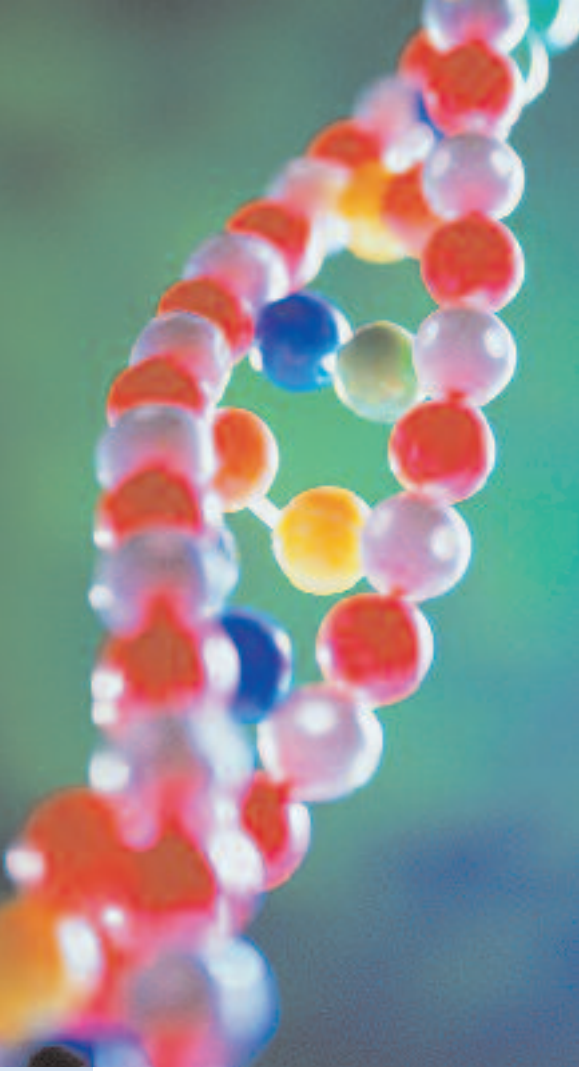

Forensics

BY WILLIAM C THOMPSON & MICHELE NETHERCOTT

Lessons From Baltimore's GSR Debacle

Two men emerge from an alley and fire several shots, striking and killing a 16-year-old boy sitting on the steps of a nearby house. The men quickly run back down the alley, disappearing from sight. Witnesses immediately call the police but the only description they can provide is that the men were black and one wore a gray shirt. The police broadcast a description of the men and minutes later a patrol officer detains a man coming out of a carryout store wearing a gray shirt. Although the witnesses cannot identify this suspect in a show up, the police take him to headquarters for questioning. While there, gunshot residue swabs are taken from his hands. Laboratory tests on the swab from one hand comes back positive; the lab report states that "unique gunshot residue (GSR)" was detected.

Imagine representing a client who finds himself in this situation. Assume your client claims he had nothing to do with the crime and never fired a gun. Could he possibly be telling the truth? What can you, the defense lawyer, do?

The first step is to realize that GSR evidence may have serious limitations. Recent litigation in Baltimore, spearheaded by the Office of the Public Defender's Innocence Project and Forensics Division, illustrates just how serious those limitations can be and points the way to effective GSR challenges in other jurisdictions. The Baltimore experience revealed some startling facts about GSR analysis that every defense lawyer should understand before dealing with this evidence.

What is GSR?

When a gun is fired, particles of the expended gunpowder often blow back onto the shooter's hands and body. These particles can be collected with adhesive lifts and then analyzed using a technique known as SEM-EDS (Scanning Electron Microscope with associated Energy Dispersive X-Ray Spectrometry). The analysis reveals the elemental composition of tiny particles found on the lifts. Based on the composition (and sometimes the number) of particles detected, the analyst makes a judgment about whether gunshot residue (GSR) is present.

