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## The importance of scientific evaluation of biological evidence – Data from eight years of case review

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## ABSTRACT

In 2009, the National Research Council published a report stating that the addition of more science and technology into the field of forensic science in the United States would be of great benefit to the judicial system. As a starting point to address this NRC report, one needs to make an assessment of the system. One factor that is continuously requested is an estimate of an error rate. In any given scientific area of forensics that is difficult to quantitate except by external review and audits. After eight years of requested defense review of cases with biological and DNA evidence, most cases appear to be scientifically sound in test methods and procedures. However, there were some cases where errors in the forensic science process did occur. This article takes information compiled from those eight years of defense review and summarizes the cases where errors have been discovered and discusses the scientific implications of these errors. The scope of this article is limited to crime scene collection and forensic science laboratory testing of biological materials for body fluid identification and DNA individualization to a source. The greatest value of defense review comes from (a) providing effective balance and independent oversight to the judicial process and (b) collecting data into a format that can be useful as a guide in training programs.

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### 1. Introduction

In the United States, our legal system is designed as an adversarial system where prosecuting and defense attorneys present two opposing views of the details of a situation to judge and jury. This situation is represented as a crime by the prosecuting attorney; the defense attorney may or may not agree that a crime has occurred depending on the case details but their role is to present the evidence in the best light for their case. Scientists and auditors, however, wish to collect information and present it in an unbiased fashion [1]. In forensic science, physical evidence is collected from the scene and tested to determine the validity of the statements of victim, defendant and

witnesses [2–9]. Often times, when the scientific test results are returned to the investigating agency and attorneys, the results do not support one or more statements made by the individuals involved. The key aspect to any judicial case is having statements and evidence that correlate. In a perfect system, all investigators and scientists are highly competent and well-trained and all evidence is collected, documented, preserved, tested and testified to properly. As with most professional fields, there are some occasional errors that unfortunately do occur. This article focuses on a few cases where issues were detected in both the processing of biological evidence and in the judgment choices of which evidence was most probative for testing (context of the evidence). Some case details and references are included as illustrative examples of problems uncovered after review of more than 150 random cases sent by defense attorneys in the United States. The intent of this paper is not to find fault with our judicial system, because in most circumstances, it does function

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properly. It does, however, provide an inside look at trends and issues that can be detected via appropriate review by scientific experts and auditors.

## 2. Evidence collection, documentation and preservation

There are many different textbooks that provide clear discussion of the forensic science guidelines for proper collection of biological evidence [10–18]. In all cases examined, the collection process was adequate and followed appropriate guidelines. The main issues detected during the review process were a lack of documentation regarding the evidence (especially in older cases), an incomplete assessment of alternative theories when evaluating which evidence to test (i.e. sometimes referred to as tunnel vision), and in one exceptional circumstance, over interpretation of the test results and inaccurate reports and testimony. Chain of custody and archival and retrieval of evidence post-trial was a problem in several cases.

Many of the cases reviewed are from the 1980–1995 time frame (date of incident) and these cases are significantly less well documented than current cases reviewed from 2002–2010 (date of incident) in all the jurisdictions. Older cases were missing photographs, had extremely limited sketches and written details from the scene, and evidence was missing or misplaced. Many of these case notes were illegible and written in pencil. In current times, our documentation system has shown improvement to include typewritten reports, standardized forms, and more sophisticated chain of custody for better tracking of evidence disposition.

In the case of *North Carolina v. Dwayne Dail* ([www.innocenceproject.org](http://www.innocenceproject.org)), a twelve year old girl had misidentified him as her attacker in a sexual assault that occurred in 1987. At that time, DNA testing was not possible. Dail heard about his impending arrest on the news and walked into the local police department to alert them to the fact he had been mistakenly identified. Much to his surprise, he was arrested and subsequently convicted. A key piece of evidence, the victim's nightgown with semen stains, was misplaced for the years Dail was imprisoned and finally located in police storage with the help of outside agencies. On DNA testing of the semen stains, the semen donor was identified as William Neal who was tried and later convicted in 2010 in North Carolina and Dwayne Dail was released after 18 years of incarceration.

In the case of *North Carolina v. George Goode, Jr.* (double homicide in 1993) there was no documentation for the disposition of the evidence post-trial. Investigators found missing evidence stored in the courthouses or clerk offices rather than with the original submitting agency. This evidence had significant gaps in chain of custody and was located unpackaged and co-mingled with other bloody evidence from the case in unsealed boxes, bags and bins. Some of the items contained large amounts of both victims' blood and were in unprotected proximity of the defendant's clothing that was later tested. The evidence was repackaged and submitted to the forensic science laboratory as if it had been appropriately packaged after all those years for retesting. The lack of concern for the evidence and tunnel vision were key ingredients to the poor scientific practice for evidence storage, packaging and retrieval in both of these cases.

## 3. Evaluation of the biological evidence

In addition, the post-conviction serological and subsequent DNA testing in 2004 (*North Carolina v. George Goode, Jr.*) was seriously flawed in scientific practice: human blood was identified by microscopy by a trace examiner rather than any standard serological test; the areas originally described as grease stains were now considered blood. Interestingly, in an effort to conceal potential DNA contamination during storage, the laboratory diluted the DNA samples and reported out only the desired DNA result. This was detected because a draft report mentioned that additional peaks were detected and

the final report omitted that result. As a result of this type of flawed scientific practice, a federal audit was made of the State Bureau of Investigation Laboratory in 2010 [19]. The training and reporting issues centered on blood detection where it was discovered that there was a systemic problem with reporting positive presumptive blood test results but omission of the subsequent negative confirmatory blood tests. This problem was exacerbated by internal training and misinformation from one agent that was passed along to the other analysts at the laboratory. In addition, although quality assurance guidelines were in place at the Laboratory, there was insufficient supervisory oversight to enforce these policies.

