

**IN THE CRIMINAL COURT FOR SHELBY COUNTY, TENNESSEE**

<b>RICKY LEE NELSON,</b>	)	
<b>Petitioner,</b>	)	
	)	
	)	<b>SHELBY COUNTY</b>
<b>v.</b>	)	<b>Case No. 89-04384</b>
	)	<b>89-04385</b>
	)	<b>89-04386</b>
<b>STATE OF TENNESSEE,</b>	)	
<b>Respondent</b>	)	
	)	

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**AFFIDAVIT OF ROBERT SHALER**

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1. I'm a DNA and serology expert with more than thirty years of experience collecting, processing, analyzing, and interpreting DNA and serology results.
  - a. From 2005 to 2010 I served as a professor of biochemistry and molecular biology at Pennsylvania State University, having founded and directed Penn State's Forensic Science Program.
  - b. Prior to joining Penn State, I served as an adjunct associate professor of pathology and forensic medicine at the New York University School of Medicine from 1978 to 2005 and an adjunct professor and adjunct associate professor at the City University of New York from 1993 to 1995.
  - c. From 1990 to 2005, I was the Director of the Department of Forensic Biology at the Office of the Chief Medical Examiner in New York City, where I performed and directed forensic biological analyses for all homicide investigations until 2005.
  - d. From 1987 to 1989, I was the Director of Forensic-Science Technical Support, Training, and Business Development at Lifecodes Corporation in New York – the nation's first forensic-DNA laboratory.
  - e. In addition, I served as director of serology at the Office of the Chief Medical Examiner in New York City from 1978 to 1986, and director of forensic science at the Aerospace Corporation in Washington, DC, in 1977 and 1978.
  - f. I worked as a criminalist at the Pittsburgh and Allegheny County Crime Lab from 1970 to 1975, and was a research director there in 1974 and 1975.
2. I have also served as a forensic-science consultant for government agencies and professional organizations.

- a. I was a member of the American Bar Association Task Force on Biological Evidence and was an author of the 2009 National Research Council (NRC) report, *Strengthening the Forensic Sciences – A Path Forward*, published by the National Academy of Sciences.
  - b. My other professional activities have included serving on the editorial review board of the *American Journal of Forensic Pathology and Medicine* and as an invited reviewer for the *New England Journal of Medicine*.
  - c. I am also member and the chair of the New York State Crime Laboratory Advisory Committee.
3. I am the author of the textbook: *Crime Scene Forensics – A Scientific Method Approach*. Published by Taylor and Francis, 2012.
  4. My resume is attached hereto as Exhibit 1. .
  5. On May 4, 2012, Craig Cooley, an Innocence Project Staff Attorney, retained me in regards to Ricky Lee Nelson's case. *See State v. Ricky Nelson*, Case No. P-11480 (Shelby County, TN). Nelson stands convicted of Francis Morgan's February 1989 sexual assault.

#### **Material Reviewed**

6. When Mr. Cooley retained me, he sent me the following material to review:
  - a. Ricky Nelson's DNA testing motion;
  - b. The State's response to Nelson's DNA motion;
  - c. Judge John Colton's August 30, 2010 order denying DNA testing;
  - d. Margaret Aiken's February 19, 1989, Physical Examiner's Checklist;
  - e. Margaret Aiken's February 19, 1989, Medical Examination of Sexually Assaulted Person's Report;
  - f. Jo Ann Mamelli's August 10, 1990 Rape Kit Evidence Report;
  - g. Memphis Police Department, Incident Report, February 19, 1989;
  - h. Release of Evidence Form, August 3, 1990;
  - i. Memphis Police Department, Supplementary Offense Report;

- j. Frances Ann Morgan's Statement, February 19, 1989;
- k. Angela Jean Young's Statement, February 19, 1989;
- l. Jo Ann Mamelli's Trial Testimony; and
- m. Margret Aiken's Trial Testimony;
- n. SERI's April 24, 2012 Serology Report.

