clothing."
2S04-114-32A		Pair of white socks.
2S04-114-32B		Leather (or vinyl) pull tab of unknown origin.
2S04-114-32C		Plastic bag "Time Saver."
2S04-114-32D		Tan button down shirt.
2S04-114-32E		Black thermal shirt.
2S04-114-32F		Cargo style jeans.
2S04-114-32G		One "BIC" disposable razor.
2S04-114-32H		One "BIC" disposable razor.
2S04-114-33	93-05718 FP8 L1	Labeled as "Ligature between L-leg and L-wrist and R-leg and R-wrist [Byers]."
2S04-114-33A		Left side.
2S04-114-33B		Right side.

List of Evidence Received on July 7, 2004 for DNA analysis, cont.:

2S04-114-34	93-05717 FP6 L2	Labeled as "Ligature between ankles and wrist, L-leg, L-wrist, R-leg, R-wrist [Branch]."
2S04-114-34A		Left side.
2S04-114-34B		Right side.
2S04-114-35	93-05717 FP6 L3	Labeled as "Ligature, L-leg, L-wrist, R-leg, R-wrist [Moore]."
2S04-114-35A		Left side.
2S04-114-35B		Right side.
2S04-114-36	93-05716 E17	Labeled as "Three tree branches."

CASE REVIEW AND RESULTS:

This case report is supplemental to the STR Forensic DNA Case Report issued December 30, 2005.

Mitochondrial DNA (mtDNA) is found in subcellular organelles called mitochondria. A specific, non-coding region of the mitochondrial genome called the D-loop is known to have variability within the human population, particularly in two segments of the D-loop that are called Hypervariable Regions 1 and 2. Multiple copies of this region of mtDNA are generated using the polymerase chain reaction (PCR). The base composition, or sequence, is then determined using automated DNA sequencing.

The following items were processed for mtDNA:

2S04-114-03Aa	(Hair from M. Moore ligature)
2S04-114-03B	(Hair from M. Moore ligature)
2S04-114-08A	(Dark Caucasian hair from S. Branch)
2S04-114-08Ba	(Dark Caucasian hair from S. Branch)
2S04-114-08Bb	(Dark Caucasian hair from S. Branch)
2S04-114-11B	(Hair found on C. Byers's body)
2S04-114-11C	(Hair found on C. Byers's body)
2S04-114-11P	(Hair found on C. Byers's body)
2S04-114-11Q	(Hair found on C. Byers's body)
2S04-114-11V	(Hair found on C. Byers's body)
2S04-114-11Z	(Hair found on C. Byers's body)
2S04-114-14	(Hair from lower body of C. Byers)
2S04-114-15	(Hair from C. Byers ligature)
2S04-114-17	(Hair from perineum of C. Byers ligature)
2S04-114-18A	(Hair from sheet, described as "Negroid hair frag")
2S04-114-18B	(Hair from sheet)
2S04-114-18C	(Hair from sheet)
2S04-114-18D	(Hair from sheet)
2S04-114-18E	(Hair from sheet)
2S04-114-18F	(Hair from sheet)
2S04-114-18H	(Hair from sheet)
2S04-114-18I	(Hair from sheet)
2S04-114-20A	(Hair from E3)
2S04-114-20B	(Hair from E3)
2S04-114-21A	(Hair from scout cap)
2S04-114-21B	(Hair from scout cap)
2S04-114-23	(Hair from tree stump)
2S04-114-27	(Dyed hair from white sheet used to cover S. Branch)

The remaining evidence was not tested for mtDNA analysis at this time.

Complete sequence data was obtained from all of the above listed items with the following exceptions:

2S04-114-17 (partial sequence data obtained)

2S04-114-21B (partial sequence data obtained)

No confirmed sequence data was obtained from 2S04-114-20A.

The mtDNA sequence obtained from evidence hairs -03B and -21A are consistent with each other at the corresponding mtDNA regions. The mtDNA sequences obtained from evidence items -08A, -08Ba and -08Bb are consistent with each other at the corresponding mtDNA regions. The mtDNA sequences obtained from -11B, -11C, -11P, -11Q, -11V, -11Z, -14, -18B, -18C, -18D, -18E, -18F, -18H, -18I and -20B are consistent with each other at the corresponding mtDNA regions. The partial mtDNA sequence data obtained from evidence item -17 is consistent with the sequence data obtained from -11B, -11C, -11P, -11Q, -11V, -11Z, -14, -18B, -18C, -18D, -18E, -18F, -18H, -18I and -20B. The mtDNA sequence data obtained from evidence items -03Aa, -15, -18A, -21B, -23 and -27 are not consistent with each other or any other item of evidence tested at this time.

The mtDNA sequence data generated for the specimens tested are shown in the Appendix.

The DNA profiles reported in this case were determined by procedures that have been validated according to standards established by the Scientific Working Group on DNA Analysis Methods (SWGDM) and adopted as Federal Standards.

