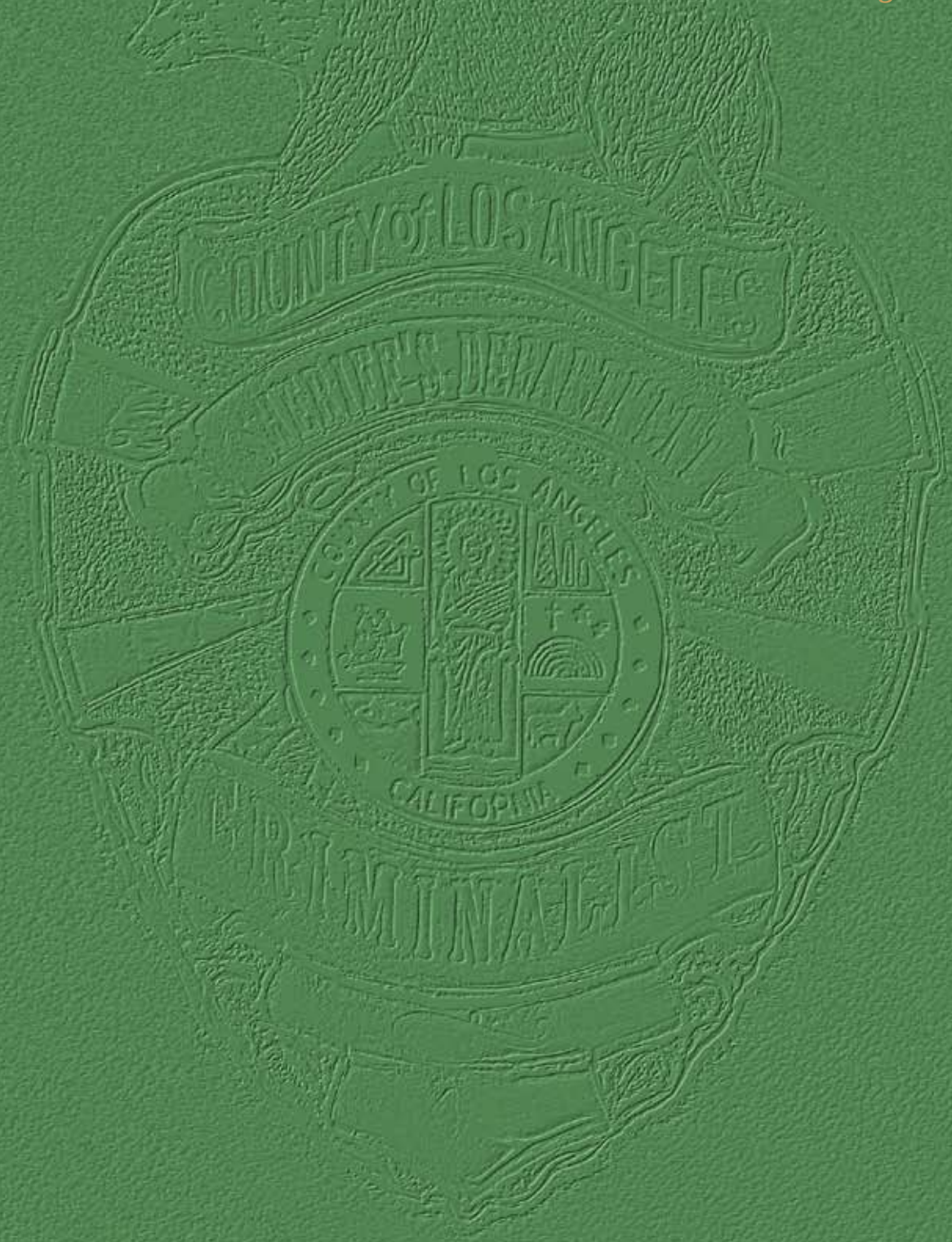
The CACNews

News of the California Association of Criminalists • Fourth Quarter 2008



The President's Desk

Good Ideas from the "Doctor"

My lab director, Mary Gibbons, came to my cubicle, sat in my guest chair, and looked around. She chuckled a little when she saw one of my favorite books on the shelf. Now you may be thinking it was a true crime book such as the Zodiac or the Black Dahlia, or maybe my physical chemistry book (yes—I still refer to it). The book that caught her eye was "Oh the Places You Will Go" by Dr. Seuss. As she read this literary classic I reflected on the simple but important message in the book.

Over the years I have given copies of this book to friends as they were considering a new life path and were trying to decide which of the many places they should go. All of the paths have been exciting, one went back to school, another chose retirement, and another to an increase in responsibilities within our profession. The book in Mary's hands was actually given to me about ten years ago when I too was trying to decide the place that I would go.

Why did you choose to go to your current place? There are as many reasons as there are individuals. The forensic science community is rather small when compared to other scientific professions (i.e. pharmacy, computer science, research). Selecting the laboratory in which to practice your craft is limited. So how does one choose?

There are many factors to consider. Some factors are focused on technical considerations such as caseload, technologies available, reputation, current staff and size. Others are more directly related to personal needs such as work location, benefits, and salary. These factors are important and must be properly weighted when you are deciding where you will go. There are other factors which must be kept in mind—the factors others will use when deciding if your choice will be accepted.

Both personally and professionally there will be times when you are on the other end of the decision of the place someone is going. You will evaluate them based upon the places they have been and the places they want to go. The factors to consider are very similar to the factors you considered when you selected the spot you are currently in. I have been at the end of the place someone is going many times.

The factors I consider significant when evaluating an individual that may become part of my staff vary only slightly from person to person. I need to consider their professionalism and ethics. Our professional community cannot tolerate individuals whom are not ethical. So, when was the last time you read the CAC Code of Ethics? I take into consideration what the individual has to offer to complement our laboratory. This may be new technology, a willingness to learn and teach, or knowledge in an area currently limited within the existing staff. I make mental notes when I hear such things as "I want to continue expanding my knowledge", "This laboratory has a good reputation of high quality analyses", and "I can offer this laboratory _____." The individual may offer several other reasons for deciding their place to go. These reasons are perfectly legitimate for the individual but may not necessarily fit the current needs of the laboratory or the profession.

There are many factors which must be considered while determining where you will go in your life. It is important to ensure you seek what will provide you with personal and professional satisfaction. It is also important to understand the decision may not always be yours alone to make. When making professional decisions, be aware of the wants and needs of the people and place you seek to go to and prepare accordingly.

Take a moment to evaluate the places you have been and the places you will go. If Dr. Seuss can help you decide, then I'm sure he would be pleased.

Selecting the laboratory in which to practice your craft is limited. So how does one choose?

Jennifer Mihalovich
CAC President

FOURTH QUARTER 2008

The CACNews

www.cacnews.org

The *CACNews, ISSN 1525-3090,* is published quarterly (January, April, July, and October) by the California Association of Criminalists (CAC), Editorial Secretary, c/o Bureau Alcohol, Tobacco and Firearms, 355 N. Wiget Lane, Walnut Creek, CA 94598-2413, (925) 280-3623, ronald.g.nichols@usdoj.gov.

The CAC is a private foundation dedicated to the furtherance of forensic science in both the public and private sectors.

Nonmember subscriptions are available for $16 domestic, $20USD foreign—contact the editorial secretary for more information. Please direct editorial correspondence and requests for reprints to the editorial secretary.

Notice to Contributors: We publish material of interest to our readers and are pleased to receive manuscripts from potential authors. Meetings and course announcements, employment opportunities, etc. are also solicited. Advertisements are also accepted, although a fee is charged for their inclusion in *The CACNews*. Please contact the advertising editor for further information.

Because of the computerized typesetting employed in *The CACNews*, submissions should be made in the form of MS-DOS compatible files on CD or by e-mail. Text files from word processors should be saved as ASCII files without formatting codes, e.g. bold, italic, etc. An accompanying hardcopy should be submitted along with the file. Graphics, sketches, photographs, etc. may also be placed into articles. Please contact the editorial secretary for details.

The deadlines for submissions are: December 1, March 1, June 1 and August 15.

On the cover...
Our "hand-tooled" faux leather cover with an impression of a Los Angeles Sheriff criminalist's badge.

INSIDE

CAC*Bits*

CAC Member Greg Laskowski appeared on a recently rerun episode of tru-TV channel's "Forensic Files." The episode was titled "Weakest Link" and first aired October, 2006.

CAC/FSS Stipend Information

The next triennial joint meeting of the California Association of Criminalists and the Forensic Science Society will take place in Lausanne, Switzerland. The meeting is being held at the "Ecole des Sciences Criminelles (ESC)", the Forensic Institute of the University of Lausanne. 2009 is the ESC's centenary. Thus, there will a double celebration during the meeting starting June 23rd, 2009. The first half of the week is dedicated to the ESC centenary, which will be in French. The second half of the week is dedicated to the FSS/CAC joint meeting, which will be in English. The joint meeting will commence with welcome drinks on Wednesday, June 24th. The full scientific program is scheduled for Thursday, June 25th through Saturday, June 27th, 2009.

