

UNDERSTANDING FORENSIC DNA ANALYSIS: THE MOCK CRIME SCENE

On March 15, 2015, Maria Murphy was a college student living on the first floor of an apartment building in a complex comprised of multiple standalone buildings. One evening after returning home from a local restaurant where she had dinner with her boyfriend, a fellow student named Sebastian Bruno, Maria was carrying multiple items in from her car and forgot to lock the sliding glass door to her apartment. At 10:30pm in a group chat with friends, Sebastian sent Maria a message reminding her to lock the door. The local community was on high alert due to a rash of recent break-ins that appeared to be targeted at female students.

Later that night, someone entered Maria's apartment and blindfolded, bound, and beat her severely. The assailant tied her to the bedframe and left. The next day, a coworker of Maria's called the police because she did not arrive to her work-study job as expected. Maria was taken to the local hospital but had been beaten so severely she died from her injuries.

Police processed the crime scene, collecting various items of evidence. There were no signs of forced entry. They seized the ligature used to bind her. They noticed the bed had been stripped, but there was bedding in the washing machine. They seized the bedding. They also collected a grey hooded sweatshirt with a red-brown stain on it.

Because of the string of break-ins and growing public safety concerns within the community, local law enforcement requested assistance from the Texas Rangers.

EVIDENCE HANDLING AND BIOLOGY SCREENING

The laboratory received the sexual assault kit (including fingernail swabs) from the Medical Examiner's office.

The grey sweatshirt, ligature and bedding were delivered to the laboratory in a Styrofoam cooler and separately packaged in breathable paper envelopes within a large FedEx envelope. The Styrofoam cooler was labeled with stickers on the outside instructing the recipient to "refrigerate upon arrival." However, because law enforcement often re-used storage coolers, the laboratory's practice was to use the submission form to determine whether evidence containers should be directed to the refrigerator or to regular storage. The submission form did not list any items requiring refrigeration, so the evidence handling technician stored the box at room temperature.

When the biology screener opened the Styrofoam cooler approximately 30 days later, there was a foul-smelling liquid in the bottom and the ice packs had melted. The FedEx envelope was damp.

The screening analyst copiously noted the storage condition of the evidence in contemporaneous bench notes. He visually inspected the separately packaged breathable envelopes in the FedEx envelope and did not see any indication that they were wet. He concluded (without consulting his

supervisor) that the storage conditions had not adversely affected the evidence inside the internal envelopes.

Though the biology screener took extensive notes, he did not photograph the storage container or the breathable envelopes or otherwise initiate a quality event related to the storage conditions. Because there was no quality event connected to the case, there was also no mention of the storage issue in the biology screening report. However, the notes were scanned and maintained in the electronic case record.

With respect to the sweatshirt, the biology screener used an alternative light source to identify possible biological stains and circled them using a Sharpie marker. The red-brown stain was negative for blood (presumptive screening test). He forwarded cuttings from the sweatshirt for DNA analysis.

The biology screener observed no biological stains on the bedding and thus did not forward the bedding for DNA analysis.

LAW ENFORCEMENT INTERVIEWS

Police interviewed Sebastian, who recalled leaving Maria's apartment at around 10pm. He stated he was concerned about whether Maria had locked the door yet, which is why he sent the text message later in the group chat.

Sebastian claimed he went straight home after leaving Maria's apartment. His mother was his only alibi witness, and she claimed she heard the garage door open but did not see him because she had already gone to bed for a 4:30am alarm. Because she worked at a local hospital less than a mile from home and the university was 10 miles away, she walked to work every day while Sebastian used their only car to get to campus. She claimed she did not have any reason to go into the garage before heading to work. She said she noticed Sebastian's backpack on the kitchen counter but did not go into his room.

Sebastian told investigators he did not return to Maria's apartment at any point during the evening. During the interview, investigators perceived Sebastian as nervous. When asked to describe his relationship with Maria, he claimed she was "the love of his life," and he was saving to buy a ring which he intended to give her after their upcoming graduation in May.

Sebastian had a criminal record including a forged check and minor drug possession charge.

Investigators interviewed various people in Maria's friend group. They all expressed shock that Maria left the door unlocked, as she was typically very cautious. Maria's best friend Emma said that Sebastian and Maria had been arguing recently and Maria was considering breaking up with him. Maria did not want to have sex with Sebastian before they got married but he kept pressuring her, because "they were going to be together forever anyway." Emma said Maria never mentioned Sebastian being violent or aggressive, but rather felt like they had grown apart given their differing values. None of Maria's friends believed Sebastian was capable of hurting Maria.