A key problem with GSR analysis, as currently practiced, is that there are no definitive standards for distinguishing gunshot residue from other substances. Forensic laboratories have applied a variety of standards for "identifying" GSR and these standards have shifted over time. Before the year 2000, most laboratories reported that GSR had been detected upon finding particles of barium and antimony in a sample.[1] But a growing body of evidence showed that barium and antimony are also found in a number of other substances in the environment that are not associated with firearms.[2] Beginning in 2000, most analysts identified a substance as "unique GSR" only if they found a combination of barium, antimony and lead fused together in a single particle. But even that standard was cast in doubt by a 2002 article reporting particles of barium, antimony and lead in the brake linings and associated wear products of various European cars.[3] GSR experts are now debating whether it is possible to definitively distinguish GSR from other substances and thus whether the term "unique GSR" should be abandoned altogether.

GSR Everywhere?

Even assuming that particles recovered from your client's hand are "unique GSR," the question remains how those particles got deposited on his hand. There have been published reports since at least 1995 documenting secondary transfer of GSR from police officers or their equipment to suspects.[4] But there is little agreement among GSR analysts about how to take account of the potential for secondary transfer when interpreting GSR test results. Recognizing the possibility of background GSR contamination, some laboratory protocols such as that of the Maryland State Police, require detection of more than one particle for a positive result. The protocols states that if only one "unique GSR particle" is detected then the possibility of secondary transfer cannot be eliminated and the result should be reported as inconclusive. Other labs such as the Illinois State Police and the Federal Bureau of Investigation require a finding of at least three particles before an association can be made with firing or handling a weapon, while still other labs require the presence of five particles or more.

As far as we can tell, there is no validation data to support any of these protocols. None of these laboratories has studied the levels of background contamination in the relevant environments sufficiently to be able to determine how frequently one, three, five or more particles will appear on the hands of suspects who have had no recent contact with a discharging firearm. The problem is compounded by the willingness of some laboratories to make strong statements linking a suspect to a crime based on data other laboratories would consider inconclusive. For example, the Baltimore City Police Department issues a standard form report when only one "unique GSR particle" is found stating:

> There is a possibility that these residues were transferred from the surface of a firearm or from an object which lay immediate-

ly adjacent to a firearm during its discharge. Most probably, however, the subject's hands were immediately adjacent to a discharging firearm or were themselves used to fire the firearm within a few hours of the time of sampling.

Conclusions of this nature are neither scientifically valid nor generally accepted; such statements should not be allowed to pass without challenge.

Inadequate Scientific Controls

The problem of background GSR contamination is compounded by the fact that most forensic analysts never bother to take control samples that could detect it. Control samples are an easy and obvious step for an analyst concerned with scientific rigor. A "GSR particle" on the defendant's hand may seem like convincing evidence taken in isolation. But what if there are also GSR particles on the handcuffs that were placed on him by the arresting officer, who also had GSR on his or her clothing and gun belt? What if there is also GSR in the back seat of the patrol car in which he was transported to the police station for testing and on the furniture and in the ambient air of the police station in which he was tested? What if the walls and floor of the police station were also covered with GSR? If GSR can be detected all over the environment that a suspect has been exposed to, then it would be foolish to claim that finding GSR on the suspect is a sure sign that he fired a gun. A careful analyst who cared about good science would take lots of control samples from places other than the suspect's hand looking for background contamination. Most forensic analysts never bother.

Baltimore Experience

In 2001, *The Baltimore Sun* reported that an internal study by the Baltimore City Police Department (BCPD) had revealed background GSR contamination, at high levels, in areas of police stations where suspects and witnesses were processed for GSR collection. On June 6, 2001, the police collected a few samples from the furniture and ambient air in the processing area at four stations. These stations were chosen for examination because all of them housed active police firing ranges. "Unique GSR particles"[5] and many more "associated GSR particles"[6] were found in the air or on surfaces at virtually every police station that was sampled over the course of the summer of 2001. At that time BCPD officials directed police officers to stop collecting samples from suspects at one station that had particularly high levels of contamination. BCPD crime lab officials claimed that they were unaware of the close proximity of police firing range to the areas where GSR samples were collected from suspects.