CAC members are encouraged to attend the 2009 FSS / CAC joint meeting. The CAC Board of Directors has approved $1000 each for ten individuals to assist with the expenses of attending this meeting. To be eligible for this award you must be a CAC member, present a paper at the joint meeting, and report back to the CAC membership upon return. The report to the membership can be an oral report at a Seminar or Section lunch/dinner meeting or a written report in the *CAC-News*. The selection for the awards will be prior to the meeting. However, the stipend will be a reimbursement once the expenses are incurred and the obligations have been met.

Application forms (published inside this issue) for the stipend must be sent to CAC President Jennifer S. Mihalovich. The applications must be received by May 1, 2009. Recipients will be selected in order of receipt. A waiting list will be maintained should a cancellation occur.

Dr. Peter De Forest, SMSI 2008 August Köhler Award Recipient

At the Inter/Micro 2008 meeting in Chicago in July, 2008, CAC member Dr. Peter DeForest, was awarded the August Köhler Medal of the State Microscopical Society of Illinois. This award has been presented occasionally over the past 40 years to individuals who have made significant contributions in microscopy – as researchers, teachers, or practitioners. Dr. DeForest's contributions to the practice and teaching of microscopy were reflected in the announcement of his award:

Dr. De Forest's academic career in forensic science began under the tutelage of Dr. Paul Kirk at the University of California at Berkeley, where he earned both his Bachelor of Science and his Doctor of Criminology degrees in Criminalistics. He went on to help found the forensic science undergraduate and graduate programs at John Jay College of Criminal Justice (part of the City University of New York), and was a Professor of Criminalistics at the school for nearly 40 years. Due to his experience in academia and research, as well as in several crime laboratories, he has successfully served as scientific consultant and expert witness throughout the U.S., Canada, and the United Kingdom. Dr. De Forest is also the author of numerous book chapters and articles in scientific journals. He has served on several scientific committees and panels, including the editorial board of the Journal of Forensic Sciences, chair of the American Board of Criminalistics (ABC) Examination Committee, and the Forensic Science Program Accreditation Commission of the American Academy of Forensic Sciences (AAFS). In 1999 he was presented with the Paul L. Kirk Award of the Criminalistics Section of the AAFS.

Dr. Peter DeForest (l) being awarded the State Microscopical Society of Illinois' August Köhler Medal by SMSI President Wynn Hopkins.

Photo credit: Sebastian Sparenga of the McCrone Research Institute.

Deadline Approaches for Two Awards

ABC Exam

The American Board of Criminalistics is allowing each of its member organizations to choose one individual per year to take an ABC exam without a sitting fee. The CAC will pay the application fee. More information on the ABC exams is available at www.criminalistics.com. If you wish to be considered for this award, please submit a completed application to the Awards Committee by December 1st. Please go to the CAC website: www.cacnews.org/awards/abc_exam.shtml for the application and requirements.

Ed Rhodes Memorial Award

The purpose of this award is to give a CAC member who is preparing for a career in criminalistics or is newly employed (less than three years) in the field of criminalistics the opportunity to attend a major forensic or scientific meeting of benefit to forensic practitioners. The award is intended to assist the recipient to pursue educational opportunities outside the normal training activities in which persons in the recipient's situation participate. Examples of forensic meetings can include, but are not limited to, CAC Semi-Annual Seminars, American Academy meetings, International Symposia, or other regional association meetings. Examples of significant scientific meetings are InterMicro and Promega. The award will cover travel, lodging, and registration expenses up to $1000. This amount may be adjusted by the Board of Directors based on income of the fund and meeting costs.

Please go to the CAC website: www.cacnews.org/awards/rhodes.shtml for the application and sponsorship form. The deadline this award is December 1st.

Anthony Longhetti *Distinguished Member* Awardees

To make a nomination, or for more information about CAC awards, please contact the CAC Awards Committee:
mey.tann@doj.ca.gov
or
alicia.lomasgross@doj.ca.gov

Photo credit: CAC archives, Peter Barnett.

Northern Section Report

On June 11, 2008, Oakland PD hosted a drug study group meeting. The topic discussed was "New Hallucinogens," which included speakers from the DEA and DOJ. There were 22 attendees (15 members).

A dinner meeting hosted by Forensic Sci. Assoc. was held on July 3rd. The guest speaker was Prof. Brian Ford of Cambridge Univ. in the UK. He presented "Ingenuity and Problem Solving of Cells." Forty-five people attended this joint meeting between the CAC (22 members) and the SF Microscopy Soc. (21 members).

On July 31st, the DNA study group met to discuss a variety of topics, which included two case reports, familial searches, CHOP, and procedures involved in DNA extraction. There were 55 attendees (37 members).

The firearms study group has a meeting planned for September 17th, 2008 at University of CA, Davis. There will be a special guest speaker from Belgium.

The trace study group may be having a meeting later this summer.

There are two new co-chairs for an arson study group.

We are seeking a new chair for the alcohol study group.

Jeanette Wallin, Regional Dir., North

The Editor's Desk

Reviewing Your Investments

Choose this day…

"The longer I live, the more I realize the impact of attitude on life. Attitude, to me is more important than facts. It is more important than the past, than education, than money, than circumstances, than failures, than successes, than what other people think or say or do. It is more important than appearance, giftedness or skill. It will make or break a company...a church...a home. The remarkable thing is we have a choice everyday regarding the attitude we will embrace for that day. We cannot change our past...we cannot change the fact that people will act in a certain way. We cannot change the inevitable. The only thing we can do is play on the one string we have, and that is our attitude...I am convinced that life is 10% what happens to me and 90% how I react to it. And so it is with you...we are in charge of our attitudes."

—Charles Swindoll

Question for the day...

Are you more influenced by the circumstances around you or do you influence the circumstances?

Another reason to maintain a positive attitude…

"A positive attitude may not solve all your problems, but it will annoy enough people to make it worth the effort."

—Herm Albright

Herm Albright according to a Giants fan…

A positive attitude will not make the Giants any better, but it will annoy enough Dodgers fans to make it worth the effort!

Is there such a thing…

…as a stupid question? "No!" we would declare in our classrooms. Yet, I remember the time I was doing some consultant work and the person I was working for prefaced a question by saying, "There's no stupid questions right?" My response, "It depends. You're paying me $195 per hour to answer them. You decide."

Another example...

A *Giants* fan and a *Dodgers* fan were having a discussion with the *Dodgers* fan simply amazed that his intelligent and successful friend could actually be a *Giants* fan. The *Giants* fan simply explained, "My brothers and sisters are *Giants* fans, our father was a *Giants* fan as were his brothers and sisters and their dad was a *Giants* fan. My family has been nothing but *Giants* fans."

The *Dodgers* fan, trying to capitalize on his friend's intelligence asked him this question, "Well if your whole family were morons that would not make you a moron would it?"

"Nope," his friend responded, "that would make me a *Dodgers* fan!"

An example of a good question…

Is the grass really greener over there or are we simply green with envy for what we perceive we lack?

On a more serious note…

So, what do attitudes and asking right questions have in common? Our attitudes and perceptions regarding something will hinder us from asking the right questions that will enable us to make an objective assessment about that something. For instance, you probably know the dangers inherent in shopping while hungry. Your attitude and perception—"I am hungry"—can hinder you from making appropriate food choices while shopping. What should have been snacks consisting of fruit and vegetables have now turned into chips, dip and some soda to wash them down, with a side of fries from McDonald's because you could not wait until you got home to open up the bag of chips!

While I write this, I am reminded of a friend who shared his strategy for buying cars a while back. He would identify the car and options he wanted, set a price he wanted to pay for the vehicle with a bit of flex room, and then have his brother do the negotiating for him while he and his wife left, to return only to sign off on the final deal. His brother did not have a personal investment in the car so he could negotiate for the car quite objectively. At the same time, he did have a personal investment in his brother which is why he agreed to go through the process at all.

That leads to two questions I would like you to ponder as you fin-

Ron Nichols
CAC Editorial Secretary

ish reading. First, how do your personal investments in something hinder your ability to handle them in an objective manner? Second, do you have someone who is invested in you as a person that you can go to them and ask them to look at your situation in an objective manner?

Let's deal with the first. Our attitudes and perceptions with regard to an issue will affect our ability to make an objective assessment of that same issue. For example, if a friend speaks with us regarding some issues he is having with one of his or her children, it is often easy for us to propose a solution. Then again, we are not living with the source of the problem. Would it be so easy a solution if we were?

Our attitude and perceptions with regard to our current work situation can drastically alter the way we look at other opportunities when they present themselves. Rather than asking the question why another position would be appealing

First...

how do your personal investments in something hinder your ability to handle them in an objective manner?

Second...

do you have someone who is invested in you as a person that you can go to them and ask them to look at your situation in an objective manner?

we find ourselves identifying all the reasons we want to leave our current situation. Keep in mind that the grass is sometimes greener on the other side because there is more fertilizer over there.

Not only do our attitudes and perceptions regarding something make it difficult to objectively assess it, it is also quite possible that it is our attitudes and perceptions that are causing the issue to begin with. Let me repeat that a different way. Maybe it's really not our circumstances. Maybe it's the way we are choosing to interpret them or choosing to respond to them. Let me repeat it differently one more time. Maybe we're the problem!