CONCLUSIONS:

A search of the mtDNA population database of the Scientific Working Group on DNA Analysis Methods (SWGDM) has been provided for evidence items where complete mtDNA sequence data was obtained and more than one item was consistent with a particular sequence. The number of observations of these mtDNA sequences in the SWGDM database is as follows:

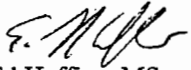
The Bode Technology Group, Inc. Sample No.	African Database	Caucasian Database	Hispanic Database	Asian Database	Native American Database	Total No. of Observations in combined Population SWGDM Database
2S04-114-03B, -21A	0 in 1305	0 in 1674	0 in 686	0 in 848	0 in 326	0 in 4839
2S04-114-08A, -08Ba, -08Bb	0 in 1305	0 in 1674	0 in 686	0 in 848	0 in 326	0 in 4839
2S04-114-11B, -11C, -11P, -11Q, -11V, -11Z, -14, -18B, -18C, -18D, -18E, -18F, -18H, -18I, and -20B	0 in 1305	6 in 1674	5 in 686	0 in 848	0 in 326	11 in 4839

The remaining evidence will be returned to the Arkansas State Crime Lab.

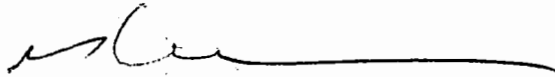
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Appendix
Mitochondrial DNA Sequence Results

For interpretation of these results, see the enclosed Interpretation Key.

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-03Aa Hair from ligature (Moore)	16221 T Confirmed Region: 15998-16390	263 G 309.1 C 315.1 C Confirmed Region: 35-361
2S04-114-03B Hair from ligature (Moore)	16069 T 16126 C 16193 T 16195 C 16242 A 16357 C Confirmed Region: 15998-16390	73 G 150 T 152 C 263 G 295 T 309.1 C 315.1 C Confirmed Region: 35-361
2S04-114-08A Hair (Branch)	16069 T 16126 C 16145 A 16186 T 16231 C 16261 T Confirmed Region: 15998-16390	73 G 75 A 150 T 152 C 195 C 215 G 263 G 295 T 309.1 C 315.1 C 319 C Confirmed Region: 35-361
2S04-114-08Ba Hair (Branch)	16069 T 16126 C 16145 A 16186 T 16231 C 16261 T Confirmed Region: 15998-16390	73 G 75 A 150 T 152 C 195 C 215 G 263 G 295 T 309.1 C 315.1 C 319 C Confirmed Region: 35-361

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-08Bb Hair (Branch)	16069 T 16126 C 16145 A 16186 T 16231 C 16261 T Confirmed Region: 15998-16390	73 G 75 A 150 T 152 C 195 C 215 G 263 G 295 T 309.1 C 315.1 C 319 C Confirmed Region: 35-361
2S04-114-11B Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 49-361
2S04-114-11C Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-11P Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-11Q Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 49-361

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-11V Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-11Z Hair from body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-14 Hair from lower body (Byers)	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 49-361
2S04-114-15 Hair from ligature (Byers)	16093 C 16192 T 16256 T 16262 T 16270 T Confirmed Region: 15998-16390	73 G 263 G 315.1 C Confirmed Region: 35-361
2S04-114-17 Hair from perineum (Byers)	16222 T 16261 T Confirmed Region: 16210-16390	Not Analyzed

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-18A Negroid hair from sheet.	16129 A 16183 D 16189 A 16215 G 16223 T 16278 T 16294 T 16311 C 16360 T Confirmed Region: 15998-16390	73 G 151 T 152 C 182 T 186 A 189 C 247 A 263 G 315.1 C 316 A Confirmed Region: 35-361
2S04-114-18B Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-18C Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-18D Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-18E Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-18F Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-18H Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 49-361
2S04-114-18I Hair from sheet	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 35-361
2S04-114-20B Hair from E3	16069 T 16126 C 16145 A 16172 C 16222 T 16261 T Confirmed Region: 15998-16390	73 G 242 T 263 G 295 T 315.1 C Confirmed Region: 49-361
2S04-114-21A Hair from scout cap	16069 T 16126 C 16193 T 16195 C 16242 A 16357 C Confirmed Region: 16009-16390	73 G 150 T 152 C 263 G 295 T 309.1 C 315.1 C Confirmed Region: 35-361

Bode Sample # Agency ID	Hypervariable Region I	Hypervariable Region II
2S04-114-21B Hair from scout cap	16223 T 16278 T 16362 C Confirmed Region: 16210-16390	 Not Reported
2S04-114-23 Hair from scout cap	Anderson Confirmed Region: 16009-16390	263 G 309.1 C 315.1 C Confirmed Region: 35-361
2S04-114-27 Dyed hair from white sheet (Branch)	16261 T Confirmed Region: 15998-16390	263 G 309.1 C 315.1 C Confirmed Region: 49-361

INTERPRETATION KEY

The following notations may apply:

- a. Transition or transversion polymorphisms as compared to a standard sequence (Anderson, et al. 1981. Nature 290:457-465) are designated by the appropriate letter (base).
- b. A deletion is designated by a "D."
- c. An insertion is designated a ".1" for a one base insertion, and a ".2" for a two base insertion.

Note: Polycytosine stretches are often difficult to interpret. A possible cause may be the presence of a mixture of length variants in the mtDNA of an individual. A predominant length species is often apparent; however, the frequency of a particular length species cannot be determined accurately and may vary between maternal relatives. The sequence reported for Hypervariable Region 1 represents the first 10 cytosines observed, beginning at position 16184. The sequence reported for Hypervariable Region 2 represents the number of cytosines present in the predominant base sequence. When no predominant base sequence is observed, the insertions that could not be confirmed are designated by a "N."

- d. A position that could not be confirmed is designated by a "N."