What prompted the police department to undertake its initial internal study of GSR contamination? Internal documents, obtained after protracted discovery battles, suggest the primary motivation was not the integrity of the evidence collection process. An OSHA report on the high levels of lead in at least one district station may have raised concerns about officers' health. We suspect another factor may have been that false positives were occurring when government witnesses were tested for the express purpose of showing that they had not fired a gun.

Internal BCPD documents that were recently and reluctantly turned over by the prosecution show that personnel in the crime lab realized the significance of the contamination problem. An analyst was reported to be "very concerned about convictions based solely on GSR evidence" and recommendations were made to the head of the crime lab that samples should be obtained from police officers and various types of police equipment such as handcuffs and vehicles in order to evaluate the scope of the problem. None of these recommendations was followed. Instead, the sum and substance of the crime lab's response to this problem was to direct officers in the field to bag the hands of suspects prior to obtaining GSR swabs and to set up a dedicated GSR collection room (called the "clean room") in the vehicle processing bay at police headquarters. The directive to bag hands has not and is not being followed consistently and of course it does not address the problem of secondary transfer that occurs in the officer-citizen interaction that occurs prior to the bagging.

The "clean room" had its own problems. It was set up in an area of the police station that was the subject of lead abatement efforts. According to the internal documents, at various times the door to this room could not be closed and so contaminants in the vehicle-processing bay were allowed to waft right into the so called "clean room". In the spring of 2004, while preparing for an attempt to seek accreditation from the American Society of Crime Laboratory Directors' Laboratory Accreditation Board, the crime lab took test samples from the "clean room." There was no effort to monitor the "clean room" over time-all samples were collected at one time on a single day. But the results were hardly reassuring.

Internal police documents reported that "unique and associated GSR particles" were found on a cleaning bucket, on the floor and most critically on the holster and gun belt of the officer overseeing the collection process. The number of particles found on the officer confirmed the worst suspicions of those crime lab personnel who had suggested three years earlier that a large source of contamination was probably to be found in police personnel and equipment. More than five "unique" particles and more than 41 "consistent particles" were recovered from the officer's gun belt, more than five "unique" and more than 37 "consistent" particles were on the holster and 1 "unique" and more than 25 "consistent" particles were on his handcuffs.7 These are disturbing findings when one considers that the BCPD crime lab continues to report that a person "most probably" fired a weapon or was in the immediate proximity of a fired weapon if they have even one "unique GSR" particle on any hand.

While BCPD's internal investigations were showing serious potential problems with GSR contamination, the department's sole GSR analyst was giving deceptive and misleading testimony in criminal trials. In the Spring of 2004, the analyst was questioned closely about his standards for identifying "unique GSR." He testified that he had attended a conference in 2000 where he learned about studies showing that barium and antimony are found in substances other than gunshot residue and where he also learned that among GSR examiners the consensus had shifted against identifying GSR based solely on finding barium and antimony. He testified that he no longer reported such a finding as positive for GSR. However, a review of his cases showed otherwise. Within days of returning from the conference the analyst reported out barium and antimony as positive for GSR and he continued to do so at least 93 times between 2000 and 2004.

This analyst's duplicity has finally caught up with him. In a recent case, a Baltimore City Circuit Court trial judge excluded from evidence his finding that the presence of a barium and antimony particle constituted a positive indication

of GSR. The exclusion was based at least in part on the analyst's inability to reconcile this finding with his sworn testimony in other cases.

Only In Baltimore?

The problems with the Baltimore City GSR testing regimen are severe due to a combination of factors: uncontrolled background contamination, lenient standards for identifying GSR, inconsistent applications of those standards, and analysts' willingness to state conclusions that simply are not supported by data. However, we doubt that Baltimore is the only place where such problems occur. Some or all of these problems may beset virtually every police department that tests for GSR.