I know at times I have been the problem and I know that many times I have been the single biggest impediment in finding a solution to my problems. Whether it was a result of my selfishness or being self-centered, I was allowing my reaction to circumstances influence my thought process as opposed to allowing my thought process to influence my circumstances. Once I take that step back and take a look from a different vantage point, it is amazing how quickly things can look so different. As one individual puts it, my attitude can change in the matter of a heartbeat. It's simply a matter of whether or not I am willing to look beyond myself.

The second point I wanted to touch on was relationships—having those individuals who are invested in us, willing to help us look at our situations in an objective manner. Notice I wrote, "help us look at our situations" and not "give us the solutions to our situations." Just as our attitude is a choice in spite of the circumstances, so too is the solution our choice. At the same time, it is helpful to have that second or third person who is willing to ask the hard questions so that we can be better prepared to make the correct choices. However helpful that is though, it is pointless unless we are willing to explore what has been asked.

A personal example might be helpful here. A good friend was offered a wonderful opportunity. He was struggling with how to proceed and called to ask some advice. It seemed to him that the answer was very clear. If he wanted to move forward in his career, the opportunities where he was at were rather limited. He saw the opportunity he was being offered as providing him with that ability to move forward in his career. The question I asked was, "Define what you mean by moving forward in your career." Actually, it was not so much a question as asking for clarification. But in doing so, he was prompted to explore what really mattered and, much more importantly, who really mattered. Extending this example, a career is what you wish to make of it. Advancement in your career can either mean an elevated position recognized by others, or by simply determining to do a better job today than what was done yesterday or positively influencing more people today than yesterday.

Another example—I was offered a wonderful opportunity recently and I simply asked a close friend, "Why is it that I find this opportunity so appealing?" The response was, "Ron, you like to build and develop things. That is your passion." The follow-up question for myself then was whether there was some way in which I could fill that need right where I was. Often we can come up with all the reasons in the world why we want to do something. Yet, if we fail to recognize the core need that is being triggered we will likely only find a temporary solution to a much bigger need in our lives. It will be the solution only until the newness wears off—then we are left right back where we started, looking for an answer to a question that we never learned to ask ourselves.

Sometimes we get so charged up over something, that we do cut off our noses to spite our faces. I would like to say I have it all figured out that that I no longer do that. Truth be told though, every day I have to examine my attitude and make sure that I make a choice to influence my circumstances instead of allowing my circumstances influence my thinking. Sometimes I fail, sometimes I succeed. When I do succeed, I find myself much more able to ask the right questions of myself and allow others to do the same so that the decisions I make are not reactions but responses, ones I will not need to regret later on.

Until next time, all my best to you and your families.

Ron

Guest Editorial

A Different Perspective on the CAC's Role

By Greg Matheson

The California Association of Criminalists has, in a small way, let down our profession either through inadvertent omission or deliberate avoidance of discussing and providing information about an important element in the career of a forensic scientist.

What is this egregious omission by the CAC that has caused me to hunt and peck my way across a keyboard?

First, let me introduce myself. My name is Greg Matheson, a forensic scientist employed by the Los Angeles Police Department Criminalistics Laboratory for just over 30 years. Longevity alone does not provide one with any special level of knowledge or expertise, but I do know what 30 years with the LAPD has given me—30 years of invaluable experiences. My training and assignments provided me with the opportunity to be a court-qualified expert in toxicology, explosives, poisons, lamp filaments, crime scene investigations, and most things related to forensic serology and DNA. Most of the cases I worked flowed through the laboratory with little to no public awareness but a select few garnered local, national and international attention. Like many criminalists before me, and many to follow, I made the transition from analyst to supervisor to manager. I have supervised units in which I was an expert and units where I had little to no technical knowledge. After years of many varied, personally valuable and fulfilling experiences I was honored with the opportunity to be the LAPD Criminalistics Laboratory director.

Throughout my career, the CAC has played an important role in my development as a forensic scientist. The many seminars I attended provided me with technical knowledge, information on cutting edge technology, and handy hints and tips to make my analytical tasks easier and better. Most importantly, seminars afforded me the opportunity to meet my colleagues and peers. I have learned from the broader forensic science community and have established friendships that will last a lifetime.

The *CACNews* has provided me with technical knowledge and kept me abreast of happenings in our profession. Its editorials; articles and other writings have expanded my knowledge in the areas of ethics and professionalism. The Founders Lectures and *CACNews* articles have taught me the importance of our history and about the pioneers that came before us. I have learned the importance of giving back to our profession by volunteering to serve on committees and by being a member of the board of directors. All in all, the CAC has been a major contributor to the skills I developed and applied to my analytical work. More importantly, the CAC helped develop my significant interest in and dedication to our profession. The CAC helped me to be the best I can be in my chosen profession.

Shouldn't there be a concerted effort to provide you, the person running the tests and writing analytical reports, with the tools to help better understand the needs of your leadership?

Given the significant positive impact the CAC has had on my life, why do I say it has in any way failed to provide its membership and the forensic science community with valuable information?

What about information regarding a criminalist's next possible career move? Or, help in making an informed decision as to whether or not to seek transition from an analyst to technical leader, supervisor and/or manager? Or, once the decision is made, what about guidance through the transition? What about filling the gap between the analyst and management? Shouldn't there be a concerted effort to provide you, the person running the tests and writing analytical reports, with the tools to help better understand the needs of your leadership? Doing so will allow them to meet your needs and prepare you to be your laboratory's next leader. The CAC is the best resource to assist a criminalist in deciding if a leadership role is the right career path. Thus, the CAC should be providing you with the information you need to know what to expect and how to prepare for future leadership positions. If a leadership role is not your selected path the CAC should be reaching out to you to help you understand the needs of technical leadership, supervision and management. This knowledge is vital to providing the highest level of quality and service to the criminal justice system.

Many would say providing training for supervisors and mangers is the role of the California Association of Crime Laboratory Directors (CACLD). After all, isn't the CACLD California's association for supervisors and managers?

Like the CAC, the CACLD is an exceptional professional organization with a specific mission. The CACLD's membership is composed of supervisors and managers of public and private laboratories. The semi-annual meetings of the CACLD provide continuing education in the areas of leadership, supervision, and management. Updates are provided in legislative matters, fiscal

opportunities and challenges, and state and federal labor laws. This training and information is given to individuals who are in leadership positions to help them improve the job they have already been selected to perform.

Becoming a leader starts early in one's career. The seeds for future success as a leader are planted while the CAC is a criminalist's primary professional organization; consciously and subconsciously watching and learning from existing technical leaders, supervisors and managers. One can gain significant knowledge by observing the habits and practices of the good, the mediocre and the bad. How many times have you witnessed a technical leader, supervisor or manager do something and then said to yourself "I could have done that better"? How many times have you been thankful for the way they resolved a problem or acted in a way that made your life easier? Chances are there are more of the former than the latter. Unfortunately, the good jobs performed by leadership, like those performed daily by the analytical staff, are expected and therefore not recognized as often as poor decisions or routine tasks. Still, most people complain that leadership is quicker to criticize than praise. We can all learn by deciphering the good from the poor and understanding the necessary roles each of us plays.

The CAC is one of the best professional organizations in the world for helping with the development of the practitioner of criminalistics, but it can go one step further by providing important information to ensure the future leaders of our profession are properly developed. I hope this monologue has left you with the desire to read more and explore a gap the CAC needs to fill. Maybe you are the next great leader of your laboratory but have yet to realize it or even consider it. The stage has been set for the many topics I wish to pursue with you in future issues of the *CACNews*. Also, I would like to hear from you about subjects, issues or questions you would like to pursue.

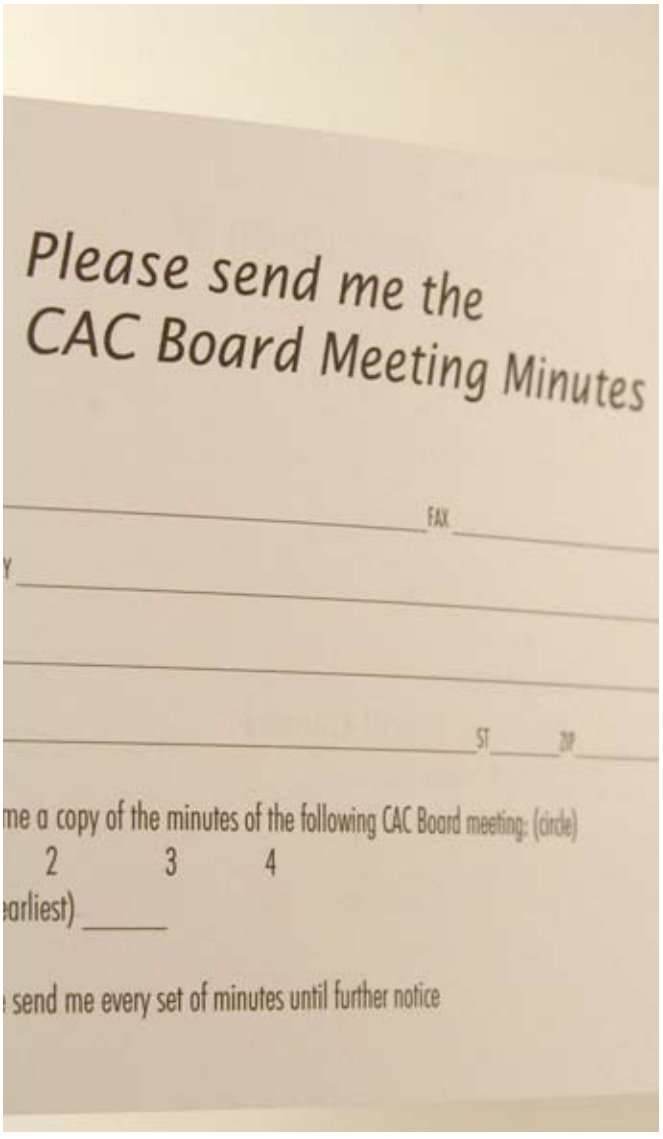
Future topics for us to consider:

- Charting the path from analyst trainee to laboratory director. Determining if this is the path for you to be professionally fulfilled. More importantly, if a leadership role is pursued, knowing when to stop on the path when you are the most fulfilled, while providing the highest benefit to your organization and the forensic science community.
- If tomorrow's leaders are not developed from within, are we willing to leave the leadership of our profession to non-forensic science professional managers? The pros and cons of managers that develop from the ranks.
- The importance of Peer Leaders, Technical Leaders, Supervisors, and Managers.
- The role of a supervisor and manager is more than most people see. Understanding the difference in perspective between the person performing the analysis and those in leadership roles.

Greg Matheson has announced his interest in the Editorial Secretary board position. —Ed.

Reader Response Cards Discontinued

To save on production costs, reader response cards will no longer be included in the *CACNews*. Please contact Jamie Miller at rd13510@fss.ocgov.com to request your copy of the minutes of CAC board meetings.



norah rudin & keith inman • the proceedings of lunch

www.forensicdna.com • norah@forensicdna.com • kinman@ix.netcom.com

Who Speaks for Forensic Science?
The Conviction and Exoneration of a Straw Man

"The debate over criminal justice has become caustic and polarized, masking substance with rhetoric."

—John K. Van de Kamp, Chair
California Commission on the
Fair Administration of Justice

Representative of our lives, the discussion for this *Proceedings* took place over several weeks in locations spanning the United States. Some conversations were fueled and lubricated by tasty comestibles and adult libations; in addition to our usual "office" at *Astaria* restaurant in San Mateo, we had several typically scrumptious meals in New Orleans during the IAFS conference. Other conversations took place over static-filled mobile phone connections from various freeways, airports and hotel rooms.

Our musings this quarter are fueled by a piece written by John Collins and Jay Jarvis. These forensic professionals distribute a news and editorial e-publication entitled *Crime Lab Report* (www.crimelabreport.com). In The Wrongful Conviction of Forensic Science (Collins and Jarvis, 2008, *reprint follows in this issue*), Collins and Jarvis explain why they believe that the innocence movement in general, and the Innocence Project in particular, have wrongfully accused and "convicted" forensic science as a leading cause of wrongful convictions. Their main target is *Judging Innocence*, a study published by Brandon Garrett in the *Columbia Law Review* (Garrett, 2008). As part of this study, Garrett tallies up what he believes to be various causes of wrongful convictions and calculates percentages that he assigns to each cause. Collins and Jarvis believe those calculations to be inaccurate and misleading.

We were somewhat taken aback by the tone of Collins and Jarvis. Clearly they are very angry about what they perceive to be an ongoing and virulent misrepresentation of forensic science and forensic scientists. Keep in mind that we too are practicing criminalists. Although Norah currently works as an independent consultant and Keith holds concurrent positions in a private laboratory and as a professor, both of us have also worked at one time or another for law enforcement laboratories. We found that Collins and Jarvis' choice of language (much of which struck us as emotionally charged) distracted from, rather than enhanced, their message; their chosen style invites dissension rather than advancing constructive discussion.

Interestingly, the term "malpractice," an apparently meaningful and important concept to Collins and Jarvis, does not appear in Garrett's manuscript

One of us happened to be observing some analysis (ironically, it happened to be post-conviction work at the request of a local Innocence Project) in a public laboratory on the day the Collins and Jarvis article hit cyberspace. Not surprisingly, it was the main topic of conversation in the break room that day (displacing the *Tour de France* doping scandal *du jour*). One laboratory scientist commented that the piece struck her as "sensationalist." Another group of scientists mentioned that they preferred to evaluate each case on its own merits, rather than make global judgments. In this laboratory, at least, people were not heeding the call to war against the Innocence Project. Nevertheless, a breadth of reaction to both the innocence movement, and, we suspect, to the Collins and Jarvis commentary, exists in the forensic community. This piqued our curiosity to have a closer look at the Garrett article (conveniently downloadable at ssrn.com/abstract=999984) to see just what had inspired such vitriol.

Although Collins and Jarvis refer throughout to "Garrett and Neufeld[1]" the *Columbia Law Review* article was authored solely by Garrett. The dual credit (or perhaps blame) appears to arise from presentations given together by Garrett and Neufeld. Having not been present at these talks, we can comment only on the published article. The purpose of Garrett's research was to evaluate the first 200 cases in which wrongful convictions were identified and reversed using DNA analysis, in an attempt to learn what went wrong during the initial tour of the judicial system. Given that the Innocence Project depends heavily on a forensic discipline, DNA testing, to support its work, it seems counter-intuitive that Garrett would have a preexisting agenda to discredit forensic science as a whole. Our impression is that Garrett performed his research and wrote his article in good faith.[2] As we all know (especially those attempting DNA statistics on complex low-level mixtures), data can be mined in innumerable ways; the assumptions one makes and the questions one asks can so radically change the conclusions drawn from a single data set that they might seem to represent different facts and figures. We have no interest (nor frankly the time) in reviewing each of the 200 innocence cases yet again, nor re-crunching the numbers ourselves. Nor do we really think this would serve to ferret out the discordant conclusions of the opposing authors. Therefore we make no claim that our comments are either comprehen-

[1] Peter Neufeld of The Innocence Project

[2] We have to disclose that we enjoy a good relationship with the Innocence Project and the greater innocence movement, including open bidirectional lines of communication.

sive or conclusive. It is the assumptions and inferences that capture our interest.

Collins and Jarvis end their report with a challenge: *"The authors hope this report is subject to fair and rigorous scrutiny."* OK, here goes…

Limitations—of both science and humans

"If the law has made you a witness, remain a man of science, you have no victim to avenge, no guilty or innocent person to convict or save – you must bear testimony within the limits of science."

—Dr. P. C. Brouardel
19th century French medico-legalist

One of Collins and Jarvis' main complaints spotlights the distinction between the bright line of intentional fraud (such as dry-labbing or deliberately misrepresenting data) and the gray area of tests with inherently limited discriminating power (e.g. microscopic hair comparison, conventional serology). We note that limited *evidence* (poor quality or low quantity) can impose exactly the same constraints on what is normally considered the most objective and discriminating forensic test, DNA typing. We have previously commented on this issue, (Rudin and Inman, 2005, 2006) and we agree that outright fraud should be considered separately from inherently limited tests or evidence. But therein lies the rub: was the limited nature of such conclusions adequately conveyed and emphasized by the analyst in reports and testimony (a responsibility of forensic science), did the attorney attempt to hijack the evidence in argument (a responsibility of the legal and judicial system), and how did the jury ultimately understand the strength and significance of the evidence (only the jury knows for sure)?

We can get some idea of how the analyst testified, and how the attorneys argued, from transcripts, if they exist. We can review laboratory reports and notes, if available, to discern if the appropriate limitations were attached to any conclusions. But, unless the jury was interviewed, and the interviews documented, typically we have no idea how various pieces of evidence, physical or otherwise, influenced the final verdict. We believe this to be an irresolvable limitation to any analysis of the cause(s) of wrongful convictions. Both studies basically counted up the different kinds of evidence (e.g. physical, witness, testimonial) presented in each case, and divided by the total to come up with a percentage contribution of each to a wrongful conviction. Neither study attempted to weight the various factors, nor is there any reliable way to do so. Consequently, while we can get some general idea of the different factors that may have been involved, it is our opinion that it is folly to argue about exact percentages when no rigorous statistical tools have been applied, and may not be applicable. Simon Cole has made similar arguments about these issues. (2005)

Contrary to what Collins and Jarvis convey, Garrett clearly acknowledges the difference between fraudulence and limited forensic tests:

The forensic evidence was often fairly central to the prosecution's case even though it may have been known to have limited probative power at the time of trial. For example, exonerations in cases involving serology may not show misconduct, but rather either the limitations of old-fashioned serology as compared with more advanced DNA testing technology or unintentional error in conducting such testing. (Garrett, pg. 131)

What concerns us as members of the forensic science profession is the slippery slope of how limited evidence is presented.