### **Questions Presented**

7. Mr. Cooley asked me to review the material and answer the following questions regarding Jo Ann Mamelli's serology testing, results, and trial testimony:
- a. **Question #1:** Based on Mamelli's serology results – what is my opinion as to the assailant's secretor status? In other words, is the assailant a secretor or non-secretor?
  - b. **Question #2:** Is Mamelli's trial testimony – that Morgan's vaginal fluid masked Nelson's H antigens – scientifically possible? In other words, can a non-secretor "mask" a secretor?
  - c. **Question #3:** Based on Morgan's statement, the post- post coital time, Aiken's sexual assault reports, Mamelli's serology reports, and SERI's serology report, is Mamelli's trial testimony – that Morgan's vaginal fluid diluted Nelson's H antigens – a likely or realistic possibility?
  - d. **Question #4:** Based on Mamelli's serology reports – is there a factual basis supporting Mamelli's trial testimony that Nelson is a "very weak" secretor?
8. Based on my review of Morgan's statements, Aiken's sexual assault reports, Mamelli's serology results, and her trial testimony, here are my short answers to Mr. Cooley's questions.
- a. **Answer: #1:** Based on the material I reviewed, I believe the assailant in this case is a **non-secretor**. I will explain the basis of my opinion in the proceeding sections.
  - b. **Answer #2:** Mamelli's trial testimony – that Morgan's vaginal fluids "masked" Nelson's H antigens – is **not scientifically possible**. Morgan is a non-secretor and non-secretors cannot mask anyone, especially a secretor like Nelson. Morgan's testimony, in this respect, was false and invalid.
  - c. **Answer #3:** Mamelli's trial testimony – that Nelson is a "very weak" secretor – has **no factual support** in her serology reports and notes. Moreover, based on

SERI's April 24, 2012 serology results, we know Nelson is **not** a "very weak" secretor.

- d. **Answer #4:** There's always a possibility of dilution in sexual assault cases, but the **likelihood** that Morgan's vaginal fluids diluted Nelson's H antigens, assuming he's in fact the assailant, is **extremely unlikely** in this case. I will explain the basis of my opinion in the proceeding sections.

### **A Primer on Conventional Serology**

9. A brief primer on conventional serology will preface my findings and conclusions.
10. Conventional serology involves analyzing fluids for certain markers that are lifelong individual characteristics, based principally on water soluble ABO blood group substances and specific isoenzymes, such as the phosphoglucomutase ("PGM") enzyme genetic marker system.
11. The ABO blood group antigens are found on the surface of red blood cells. Within this genetic marker system there are four possible general types: A, B, AB, and O.
12. Based on the analysis of more than 70,000 samples, scientists determined that approximately 40% of the Caucasian population is type A, 11% type B, 45% type O, and 4% type AB.<sup>1</sup>
13. For African-Americans, 23% are type A, 22% type B, 51% type O, and 4% type AB. *Id.* The following chart summarizes these statistics:

<u>ABO Blood Group Frequencies</u>		
<u>Caucasians</u>	<u>Type</u>	<u>African-Americans</u>
40%	A	23%
11%	B	22%
45%	O	51%
4%	AB	4%

14. Every member of the population falls into one of these four types and every member of the population has the appropriate A, B, AB, or O blood group antigens on the surface of his or her red blood cells.
15. Those population members who are deemed *secretors*, which is approximately 80% of the population, will also have the corresponding blood group antigen dissolved in the watery portion of several body fluids, including *saliva, semen, and vaginal fluid*.
16. Individuals deemed *non-secretors*, which are roughly 20% of the population, **will not** have the corresponding blood group antigen in the watery portion of their body fluids

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<sup>1</sup> See Dale Dykes, *Probability of Inclusion in Paternity Testimony – A Technical Workshop*, AMERICAN ASSOCIATION OF BLOODBANKS (1982).

even though they have blood group antigens on the surface of their red blood cells. Thus, a female who's a non-secretor **will not** secrete her blood antigen in her vaginal secretions.

17. Moreover, individuals who are A, B, or AB secretors, in addition to possessing the appropriate A, B, or AB blood group antigen, also possess the H[O] blood group antigen.
18. This is so because the H[O] blood group antigen is a precursor substance upon which the A and B blood group antigens are built.<sup>2</sup>
19. The following chart summarizes the critical differences between secretors and non-secretors:

<b>ABO Genetic Marker System</b>			
<b>Antigens Found in the Cells of Body Fluid</b>			
<b>Secretions of Secretors and Non-Secretors</b>			
<b>Antigens on Red Blood Cells for Secretors and Non-Secretors</b>		<b>Secretions of Secretors and Non-Secretors</b>	
<b><u>Secretors</u></b>	<b><u>Non-Secretors</u></b>	<b><u>Secretors</u></b>	<b><u>Non-Secretors</u></b>
A		A, H	Negative
B		B, H	Negative
AB		A, B, H	Negative
O[H]		H	Negative