DNA REPORT (DATE OF LAB REPORT February 10, 2016)

The laboratory DNA report included the following results:

1. Vaginal swab from sexual assault kit: Lab reports a two-person mixture with clear major/minor contributors, where the victim's known profile was assumed. Suspect cannot be excluded. Random Match Probability statistic: 4 quadrillion.

Significance: Defense will argue evidence not probative given romantic relationship between victim and defendant. State will argue this is evidence that Sebastian assaulted and murdered Maria after flying into a rage due to her continuous refusal to have sex with him.

2. Fingernail swabs: Lab reports a mixture of at least two individuals; the victim cannot be excluded as a contributor. No conclusions will be made regarding the Suspect.

Significance: This will become important during the testimony session as well as after reinterpretation using STRmix.

3. Ligature: Lab reports a mixture of at least three individuals. Suspect cannot be excluded as a contributor. Combined Probability of Inclusion statistic: 1 in 835.

Significance: This will become important later due to the State's closing argument at trial.

4. Cuttings from light grey sweatshirt: Lab reports a mixture of at least three individuals. The laboratory is unable to perform comparisons or provide any statistic because it is a low-level mixture.

Significance: The purpose of including the sweatshirt here is to discuss how laboratories approach suspected blood and semen stains, including the utility and limitations of screening tests. Also, reinterpretation with STRmix later will include a likelihood ratio.

The laboratory report included language at the bottom indicating that some items of evidence may benefit from reinterpretation using probabilistic genotyping software, which the laboratory was in the process of validating.

The laboratory's STRmix validation was completed in March 2017.

DISCOVERY

The defense obtained the forensic biology screening report, the DNA report, the autopsy report, and the post-mortem toxicology report. However, they did not obtain the casefile, bench notes, or underlying data.

INVESTIGATION AND ARREST

Law enforcement obtained Maria's cell phone which showed a few arguments via text between Sebastian and Maria. Sebastian appeared jealous of Maria's friendship with a male student in her organic chemistry class.

During questioning, Sebastian admitted he had called Maria asking if he could come back over to "keep her company" the night she was murdered. However, he claimed he did not go back to her apartment because Maria said she was tired and had to get up early for work the next day. Sebastian also asserted that even though he and Maria had been dating for two years, they only had sex for the first time within the last month. He said Maria did not want to admit they had sex to any of her friends because she had broken her commitment to wait until marriage. Sebastian claimed the last time he and Maria had intercourse was approximately 48 hours before her murder.

When asked why he did not mention any of this during his initial interview, Sebastian said he was scared to say anything about their sexual relationship because he knew how angry and disappointed Maria's family would be. Sebastian also said he was scared the police would think he had something to do with Maria's murder. Absent any other plausible suspects and given his initial lack of candor, Sebastian became the main suspect. He was arrested and tried for Maria's murder. He steadfastly maintained his innocence.

TRIAL (January 2017)

Fingernail swabs

At trial, the DNA analyst was questioned about the results obtained from the fingernail swabs. The analyst testified that she was "not able to make a determination if Sebastian was a contributing individual to that mixture" and that she "could not make a conclusion." The prosecutor followed with this line of questioning:

Q: "It says: No conclusions will be made regarding Sebastian Bruno as a possible contributor to this DNA mixture. What does that mean?"

A: "It means that with a mixture we're dealing with a lot more information. And when I sit down and look at the mixture and compare it to Sebastian Bruno, I was not able to make a clear determination if he was a contributing individual to that mixture. I could not make a conclusion.

Q. "So, in that circumstance, you could not exclude the defendant as a possible contributor to that DNA?"

A. "Correct."

Neither the State nor the defense asked—and the analyst did not volunteer—that she never attempted to exclude the defendant as a possible contributor to the mixture obtained from the

fingernails. The laboratory's standard operating procedure did not include a comparison step solely for purposes of excluding a known profile as a possible contributor to the mixture. If the DNA analyst deemed the profile too complex or low-level to be suitable for associating a suspect's known profile to the mixture, the laboratory also did not attempt to exclude the suspect as a contributor to the mixture.

Ligature

With respect to the ligature, the analyst testified that Sebastian could not be excluded as a possible contributor. During cross-examination, the analyst agreed with the defense attorney that the CPI statistic of 1 in 835 was "not very strong."