A preliminary review of serological testimony during these exonerees' trials disclosed that more than half involved improper testimony by forensic examiners. (Garrett, pg. 132)

Over decades of casework review, both of us have encountered enough failures to appropriately delineate the limitations of either the test or the evidence, that such instances don't impress us as particularly rare or exceptional. Frequently, such evidence serves only to corroborate other elements of a case, so, in and of itself, might not be a tipping factor in the jury's decision, be it conviction or acquittal, wrongful or correct. However, that it might legally be judged as harmless error, does not make the practice scientifically supportable. We would agree that the vast majority of time that we have encountered overstatement of the strength of physical evidence, no reason exists to think that it is anything other than entirely unintentional. Elements of human nature such as context effect (Dror et al., 2005, 2006, 2006a, 2008, Gianelli, 2007, Krane et al., 2008, Risinger et al., 2002, Rosenthal, 1966) and our natural tendency toward a team player mentality, can subtly or even grossly affect our representation of the evidence. Insufficient checks and balances in the system (e.g. administrative firewalls and the sequential unmasking of information (Krane et al., 2008), or inadequate education and training, may also influence the presentation of results. Rather than argue about the exact number of cases in which overstatement of the strength or significance of physical evidence may have occurred, we encourage the forensic community to extend its vigilance to ensure that results are reported accurately and completely, and that appropriate limitations are specified, both in written reports and in testimony.

Numbers and words

Torture numbers, and they'll confess to anything.

—Gregg Easterbrook

Speaking of numbers, a scientist from another public laboratory, separated by an entire continent from the first, mentioned her incredulity that an 11% "malpractice" rate (the proportion of "forensic science malpractice" instances offered by Collins and Jarvis, (2008b, pg. 1) was somehow acceptable. Interestingly, the term "malpractice," an apparently meaningful and important concept to Collins and Jarvis, does not appear in Garrett's manuscript even once. Collins and Jarvis fail to define exactly what they mean by "malpractice," so it is impossible to compare their discussion with Garrett's. On the first page of their report , they mention "malpractice, fraudulent or not" which further confuses the issue. If redefining the language of the discussion using a loaded word meaning "bad practice" is somehow an attempt to distance the forensic profession from taking responsibility for accurately conveying the meaning of limited tests or weak evidence, then we take exception to the notion. That the historical science is inherently limited is in no way pejorative, it is simply a fact; if Collins and Jarvis, or any other forensic scientist, chooses to be offended by this description, we suggest this is entirely of their own construction. Similarly, "probable systemic failure", a phrase used throughout by Collins and Jarvis, never appears in the Garrett manuscript, nor do they ever define it. Their failure to use a common language, or even define their own

terminology, renders their report virtually incomprehensible; it creates an intellectual vacuum into which readers can easily project their own pre-existing biases and interpretations.

Returning to the 11% "malpractice" that Collins and Jarvis offer as a more accurate interpretation of the data, if this is true, aren't we horrified and embarrassed by this (in our opinion) unacceptably high "malpractice" rate of our profession? We have no control over eyewitness misidentification, false confessions, prosecutorial misconduct, defense incompetence, or judicial ignorance; what we can influence is how we monitor and safeguard our own profession. While rogue individuals will always exist in any profession, we can certainly institute systemic checks and balances to identify fraud and minimize unintentional error. While the forensic science profession has made great strides in addressing these issues in recent years, we still have work to do in this area.

The accreditation solution

If one considers what need people have of an external regulation to constrain and steady them, how compulsion, slavery in a higher sense, is the sole and final condition under which the person of weaker will can prosper; then one understands the nature of conviction, "faith."

—Friedrich Nietzsche

Another point made by Collins and Jarvis is that only one of the instances in which forensic analysis supported a wrongful conviction involved an accredited lab. (pg. 1, 2008b) We remain unconvinced of the relevance or utility of this point. Obviously the cases under discussion represent a time period prior to commonplace accreditation of laboratories. Most cases during that time period would have been worked by unaccredited laboratories, therefore this is simply not a meaningful statement. The arguments made by Cole (2005) cautioning against extrapolating generalizations from post-conviction exoneration data apply here as well.

More to the point, however, the accreditation process only reviews the infrastructure of a laboratory, it does not address the specifics of any particular case. We have previously opined (Rudin and Inman, 2005), and we maintain, that, although accreditation can support quality casework, it does not, nor can it, ensure correct results. Internal technical review and external independent review are the most effective checks on the quality of individual cases. Further, to suggest that the Innocence Project dismisses accreditation as a useful tool to support quality case work is pure fiction. In *Sidebar 2* we reprint an excerpt from a letter written by Barry Scheck, co-director of the Innocence Project, in direct refutation of this point. The "article" referenced in the first line is, in fact, the Collins and Jarvis piece.

The legal solution

Scientists should always state the opinions upon which their facts are based.

—Author Unknown

Collins and Jarvis suggest that, *"when [forensic science malpractice] does occur …. the risks are best mitigated by competent and ethical trial lawyers."* Further, they suggest, *"at least preliminarily, that nearly all of the overturned convictions would have been prevented by more competent and ethical legal counsel on both sides. This finding seems to be intuitively reasonable mainly because lawyers are critical to ensuring that our criminal justice system is fair to all parties dedicated to seeking the truth."* While prosecuto-

Sidebar 1

We were particularly keen to follow up on several specific cases Collins and Jarvis mention at the end of their report in which they say that the "Innocence Project case profiles cite unreliable / limited science as being a factor contributing to the conviction despite the knowledge of exculpatory forensic results before trial." According to Collins and Jarvis:

James Ochoa, for example, was convicted of armed robbery and carjacking in 2005. Prosecutors were certain of his guilt even though DNA and fingerprint evidence excluded Ochoa prior to trial. Yet his conviction is blamed by the Innocence Project on unreliable / limited science and is included by Garrett and Neufeld as an example of faulty forensic science.

After reading this case description on the Innocence Project web site (/www.innocenceproject.org/Content/43.php), we were also somewhat mystified as to why unreliable / limited science was listed as one of the causes of this particular wrongful conviction. Indeed, fingerprint evidence reportedly excluded Ochoa, and DNA evidence not only excluded Ochoa, but appeared to clearly inculpate another male. When we contacted the Innocence Project for clarification, we were directed to the use of a dog who supposedly traced the scent from a discarded baseball cap to Ochoa's house. We have suggested to the Innocence Project that most criminalists would not consider bloodhounds part of our profession and that this case should be reclassified. While one case will not substantively change any percentages or conclusions, it would be a gesture of reasonableness and goodwill.

Next, Collins and Jarvis cite the case of Drew Whitely:

Drew Whitley was convicted of murder in 1989. A laboratory technician testified that a saliva sample associated with the crime scene did not match Whitley. Yet his conviction is blamed on unreliable / limited science.

In this case Collins and Jarvis provide incomplete information. According to the Innocence Project web site (www.innocenceproject.org/Content/292.php), in addition to the saliva exclusion (no further information is provided as the exact testing performed), testimony regarding "similar hairs" and an ABO blood inclusion on other items was presented. Did they think we wouldn't notice?

Finally, Collins and Jarvis offer the case of Roy Brown:

Roy Brown was convicted of murder in 1992. A bite-mark expert retained by the defense testified during trial that six of seven bite-marks were not sufficient for analysis and that "the seventh excluded Brown because it had two more upper teeth than he had." Yet his conviction is blamed on unreliable / limited science.

Again, Collins and Jarvis commit the sin of omission. While the defense did indeed present testimony that the majority of the bite marks on the victim's body were insufficient for analysis, and one was exclusionary, this was only after a prosecution bite-mark expert testified that the 7 bite marks were "entirely consistent" with Brown! (www.innocenceproject.org/Content/425.php)

If this is how Collins and Jarvis understand "the whole truth" we are suddenly less concerned about the dog.

rial misconduct, incompetent defense counsel, and unsound judicial rulings undoubtedly contribute to practically every case of wrongful conviction, we find the broad statement by Collins and Jarvis disturbing. For two gentlemen who seem intent on arguing the fine points of statistics, to baldly base such a sweeping conclusion on "reasonable intuition," however "preliminarily," seems, at the very least, internally inconsistent. Is it too much to expect that scientists base conclusions on data?

More to the point, however, forensic scientists love to complain about lawyers and judges who don't understand science. They are both our *raison d'etre* and the bane of our existence; without them we don't have a job, yet the tension between science and law overlays much of our professional lives. How can we reasonably, never mind ethically, ask trial lawyers to do our job for us? While legal argument and judicial decisions are layered on top of our reports and testimony, it is absurd to expect lawyers and judges to vet the science. That's our job. We need to monitor our own profession before indicting a profession to which we do not belong.

That said, we have heard representatives of the Innocence Project very clearly and publicly acknowledge that the problems with incompetent and unethical lawyering are both pervasive and difficult to address. For example, studies on prosecutorial misconduct (Ridolfi, 2007, Uelmen, 2007) and incompetent defense lawyering, (Benner, 2007, Uelmen, 2007) as well as a host of relevant criminal justice topics were conducted as part of the California Commission on the Fair Administration of Justice, and can be found on their web site (www.ccfaj.org). Nevertheless, however prevalent these issues may be, waving a red flag on the other side of the street is not going to fix the potholes in the middle. And the existence of problems elsewhere does not relieve us from the responsibility of fixing the potholes and repaving the road (with something hopefully more substantive than good intentions).

The scientist is not a person who gives the right answers, he's one who asks the right questions.