The importance of proper disclosure of the types of blood tests performed (presumptive v. confirmatory) and the scientific weight of those tests is illustrated in *State of New York v. Jevon Lawyer*, 2007. Jevon Lawyer was a young man playing basketball on a public basketball court where another individual was stabbed. He claimed that he had no active participation in the crime and was arrested as an innocent bystander. On examination of his clothing and shoes for potential human blood; a pinprick of potential blood from a shoe tested presumptively positive with phenolphthalein, but subsequent testing by an independent laboratory was negative. In the absence of any blood or DNA evidence linking him to the crime, he was acquitted on the first day of trial.

In most of the reviewed cases, the probative value of the evidence was adequately assessed during the first evaluation. However, in *North Carolina v. Samuel McCullum*, a 1995 homicide case, a hair was found clutched in the victim's hand that was never tested. This is probative because her body was found dumped by a roadside and that evidence was the closest in time frame to her death. The initial investigation, however, focused primarily on the semen recovered from her body that matched to a defendant who had been with her some days prior to her death at a motel. Although that provided an investigative lead, semen can be detected for up to 72 hours after intercourse which yields a fairly broad window of time for contact with any number of individuals. The hair evidence was evaluated just prior to trial and when the hair was tested, it came back as not matching the semen donor and is now the most probative biological evidence available to provide a link to her true killer. The case remains an unsolved homicide.

Yet still another aspect of biological fluid identification leads into the arena of crime scene reconstruction. While crime scene reconstruction uses biological evidence such as bloodstains and DNA tests to interpret patterns and individual sources of fluids, respectively, it is often not performed due to a lack of trained individuals or a lack of resources to pay for experts. Very frequently, assumptions have been made based on the DNA evidence as to when or how the blood pattern was placed on an item. It is critical that investigators and scientists alike realize that DNA testing is not a replacement for the chemical identification of human blood. Neither is DNA a replacement for full crime scene reconstruction analysis. DNA is a valuable test to identify a potential source or sources of biological material but unless it is recovered from an intimate sample (e.g. semen from a body orifice), there is limited technology that can determine the exact time the DNA was placed on the item, be it clothing, furniture, vehicles, etc. [20,21].

An excellent example of the need to use combined serology and DNA testing in evaluating evidence and alternate theories is illustrated in *North Carolina v. Vaughn Jones*, a double homicide that occurred in 2003. The defendant was known to both victims and had frequented their home on many occasions. A key piece of evidence at trial was a potential smudged bloody fingerprint on a door. DNA was collected from that surface and the DNA results were so limited that no population frequency data was generated to give weight to the DNA match. At issue was how many other individuals would have that same fragment of DNA; and was it possible that the DNA detected was from prior entry and exit via that door; the concern

being DNA from Jones could have been present on the door from prior epithelial cells and the blood-like fingerprint where only the victim's DNA was detected could have given an artificial impression that both sources were placed on the door at the same time (i.e. source masking effect). This case ended in a mistrial.

#### 4. Effect of errors in testing or judgment

Perhaps the most challenging aspect of performing case review for defense attorneys is determining what to do when errors are identified. Each attorney has their own individual strategy for best assisting their client with this information. Some choose to use it for gaining sentence reduction for their client in a plea bargain rather than disclose the error at trial. Others prefer to go forward with a trial and disclose the errors openly in a reasonable effort to discredit the investigator or scientist who made the error. This is partly why it is so difficult to assess the error rate in forensic science testing, because often the information is not made publicly available. All forensic science laboratories have a quality assurance/quality control (QA/QC) program and written policy in place if they are accredited [22]. Most if not all laboratories have a designated quality control manager to track the performance of equipment, a reagent, positive and negative controls, temperature logs and training issues with personnel. The purpose of having such a program is for the laboratory itself to track potential for errors in their system and periodically assess the need for changes in their laboratory practices if a trend is detected. These errors can include sample switches, inappropriate testing and reporting, malfunctioning equipment or reagents, and testimony inconsistent with written reports. A full disclosure should be made if a sample switch does occur or a mistrial could result (*Maine v. Troy Claridge*, 2009).

The choice of which evidence to test is typically left up to the submitting investigative agency. This can be problematic if the investigator has a bias and is submitting only evidence that is likely to fit his or her theory on who committed the crime [19]. A laboratory supervisor can assist in making the choice of which evidence is most probative and valuable to the case by meeting with the investigator, discussing the case details and determining if any alternate hypotheses should be investigated. Currently this role is often performed by the defense attorneys and the experts they retain to balance out any potential for pro-prosecution bias by either the investigator or the laboratory. In this process, the evidence logs and all evidence descriptions as well as investigative reports are reviewed to determine the potential probative value of the remaining untested biological evidence and assess if the reports and/or testimony are supported by the test results.

In summary, in most of the cases where review was requested, there either was no issue or the issue was nominal in nature. However, the importance of full review and need for full disclosure of all documentation by law enforcement and forensic science laboratories is emphasized here by the few case examples where major issues were detected and needed to be corrected by the courts and via audits. The true benefit to having external audits and continuous review of cases where it is warranted is that errors in justice do not get made

and the public whom the forensic science community serves can have faith in the judicial system. That building of trust is the essential component to justice being served.

#### Disclosure

The information referred to in this article was collected from defense review cases submitted through a private consulting firm, Identacode Consulting LLC.

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