### **Factual Findings**

20. Here are the facts as presented in the Morgan's statement, Aiken's two sexual assault reports, Mamelli's serology results, and Mamelli's.
21. The assault, as reported by Morgan, occurred at 9:30 a.m. on February 19, 1989 and Morgan arrived at the rape crisis center at 12:20 p.m. the same day where Margaret Aiken examined her.
22. Aiken reported the following facts and observations in her *Physical Examiner's Checklist* report:
  - a. There was no bloody external physical trauma to Morgan's genitalia;
  - b. She identified non-motile sperm;
  - c. Morgan was not menstruating;

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<sup>2</sup> See George F. Sensabaugh, Jan Bashinski & Edward T. Blake, *The Laboratory's Role in Investigating Rape*, Diagnostic Medicine 4 (March 1985); PAUL C. GIANNELLI AND EDWARD L. IMWINKELRIED, JR., SCIENTIFIC EVIDENCE § 17.09 (2007).

- d. Morgan did not shower, bath, or douche after her assault;
  - e. Morgan told Aiken her assailant did not wear a condom;
  - f. Morgan reported vaginal penetration with ejaculation;
  - g. Morgan did not report or mention excessive or excess drainage of vaginal fluids during or after her assault.
23. Aiken reported the following facts and observations in her *Medical Examination of Sexually Assaulted Persons* report:
- a. Aiken wrote “No trauma to vaginal or anal areas. No bleeding or discharge”;
  - b. Aiken again noted that Morgan did not urinate, bath, douche, or shower after her assault;
  - c. Aiken again noted that she identified non-motile sperm.
24. Mamelli performed her serology examinations on the following dates.
- a. On March 16, 1989, Mamelli tested Morgan’s blood and saliva sample.
    - i. Morgan’s had type A blood.
    - ii. Morgan’s saliva sample presented with no ABO blood antigens meaning she’s a non-secretor. As a non-secretor, Morgan’s vaginal fluid would not present with any ABO blood antigens.
  - b. On March 20<sup>th</sup> and 27<sup>th</sup> 1989, Mamelli performed visual and chemical examinations on the vaginal swab from Morgan’s rape kits.
    - i. Mamelli visually identified a moderate number of “intact” sperm – or sperm with tails – on the vaginal swabs.
    - ii. Mamelli had a positive acid phosphatase (AP) result on the vaginal swab sample. The AP test is a presumptive test for semen.
    - iii. Mamelli also had a strong positive p30 result on the vaginal swab sample. P30 is a protein found in seminal fluid and its detection is conclusive evidence of the presence of semen. Here, Mamelli reported a “3” in her report indicating there was a significant amount of p30 on the vaginal swab.
  - c. On August 6, 1990, Mamelli conducted an ABO secretor test on a liquid extract made from the vaginal swab.

- i. The liquid extract was a mixture of Morgan's vaginal fluid and the assailant's semen.
  - ii. The results were **negative** for ABO antigens A, B, and O.
- d. On August 6, 1990, Mamelli chemically tested Nelson's blood and saliva samples.
  - i. Nelson was determined to be an ABO type O and a secretor. As a type O secretor, the seminal plasma (the watery portion of Nelson's semen) would contain the O[H] or H antigen.
  - ii. On her report, Mamelli handwrote the word "inconclusive."

25. Mamelli testified to the following at Nelson's trial:

- a. Mamelli testified that her ABO-secretor test on the liquid extract of the vaginal swab was "inconclusive."
- b. Mamelli said her results were "inconclusive" for three reasons:
  - i. Masking;
  - ii. Dilution; and
  - iii. The fact that Nelson was a "very weak" secretor.
- c. In terms of masking, Mamelli said Morgan's vaginal fluids "masked" Nelson's H antigens.
- d. In terms of dilution, Mamelli said the following:
  - i. Morgan drained a "copious" amount of vaginal fluid during and after her assault that "diluted" Nelson's H antigens.
  - ii. Morgan may have suffered vaginal trauma and bleeding and the blood "diluted" Nelson's H antigens.
  - iii. Morgan may have urinated after her assault and the urination "diluted" Nelson's H antigens.
  - iv. Morgan's vaginal fluid "diluted" Nelson's H antigens because he's a "very weak" secretor.