— Claude Lévi-Strauss, Le Cru et le cuit, 1964

Collins and Jarvis end their diatribe with a statement of the question they hoped to answer:

"The major public policy question that this study hoped to answer was whether or not governmental oversight of crime laboratories is statistically and economically justified. The opinion held by many in the innocence movement is that such oversight is needed; however, this opinion depends on two assumptions that were invalidated by this study:

1. That forensic science malpractice is a leading cause of wrongful convictions.

2. That crime laboratory accreditation fails on its own to provide the structure and accountability necessary to minimize the occurrences of forensic science malpractice."

Whether the statistics offered by Collins and Jarvis address any questions regarding oversight can be debated, but at least statistics were discussed. However, if they intended to offer any analysis of the economics of governmental oversight, we can't find it. Of greater concern, however, are the assumptions that they blithely attribute to the innocence movement.

Regarding the first proffered assumption, nowhere in

Sidebar 2

Excerpt from :

MEMORANDUM
To: Members of the California Crime Laboratory Review Task Force
From: Barry Scheck, Co-director
Date: June 4, 2008
RE: June 5, 2008 CCLRTF meeting agenda item 5: Discussion of Oversight Commissions

The principal charge made in this article concerns the "refusal of Innocence Project representatives to publicly acknowledge accreditation as an important and intricate self-regulatory system for forensic science laboratories." As someone who has publicly and strenuously advocated accreditation of crime laboratories for two decades, I assure you the author of this article is, at best, confused. Our role in requiring ASCLD/LAB accreditation in New York alone demonstrates we are committed to accreditation as one important part of a forensic regulatory system.

Finally, we feel it's important to make it clear that the distortions and mischaracterizations of the Innocence Project's work made by Crime Lab Report do not reflect our experiences working with the larger forensic community. Innocence Project Co-Director Peter Neufeld, Communications Director Eric Ferrero, Research Analyst Gabriel Oberfield and Policy Director Stephen Saloom met with ASCLD leadership, including President-Elect Dean Gialamas, President Stephanie Rielander, Consortium of Forensic Science Organizations lobbyist Beth Lavach, and others in February 2008 to discuss, among other things, Crime Lab Report. At that meeting those leaders made it abundantly clear that ASCLD has no connection to Crime Lab Report, and was not representative of its views. More importantly, at that meeting significant progress was made identifying areas of agreement between ASCLD and the Innocence Project, establishing official liaisons between the two organizations for continued communication, and indeed working out some issues to mutual satisfaction since that time.

* * *

We expect that the entire letter, as well as a presentation given by Mr. Scheck will eventually be posted to the Task Force web site at caag.state.ca.us/meetings/tf/content/080708_CA_Crime_Lab.php and we encourage readers to review both documents in their entirety.

Judging Innocence[3] or on the Innocence Project web site[4] can we find a condemnation of "forensic science malpractice" as a leading cause of wrongful conviction. Both sources clearly differentiate between "limited science" and fraud, and both acknowledge that intentional misrepresentation represents a relatively small proportion of instances. Nevertheless, limited science, intentional fraud, and a continuum of complexity in-between, have contributed to wrongful convictions—that is fact. Finally, Garrett's conclusion[5] hardly vilifies forensic science, rather he clearly speaks to criminal justice reform as a whole.

Regarding the second proffered assumption, we've offered clarification that, while those in the innocence movement strongly support accreditation, they don't believe (nor do we) that this element alone speaks to quality work on any particular case. As we have previously discussed, the argument that "only one case involving forensic science malpractice occurred in accredited laboratory" is empty. In fact, several instances of outright fraud have recently been reported in modern, well-respected, accredited laboratories. (ASCLD/LAB, 2005, Cotton, 2004, USDOJ/OIG, 2004, 2006, USSCIL, 2005). In our view, the forensic community is just beginning to discuss issues of complete and accurate reporting of ambiguous results, whether due to tests with inherently limited discrimination power resulting from poor quality or low quantity evidence. These subtle and complex issues are simply outside the purview of accreditation.

When you're right you pound the facts, when you're wrong you pound the table.

—Author Unknown

Declaring war on the innocence movement is not constructive and ultimately self-defeating. Forensic science, in particular through DNA testing, has the power to correct historical injustices to which we may have contributed, even inadvertently. Rather than nitpicking the numbers, we should actively seek to work with all players in the criminal justice system to exonerate those who have been wrongfully convicted, to identify the true perpetrators of a crime, and to minimize the risk of future injustice.

It strikes us that the Collins and Jarvis response to Garrett's work is unnecessarily provocative. As members of the forensic community, we don't feel "attacked" by the innocence movement[6]. It strikes us that a deep breath, followed by a figurative hand-shake and initiation to coffee (or other beverage of mutual choice), serves all interests best. Until then, it must be time for more adult libations.

[3] " … this study examines the leading types of evidence supporting their wrongful convictions, which were erroneous eyewitness identifications, forensic evidence, informant testimony, and false confessions. … These findings all demonstrate how our criminal system failed to effectively review unreliable factual evidence, and, as a result, misjudged innocence."

[4] "*Limited, unreliable or fraudulent forensic science has played a role in 65 percent of wrongful convictions.* In over half of DNA exonerations, the misapplication of forensic disciplines—such as blood type testing, hair analysis, fingerprint analysis, bite mark analysis, and more—has played a role in convicting the innocent. In some cases, forensic scientists and prosecutors presented fraudulent, exaggerated, or otherwise tainted evidence to the judge or jury which led to the wrongful conviction. Three cases have even involved erroneous testimony about DNA test results."

[5] "*Conclusion:* Though as Justice Powell wrote, "a prisoner retains a powerful and legitimate interest in obtaining his release from custody if he is innocent of the charge for which he was incarcerated," the experiences of 200 innocent former convicts provides a body of examples in which our criminal system failed to address, much less remedy, the sources of wrongful convictions. These exonerees could not effectively litigate their factual innocence, likely due to a combination of unfavorable legal standards, unreceptive courts, faulty criminal investigation by law enforcement, inadequate representation at trial or afterwards, and a lack of resources for factual investigation that might have uncovered miscarriages. Some exonerees were reconvicted by multiple juries. These innocence cases are not anomalies. Rape and murder convictions appear prone to reversals based on factual error. And lest one think that with the hindsight of DNA courts would rule differently, many exonerees had difficulty obtaining a vacatur even after DNA testing excluded them.
Our criminal system can judge innocence with greater accuracy. This study uncovers a range of areas in which courts misjudged innocence due to institutional constraints and legal doctrine. A range of policy choices can flow from these findings, and academics have begun to explore the implications of wrongful convictions for our criminal system. Our criminal system need not remain structurally averse to the correction of factual errors. However, to improve the judging of innocence by all involved in the criminal system would require an investment in additional resources for factual investigation and review, and a sustained effort to analyze the costs and benefits of such reforms. Legislators and criminal courts have begun to consider such changes, including the adoption of trial reforms, implementation of accuracy enhancing changes in law enforcement practices, and the creation of innocence commissions to investigate claims of innocence. Additional studies should be undertaken to examine the growing number of DNA exonerations, so that future efforts to reform our criminal system benefit from the lessons that we now can learn about how to better judge innocence."

[6] For a pointed critique on the fundamentals of forensic science, see Saks and Koeher, 2008.

References

ASCLD/LAB Limited scope Interim Inspection Report of the Commonwealth of Virginia Division of Forensic Science Central Laboratory Biology/DNA Unit, April 9, 2005. www.dfs.state.va.us/services/forensicBiology/externalReviewAuditReport.pdf, www.dfs.state.va.us/services/forensicBiology/externalReviews.cfm

Benner, L.A., Stern, L.S., and Avakian, A., Systemic Factors Affecting the Quality of Criminal Defense Representation, California Commission on the Fair Administration of Justice, 2007. [preliminary report, final report to be posted shortly] www.ccfaj.org/rr-pros-expert.html

California Commission on the Fair Administration of Justice, Reports and Recommendations, Professional Responsibility and Accountability of Prosecutors and Defense Lawyers, 2007. www.ccfaj.org/rr-pros-official.html

Cole, S.A., More than zero: Accounting for error in latent fingerprint identification, *J Crim Law & Criminology*, 2005, p. 1025-1028,

Collins J. and Jarvis, J., *Crime Lab Report*, www.crimelabreport.com

Collins J. and Jarvis J., New study 'exonerates' forensic science, *Crime Lab Report*, July 16, 2008a

Collins J. and Jarvis J., The Wrongful Conviction of Forensic Science, *Crime Lab Report,* July 16, 2008b

Cotton, R., Affidavit in the Circuit Court for Anne Arundel County, MD, November 2, 2004. www.nlada.org/Defender/forensics/for_lib/Documents/1108771180.36/blair-cotton%20aff.pdf

Dror, I.E., Peron, A., Hind, S., & Charlton, D. When emotions get the better of us: The effect of contextual top-down processing on matching fingerprints. *Applied Cognitive Psychology*, 19(6), 799-809, 2005.

Dror, I.E., Charlton, D., Why experts make errors. *Journal of Forensic*

Identification, 56 (4), 600-616, 2006.

Dror, I.E., Charlton, D., & Peron A. Contextual information renders experts vulnerable to making erroneous identifications. *Forensic Science International*, 156 (1), 74-78, 2006.