Persistence of DNA: Vaginal Swab

The attorneys also engaged in a lengthy back-and-forth regarding whether the results from the vaginal swab could have been due to a consensual sexual encounter that happened 48 hours before the murder, or whether it had to be more recent for the DNA observed to persist.

Summation

During closing, the prosecutor stated:

"Ladies and gentlemen, we know the DNA on the ligature came from Maria and this defendant. Of course, we expect Maria's DNA to be present on the ligature; she was tied up with it. Science tells us there is a 1 in 835 chance the other DNA on the ligature came from anyone other than the defendant. In plain English, you have 835 reasons to convict this man. You can see to it that Maria and her family get the justice the justice they deserve."

As is typically the case, neither the DNA analyst nor anyone from the laboratory was present during closing to hear the prosecutor's representation of the statistic to the jury.

Jury Verdict and Sentence

Sebastian was convicted and sentenced to life in prison without the possibility of parole.

OTHER OFFENSES IN THE COMMUNITY

After Maria's murder, the break-ins that had plagued the college community stopped...for a time. In early 2017, a new series of break-ins with increasingly aggressive sexual assaults began. Three women were beaten and killed within a six-month timeframe. The Texas Rangers identified a common pattern; the assailant ejaculated on the chest of his victims in each of the homicides.

DIRECT APPEAL

Sebastian's conviction was affirmed on direct appeal. The appellate court found defense counsel's failure to object to the improper CPI argument in closing waived any error.

CHAPTER 64 AND WRIT OF HABEAS CORPUS

The defendant filed a *pro se* Chapter 64 motion asking for additional DNA testing. The State requested appointment of counsel in the interest of justice.

The court appointed an attorney who requested discovery of the laboratory case records including the casefile, bench notes and underlying data. For the first time, an attorney representing Sebastian realized there were melted ice packs in the cooler with the evidence, as stated in the bench notes.

Sebastian's attorneys also realized the sexual assault kit from the Medical Examiner's office contained a breast swab that was not originally tested. They included a request for testing of the breast swab in their Chapter 64 motion.

The laboratory performed male screening of the *untested* items in the sexual assault kit, including the breast swab. Defendant [Sebastian] was excluded as a possible contributor.

The attorney noticed the language at the bottom of the laboratory report regarding the introduction of probabilistic genotyping. He requested reinterpretation using STRmix. Having finished their STRmix validation two months after trial, the laboratory agreed to reinterpret and reported the following regarding the fingernail:

The DNA profile previously obtained from this item (right hand fingernail swab) was reinterpreted as a mixture of two individuals with at least one male contributor and the victim as an assumed contributor. Suspect is excluded as a contributor to this profile.

The laboratory detected the presence of an unknown male profile in the mixture from the fingernail swab. They were able to generate an allele list that met the criteria for searching in the CODIS database. A CODIS search was conducted but resulted in no hits to a known offender.

The reinterpretation of the DNA profile from the sweatshirt reported the following:

The DNA profile previously obtained from this item (cuttings of three stains having the appearance of semen) was reinterpreted as a mixture of three individuals under the following scenarios:

The probability of obtaining this profile if the DNA came from Maria Murphy and two unrelated, unknown individuals is 500,000 times greater than the probability of obtaining this profile if the DNA came from three unrelated, unknown individuals.

The probability of obtaining this profile if the DNA came from Sebastian Bruno and two unrelated, unknown individuals is 5,000,000 times greater than the probability of obtaining this profile if the DNA came from three unrelated, unknown individuals.

Sebastian's attorneys developed a new theory of the case based on the new DNA results: the male DNA profile from the breast swab and the male DNA profile from the right-hand fingernail swab,

both of which excluded Sebastian but share alleles at the same loci, should point investigators to the real murderer.

INVESTIGATION MOVES FORWARD USING NEW TECHNOLOGY

Concerned about the possible presence of a serial rapist/murderer in the community as well as the integrity of the conviction in this case, the District Attorney's Office sought input from both the Texas Rangers and the Office of the Attorney General.

They suggested the possibility of using Forensic Investigative Genetic Genealogy.

During this session, faculty will discuss what FIGG is and how it might be used in a case with similar facts. Faculty will also discuss the technology's limitations and current availability for criminal justice partners in Texas. Faculty will share their experience using FIGG to help solve cold cases and discuss efforts underway to expand the technology's use in other scenarios.

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