### Opinions and Conclusions Drawn From Factual Findings

26. Based on the factual findings, here are my opinions and explanations regarding Mr. Cooley's four questions.
27. **Question #1:** Based on Mamelli's serology results – what is my opinion as to the assailant's secretor status? In other words, is the assailant a secretor or non-secretor?
- a. In my expert opinion, **the assailant in this case is a non-secretor** for the following reasons.
    - i. Morgan is an ABO type A non-secretor, while Nelson is an ABO type O secretor.
      1. As a non-secretor, as mentioned, Morgan does not secrete her A antigens in her vaginal fluids.
      2. As a secretor, though, Nelson secretes his O[H] antigens in his seminal plasma (the watery portion of his seminal fluid).
    - ii. The liquid extract from the vaginal swab that Mamelli tested represented a **mixture** of Morgan's vaginal fluids and the assailant's semen.
    - iii. Moreover, the quantity of intact sperm, the strong positive AP and p30 results, the three hour post coital time interval, and the facts presented in Aiken's two reports plainly indicate that the amount of semen identified on the vaginal swabs was **sufficient** to detect the semen donor's ABO type and secretor status if the assailant was, in fact, a secretor.
    - iv. Thus, if Nelson was, in fact, the assailant, Mamelli would have identified Nelson's H antigens. Mamelli, however, **did not identify any antigen** in the liquid extract.
  - b. Consequently, based on the absence of any antigenic activity, the fact masking definitely could not occur here, and that it's extremely unlikely dilution occurred here as well, it's my expert opinion that **Morgan's assailant is a non-secretor**.
28. **Question #2:** Is Mamelli's trial testimony – that Morgan's vaginal fluid masked Nelson's H antigens – scientifically possible? In other words, can a non-secretor "mask" a secretor?
- a. Morgan's vaginal fluids **could not have "masked" Nelson's H antigens**, assuming Nelson is, in fact, the assailant.



- b. “Masking” occurs when a victim’s ABO type is identical to, or inclusive of, the culprit’s ABO type.
    - i. For instance, if the victim is an AB-secretor and the culprit is an A-secretor, conventional ABO typing would not detect the culprit’s ABO type because it’s being “masked” by the victim’s ABO type. In other words, if ABO typing only detects an A antigen on the victim’s vaginal swab, it’s impossible to determine whether the A antigen came from the victim or the culprit because both secrete A antigens.
    - ii. A non-secretor, however, cannot “mask” anyone, not even another non-secretor. A capable serology in 1990 should have known this immediately.
      - 1. Morgan is a non-secretor.
      - 2. As a result, **Morgan could not have masked Nelson’s H antigens.**
    - iii. Consequently, Mamelli’s testimony that Morgan’s vaginal fluids “masked” Nelson’s H antigens is false and invalid.
29. **Question #3:** Based on Morgan’s statement, the post- post coital time, Aiken’s sexual assault reports, Mamelli’s serology reports, and SERI’s serology report, is Mamelli’s trial testimony – that Morgan’s vaginal fluid diluted Nelson’s H antigens – a likely or realistic possibility?
- a. “Dilution” – which is distinct from “masking” – occurs when the ABO antigens become no longer detectable by conventional serology analysis, even though sperm and p30 can still be detected.
  - b. In sexual assault cases, dilution is always a possibility, but the **likelihood** dilution occurred here is **extremely unlikely for the following reasons.**
    - i. First, the quantity of ABO antigens in semen is extremely high, easily capable of being detected at dilutions of 1:1000.
      - 1. To fully understand the significance of this, consider that the volume of the average ejaculate is 3.5 milliliters:
      - 2. If it were to be mixed with 3.5 liters of water, the ABO type would still be detectable.
      - 3. In my own experience, I have frequently observed detection at the 1:2000 and 1:4000 range, with occasional detection at the 1:8000 range.

4. Even if the volume of the culprit's ejaculate were only 1 milliliter, an analyst would still be able to detect it if the victim had copiously secreted a liter of vaginal fluid.
- ii. Second, the quantity of intact sperm, the strong positive AP and p30 results, the three hour post coital time interval, and the facts presented in Aiken's two reports plainly indicate that the amount of semen identified on the vaginal swab was **sufficient** to detect the semen donor's ABO type and secretor status if the assailant was, in fact, a secretor.
- iii. Third, Aiken's two sexual assault reports specifically noted the following facts:
  1. Morgan did not report and Aiken did not observe excessive vaginal drainage after the assault.
  2. Morgan did not report and Aiken did not observe vaginal or anal bleeding and trauma.
  3. Morgan did not bath, douche, and urinate after her assault.
- iv. Fourth, based on Gary Harmor's April 24, 2012 report, Nelson is not a "very weak" secretor. To the contrary, he is a so-called "run-of-the-mill" secretor who secretes normal levels of antigens in his bodily fluids, including his semen.
- c. Thus, based on these facts, **it is extremely unlikely dilution occurred here.**
- d. These facts, moreover, support my initial conclusion to Question #1 which is: the **most scientifically plausible and sound** answer to why Mamelli did not identify Nelson's H antigens in the liquid extract from the vaginal swab is that Nelson is not the assailant because the assailant in this case is a non-secretor.