Dror, I.E. and Rosenthal, R. Meta-analytically quantifying the reliability and biasability of forensic experts. *J Forensic Sci*, 53(4) 2008.

Dror, I.E. and Fraser-Mackenzie, P. Criminal Investigative Failures in Cognitive biases in human perception, judgment, and decision making: Bridging theory and the real world. K. Rossmo (Ed.), Taylor & Francis Publishing. In press.

Garrett, B.L., Judging Innocence. *Columbia Law Review*, January 2008. SSRN: ssrn.com/abstract=999984

Gianelli P.C., Confirmation bias. *Crim Just* 2007;22(3):60–1.8

Humphreys, R.J., Report to the Governor of Virginia, September 12, 2005. www.dfs.state.va.us/services/forensicBiology/externalReviewReport.pdf, www.dfs.state.va.us/services/forensicBiology/externalReviews.cfm

Krane, D.E., Ford, S., Gilder, J.R. Inman, K., Jamieson, A., Koppl, J., Kornfield, I.L., Risinger, D.M., Rudin, N., Taylor M.C., and Thompson, W.C., Sequential Unmasking: A Means of Minimizing Observer Effects in Forensic DNA Interpretation, Letter to the Editor, *J Forensic Sci*, 53 (4), 2008.

Ridolfi, K., Prosecutorial Misconduct: A Systemic Review, California Commission on the Fair Administration of Justice, July 11, 2007. [preliminary report, final report to be posted shortly] www.ccfaj.org/documents/reports/prosecutorial/expert/Ridolfi--Prosecutorial %20Misconduct%20A%20systemic%20review.pdf

Risinger DM, Saks MJ, Thompson WC, Rosenthal R. The Daubert / Kumho implications of observer effects in forensic science: hidden problems of expectation and suggestion. *Calif L Rev*, 90(1):1–563, 2002.

Rosenthal R. Experimenter effects in behavioral research. New York: Appleton-Century-Crofts, 1966.

Rudin N., and Inman, K., A Hitchhiker's Guide to Accreditation, *CACNews* 3rd Quarter 2005.

Rudin N., and Inman, K., The Shifty Paradigm, Part I: Who Gets to Define the Practice of Forensic Science? *CACNews* 4th Quarter 2005.

Rudin N., and Inman, K., The Shifty Paradigm, Part II: Errors and Lies and Fraud, Oh My! *CACNews* 1st Quarter 2006.

Rudin, N., and Eisenberg, A., Report to the Virginia Scientific Advisory Committee, Addendum, January 8, 2008, www.dfs.virginia.gov/about/minutes/saCommittee/20080108.pdf

Saks, M., and Koehler, J., The Individualization Fallacy in Forensic Science Evidence. 61 *Vanderbilt L. Rev.* 199 2008.

Scheck, B.J., Memorandum to: Members of the California Crime Laboratory Review Task Force, June 4, 2008.

U.S. Department of Justice, Office of the Inspector General, A review of the FBI's Handling of the Brandon Mayfield Case, January 2006. www.usdoj.gov/oig/special/s0601/final.pdf

U.S. Department of Justice, Office of the Inspector General, The FBI Laboratory: A Review of Protocol and Practice Vulnerabilities, May 2004. www.usdoj.gov/oig/special/0405/final.pdf

Uelmen, G., Ed. Final Report, California Commission on the Fair Administration of Justice, 2007. www.ccfaj.org/documents/CCFAJFinalReport.pdf

United States Army Criminal Investigation Command, Press release. August 26, 2005. www.cid.army.mil/Documents/CID%20Lab%20Release_final.pdf

The Wrongful Conviction of Forensic Science

By John Collins and Jay Jarvis

Crime Lab Report is an independent research organization that examines media and public policy trends related to forensic science. Past research and commentary published by Crime Lab Report have been both supportive and critical of the forensic sciences. The purpose of this study, however, was to examine the accuracy of claims that forensic science is a leading cause of wrongful convictions. To accomplish this, Crime Lab Report reviewed public information pertaining to the first 200 DNA exonerations that occurred between 1989 and 2007. The frequencies of "probable systemic failures" extracted from case profiles published by the Innocence Project were tabulated and analyzed. As a result of this study, forensic science malpractice, whether fraudulent or not, was shown to be a comparatively small risk to the criminal justice system. When it does occur, however, the risks are best mitigated by competent and ethical trial lawyers dedicated to seeking the truth.

Executive Summary

1. In the 200 convictions studied, 283 instances of probable systemic failure were identified and isolated from case profiles published by the Innocence Project. In many cases, these profiles were either corroborated or clarified by other sources. These failures are ranked as follows:

Rank	Percent	Number	Description
1	54%	153	Eyewitness misidentifications
2	15%	43	False confessions
3	**11%**	**32**	**Forensic science malpractice**
4	10%	27	Government misconduct
5	9%	25	Informant snitches
6	1%	3	Bad lawyering

2. Of the 32 instances of forensic science malpractice shown above, only one was found to have occurred in an accredited laboratory. This error did not directly incriminate the defendant.

3. In 36 of the 200 overturned convictions, the existence of forensic testing results **favorable** to the defendant was confirmed by various sources. This favorable forensic evidence has been largely ignored in public statements made by the Innocence Project likely because the results were either not presented at trial or otherwise failed to cause an acquittal.

4. Bad lawyering was found to be a much more pervasive problem than what has been previously estimated by both the Innocence Project and a highly publicized study recently published in the *Columbia Law Review*.

5. Forensic science malpractice was identified as the sole systemic failure in only two overturned convictions (1%). Both were associated with the work of Fred Zain.

6. Claims that "faulty forensic science" is a leading cause of wrongful convictions were found to be based on careless and improper statistical expressions resulting from a misuse of available exoneration data.

Introduction

The purpose of this study was to explore the basis and validity of claims being perpetuated in the public domain that faulty forensic science is a leading cause of wrongful convictions. Many wrongful convictions have been identified and remedied in recent years through post-conviction litigation and DNA testing. Post-conviction litigation is the specialty of an organization called the Innocence Project in New York. Its affiliates and supporters comprise what is known as the Innocence Network—organizations and advocates dedicated to supporting convicted offenders whose innocence can be proven using modern DNA technology.

The exoneration of truly innocent people is clearly an act of social justice; however, the work of the Innocence Project goes far beyond this. Passionately and convincingly they promote the establishment of state oversight commissions to "review the forensic methods that are accepted in state courtrooms and to investigate allegations of misconduct, negligence or error in labs."[1] Superficially, this might seem reasonable. But a rapidly growing number of forensic science laboratories in the United States already subject themselves to rigorous scrutiny through accreditation and other quality-control safeguards that have only recently demonstrated their full potential to monitor work practices and accuracy in the profession of forensic science. For each of these laboratories, the implications associated with being governed by a commission prone to political wrangling and bureaucratic inefficiencies are quite troublesome.

For years, the Innocence Project has publicly condemned what it claims to be the frequent use of erroneous, fraudulent, or unreliable forensic evidence against defendants in criminal trials. And until recently, no authoritative statistical studies had been completed to either support or refute this argument.

But all this changed with a groundbreaking study published in the January 2008 issue of the *Columbia Law Review*, titled "Judging Innocence." Its author, Brandon Garrett, is an associate professor at the University of Virginia School of Law. Garrett and his team carefully studied the first 200 DNA exonerations that occurred between 1989 and 2007, documenting the types of evidence originally used against the defendants during their trials. Based on his research, Garrett argued in support of special commissions to prevent wrongful convictions. "[R]esearch suggests that procedures such as…. oversight of forensic crime laboratories, could have prevented many such costly miscarriages…"[2]

Professor Brandon Garrett is an experienced post-conviction litigator who once served as an associate at Cochran,

Neufeld & Scheck LLP in New York City. Peter Neufeld and Barry Scheck are the cofounders of the Innocence Project located in Manhattan.[3]

Crime Lab Report editors became intrigued by the work of Professor Garrett when it was learned that his study was presented before a special committee convened by the National Academy of Sciences in Washington, D.C. News reports from various sources, including the *New York Times*, attempted to summarize Garrett's findings, which seemed to indicate that faulty forensic science may very well be a leading cause of wrongful convictions in the United States. Therefore, *Crime Lab Report* studied the work and findings of Professor Garrett and extracted pertinent data. This information was then cross-referenced with case profiles, media reports, and public comments pertaining to the first 200 convictions overturned by post-conviction litigators armed with modern DNA technology and other scientific evidence.

Based on this research, a very compelling and contextually honest case can be made for why the conviction of forensic science may be as erroneous as the 200 convictions summarized in this report. Hopefully, future studies seeking to explain the major causes of wrongful convictions may be conducted with more statistical and scientific accuracy.