The underlying problems with GSR analysis are beginning to garner national attention. The FBI is reportedly inviting GSR examiners from law enforcement agencies across the nation to convene this summer in Quantico, Virginia to discuss the ongoing problems surrounding GSR testing. In a recent editorial *The Baltimore Sun* called upon the National Institute of Justice to conduct a study on the issue. In the view of the authors a more appropriate entity to conduct this review would be the National Academy of Sciences so that the views of the larger scientific community could be brought to bear without being subject to any partisan influences. Time will tell whether GSR testing can be saved by better validation and clearer standards or whether it becomes another discredited forensic science, joining handwriting analysis, microscopic hair analysis, and bullet lead analysis as an example of the questionable evidence that can pass for science in the criminal courts.

In the meantime, criminal defense attorneys must carefully scrutinize and actively challenge GSR evidence. Defense lawyers can no longer simply accept at face value a conclusory expert report that says a client's hands or clothing was "positive" for GSR. The defense lawyer must obtain the underlying laboratory notes and data, examine the relevant laboratory protocols and validation studies, and carefully considering alternative explanation for the findings. History shows that the best way to assure that forensic science is carefully validated is for defense lawyers to successfully challenge its admissibility as evidence. Thus, effective challenges to bad forensic science not only serve our clients' interests, they serve our shared interest as citizens in the quality and integrity of the justice system. Model discovery requests and related information can be found on the Forensics websites of NACDL and NLADA.8

Notes

1. Barium and antimony are components of the primers used in most cartridges.

2. See Current Methods in Forensic Gunshot Residue Analysis, A.J. Schwoeble, David L. Exline, CRC Press, LLC 2000; *Identification of gunshot residue: a critical review*, Francesco Saverio Romolo and Pierre Margot, Forensic Science International Volume 119,195-211 (2001).

3. See *Brake Lining: A Source of Non-GSR Particles Containing Lead, Barium and Antimony,* Carlo Torre, Grazia Mattutino, Valentina Vasino and Carlo Robino, Journal of Forensic Science Volume 47 (3) 494-504 (2002)

4. See *Casework Experience of GSR Detection in Israel, on Samples from Hands, Hair, and Clothing Using an Autosearch SEM/EDX System*, Arie Zeichner and Nadav Levin, Journal of Forensic Sciences, Volume 40, (6) 1082-1085, (1995).

5. Unique is defined by the BCPD in this context as those particles containing a fusion of lead, barium and antimony.

6. "Associated GSR particles" are defined by BCPD as particles containing lead, lead and antimony, lead and barium, or antimony and sulfur.

7. The exact number of particles on each item is unknown because the analyst stopped counting upon finding the numbers reported. The presence of "consistent" particles in the "clean room" turned out to be significant because BCPD reports a positive for GSR on finding a single fused particle of barium and antimony if at least six "consistent" particles are also found. "Consistent" particles include particles of barium and lead, antimony and lead, antimony and sulfur, or lead. Lead by itself is, of course, very common-particularly in areas targeted for lead abatement.

8. See www.nacdl.org or www.nlada.org/Defender/forensics .

About the Author

William C. Thompson, J.D., Ph.D., is a professor in the Department of Criminology, Law & Society at the University of California, Irvine and a member of the California Bar. He has been a member of the NACDL DNA Strikeforce and has represented a number of defendants in cases that turned on DNA evidence.

William C. Thompson
Department of Criminology,
Law & Society
University of California
Irvine, Calif. 92697
949-824-6156
Fax 949-824-3001
E-MAIL wcthomps@uci.edu

About the Author

Michele Nethercott is chief of the Forensics Division and the director of the Innocence Project at the Office of the Public Defender in Baltimore. Previously, she worked for the Legal Aid Bureau of Maryland doing civil representation of prisoners. A graduate of Northeastern University Law School, she also worked for the South Carolina Office of Appellate Defense.

Michele Nethercott
Office of the Public Defender
Innocence Project
201 E. Baltimore Street, Suite 1600
Baltimore, MD 21202
410-223-3790
Fax 410-223-3787
E-MAIL mnethcott@yahoo.com