### **Conclusions and Observations Regarding Mamelli's Trial Testimony**

30. It's evident from Mamelli's trial testimony she started with the assumption that Nelson was, in fact, the assailant and then worked backwards from that assumption trying to explain why her serology tests did not identify his H antigens on Morgan's vaginal and anal swabs.
  - a. Mamelli's approach was antithetical to the scientific method.
  - b. A capable serologist in 1990 should have known that the proper null hypothesis, in this context, would have been the exact opposite – that Nelson is not the assailant.

- c. With this hypothesis in place, a capable serologist would've performed her serology tests with the intent of trying to disprove the null hypothesis. Here, disproving the null hypothesis meant identifying H antigens in the liquid extract from the vaginal swab.
  - d. The serology results, however, did not disprove this null hypothesis because it did not identify H antigens in the liquid extract.
31. It's also apparent that her trial testimony is not based on facts in the record, specifically those facts contained in Aiken's two sexual assault reports.
- a. This is most noticeable when Mamelli discussed dilution and the fact that Nelson was supposedly a "very weak" secretor.
  - b. In regards to dilution, Aiken's two sexual assault reports are **void** of observations, facts, evidence, or comments remotely suggesting that:
    - i. Morgan drained a "copious" amount of vaginal fluid;
    - ii. Morgan suffered vaginal bleeding; and
    - iii. Morgan urinated, bathed, or douched after her assault.
  - c. In regards to Nelson's secretor status, there is absolutely no information, data, or evidence in Mamelli's serology reports that support or corroborate her claim that Nelson is a "very weak" secretor.
32. It's also clear Mamelli did not understand the critically important differences between "dilution" and "masking."
- a. Mamelli's "masking" and "dilution" claims are incorrect for the previously stated reasons.
  - b. A capable serologist in 1990 would have known the critical distinction between these two phenomena.
33. Consequently, Mamelli's trial testimony was wrong, purely speculative, and inappropriate.
- a. It was inappropriate for her to start with the assumption that Nelson was, in fact, the assailant.
  - b. It was even more inappropriate for her to *speculate* as to why she did not identify Nelson's H antigens in the liquid extract from the vaginal swab, especially when

masking was not possible and the facts contained in Aiken's sexual assault reports did not support her dilution theory.

### **Availability in 1990**

34. While my opinions are based on my training, education, and experience, they're also based on information, literature, and scientific evidence that was available prior to Nelson's 1990 trial.
35. Moreover, had trial, direct appeal, or initial state post-conviction counsel contacted me, I would have provided the opinions contained in this affidavit.
36. Had trial counsel, Trent Hall, contacted me I would have advised him in the following ways:
  - a. I would have prepped him as to what questions to ask Mamelli on cross-examination.
  - b. I would have recommended that he have an independent serologist, like me, test Nelson's sample to determine whether Nelson is, in fact, a "weak" secretor.
37. Had Nelson's initial post-conviction counsel contacted me I could have advised him in the following manner:
  - a. I would have recommended that he have an independent serologist test Nelson's sample to determine whether Nelson is, in fact, a "weak" secretor.
  - b. I would have reviewed Morgan's statements, Aiken's sexual assault reports, Mamelli's serology results, and Mamelli's trial testimony. Had initial post-conviction counsel provided me with this material, I would have provided the opinions offered in this affidavit.

### **Disclosure**

38. When Mr. Cooley contacted me on May 4, 2012, he did not mention that Gary Harmor and Arthur Young had already reviewed the same material and concluded that Mamelli's testimony was false and invalid and that the assailant was a non-secretor. Mr. Cooley purposely did this to prevent Harmor's and Young's conclusions and opinions from tainting, impacting, or affecting my conclusions and opinions.
39. Thus, I did not know of Harmor's or Young's conclusions and opinions when I reviewed the material Mr. Cooley sent to me. As a result, Harmor's and Young's conclusions and opinions did not impact my conclusions and opinions.
40. Only after I conveyed my opinions and conclusions to Mr. Cooley on May 12, 2012, did he inform me of Harmor's and Young's conclusions and opinions.

41. I reviewed Nelson's material and provided this affidavit to Mr. Cooley free of charge. I did not charge the Innocence Project for my services.

/s/ Robert Shaler  
Robert Shaler  
Serology/DNA Expert

Dated: May 14, 2012