The Conviction of Forensic Science

The year 1989 marked the beginning of a long and arduous period in the history of America's criminal justice system. It was then that Gary Dotson and David Vasquez were exonerated and released from prison based on new DNA testing capabilities. Dotson served 10 years in prison for aggravated kidnapping and rape. Vasquez served four years in prison for second-degree murder and burglary. Both men were incriminated by forensic evidence during their original trials.[4]

In 1992, well-known criminal defense attorneys Barry Scheck and Peter Neufeld created the Innocence Project, "a national litigation and public policy organization dedicated to exonerating wrongfully convicted people through DNA testing and reforming the criminal justice system to prevent future injustice."[5] As the Innocence Project expanded over the next sixteen years, the basic principles of its public policy agenda were advanced through well coordinated and carefully prepared statements that repeatedly called into question the reliability and professionalism of forensic scientists in the United States.

In a 1996 *USA Today* cover story written by Becky Beaupre and Peter Eisler, Innocence Project co-director Peter Neufeld was quoted as saying "There's absolutely no reason that crime laboratories, which routinely make decisions that have life and death consequences for an accused person, should be less regulated than a clinical laboratory utilizing similar tests."[6]

Similar sentiments were expressed in astounding detail by an aggressive team of *Chicago Tribune* reporters who published a stinging series of investigative reports in 2004 that chronicled some of the cases being worked by the Innocence Project. The reports, which were released one after another over the course of a week, seemed to intentionally lure even the most educated and thoughtful readers into believing that forensic science laboratories were some of the most corrupt and incompetent organizations in the United States.

The *Tribune* set the stage for its attack on forensic science in the first article published on October 17, 2004. "At the center of this upheaval is the advent of DNA testing, which has injected a dose of truth serum into other forensic tools," argued *Tribune* reporters Flynn Roberts, Steve Mills, and Maurice Possley. "With its dramatic precision, DNA has helped reveal the shaky scientific foundations of everything from fingerprinting to firearm identification, from arson investigation to such exotic methods as bite-mark comparison."[7]

On January 13, 2005, *CNN* aired "Can Crime Labs Be Trusted," a probing investigative report that claimed to uncover profound weaknesses in how America's crime laboratories were being operated. Among the pertinent points delivered by *CNN* was the supposed lack of oversight and accountability to ensure that work is conducted properly. Peter Neufeld as interviewed in the documentary. "Forensic science has gotten a free ride for the last 50 years, primarily because they made this bogus argument that [they] don't need to be regulated." [8]

Then, exactly three years after the Chicago *Tribune* series, the "shaky" scientific methods it brought to light became the subject of another television documentary, this time by *MSNBC*, titled "When Forensics Fail," which showcased the troubling stories of innocent persons convicted and imprisoned of crimes that they likely did not commit.[9] One of the cases was that of Ray Krone, who was convicted in 1992 for murder, kidnapping, and sexual assault based largely on a forensic bite-mark identification. DNA collected from the bite-mark was eventually excluded as belonging to Krone.

On October 1, 2007, not long before *MSNBC* aired its documentary, the New York *Times* published a powerful front-page story about the public policy lessons of post-conviction litigation using DNA. In the article, Peter Neufeld argued that "The legislative reform movement as a result of these DNA exonerations is probably the single greatest criminal justice reform effort in the last 40 years."[10] But what quickly attracted the attention of some in the forensic science community was not the article itself, but the fact that it "coincidently" appeared during the weeklong annual training symposium hosted by the American Society of Crime Laboratory Directors in Orlando, Florida.

Any suspicions that the timing of the aforementioned Times article might have been orchestrated by the Innocence Project and/or its supporters in the media were nearly confirmed on February 19, 2008 when a similar front-page story about post-conviction DNA exonerations appeared in USA Today during the annual meeting of the American Academy of Forensic Sciences, one of the largest annual forensic science conventions in the world. A provocative comment by Peter Neufeld was included in the story.[11]

So by the time Professor Brandon Garrett published the results of his research in "Judging Innocence," the profession of forensic science had been entirely and completely convicted of being responsible for the imprisonment of innocent citizens and a symbol of decline and incompetence within America's criminal justice sys-

"Forensic science has gotten a free ride for the last 50 years, primarily because they made this bogus argument that [they] don't need to be regulated."

—Peter Neufeld, Co-Director, Innocence Project

tem. News outlets across the country bought into what they perceived to be a compelling and disturbing story. Elected officials became more open to the idea that faulty forensic science was running rampant in U.S. courtrooms and might require legislative action to correct. Garrett's work simply provided what appeared to be a long-awaited statistical validation of the rhetoric being disseminated by the Innocence Project and its supporters.

In a case that has been touted as the quintessential example of faulty forensic science, it was forensic science that got it right from the start.

In fact, both Brandon Garrett and Peter Neufeld presented the "Judging Innocence" findings on September 20, 2007 to a special committee convened by the National Academy of Sciences, which was charged with the task of identifying the needs of the forensic science community. *Crime Lab Report* obtained a copy of their presentation from the National Academy of Sciences public records office.[12]

Flawed Testimony

Of the 200 exonerations that Professor Garrett examined, he identified 113 cases (57%) where forensic evidence was presented against the defendant during the original trial.[13] According to Garrett, the major problem in wrongful convictions seems to be "improper and misleading testimony regarding comparisons conducted."[14] Such testimony, he argues, tends to bolster questionable evidence that might otherwise have been dismissed as erroneous or unreliable in the eyes of the jury.

Garrett and Neufeld discussed the problem of misleading testimony during their presentation at the National Academy of Sciences in Washington, D.C. In the 113 cases involving the use of forensic evidence against a defendant, 57% of the cases in which trial transcripts were located involved what Garret and Neufeld characterized as improper (but not intentionally so) scientific testimony. An additional seven cases were presented that they claimed to have been tainted by "known misconduct."[15]

Taken together, 42 cases or 69% of the trial transcripts reviewed were alleged by Garrett and Neufeld to have been tainted by faulty forensic science—a disturbing statistic if found to be true. They also went as far as to list the names of "offending" scientists and laboratories.

In January 2008, the Senate Judiciary Committee convened a hearing to investigate the alleged failure of the Justice Department to enforce forensic-related provisions contained in a bipartisan legislative effort known as the *Justice for All Act of 2004*. Peter Neufeld testified on behalf of the Innocence Project:

"Together, misapplication of forensics and misplaced reliance on unreliable or unvalidated methodologies are the second greatest contributors to wrongful convictions. Despite these demonstrated problems, independent and appropriately conducted investigations—which should be conducted when serious forensic negligence or misconduct may have transpired—have been exceedingly rare."[16]

The Verdict

The final verdict in the case against forensic science may have come from the United States Inspector General, Glenn A. Fine, during his own testimony before the Senate Judiciary Committee. In a statement as devastating as it was simple, Fine agreed that "Negligence and misconduct in forensic laboratories…have led to wrongful convictions in several states."[17]

If the profession of forensic science is truly guilty of these charges, and if it can be shown that it has failed to establish the checks and balances necessary to prevent junk science and improper testimony from violating the rights of defendants, then the recommended "sentence" of being subjected to a politically charged, bureaucratic oversight commission would seem well deserved.

But a more reliable and honest statistical analysis has now made a compelling case to the contrary.

The Case for Exoneration

Although they don't command much attention amidst the fervor surrounding the innocence movement, suspicions that DNA exonerations do not portray an accurate picture of the American criminal justice system have been communicated from various sources.

On April 26, 2007, an op-ed piece authored by Morris Hoffman, a Colorado district court judge and adjunct professor of law at the University of Colorado, was published in the *Wall Street Journal*. Hoffman argued that that innocence movement is prone to exaggeration and a tendency to "stretch their results beyond all statistical sense." The following quote from Hoffman seems to adequately summarize his position:

"The mythmakers also directly conflate trial error rates with wrongful conviction rates. Studies showing astonishingly high error rates in capital trials have very little to do with the question of the rate at which innocent people are being convicted. I can't remember a single trial over which I have presided—including dozens of homicides—in which, looking back, I didn't make at least one error in ruling on objections. It is a giant leap from an erroneous trial ruling to reversible error, and another giant leap from reversible error to actual innocence."[18]

As *Crime Lab Report* moved forward with its research into claims that faulty forensic science is a pervasive problem in the United States, Hoffman's observations began to take on new meaning. As will be shown in this report, even the most rudimentary analysis demonstrates that the public-policy rhetoric of the Innocence Project is being underwritten by statistical expressions and characterizations that collapse under the weight of intellectual scrutiny. While this does not devalue the work of representing convicted felons who have a strong case of innocence (even Judge Hoffman pointed out that such work "is incredibly important and should be celebrated…"), the weight assigned to any public policy or legislative recommendations based on such misrepresentations would seem to warrant either minimal consideration or maximum scrutiny.

Misinterpretation of Exoneration Data

The statistical evidence used against forensic science was summarized in a *New York Times* editorial published on July 23, 2007. "The leading cause of wrongful convictions was erroneous identification by eyewitnesses, which occurred 79 percent of the time," wrote *Times* legal correspondent Adam Liptak. "Faulty forensic science was next, present in [57] percent of the cases."[19]

The eagerness of the media to harvest these troublesome figures was only magnified by the presentation that Brandon Garrett and Peter Neufeld gave to the National Academy of Sciences in September 2007. The slide show they presented was titled "Improper Use of Forensic Science in the First 200 Post-Conviction DNA Exonerations" and it relied heavily on the data generated by Garrett's research.

But even when summarizing his own research in "Judging Innocence," which was published only months after his appearance at the National Academy of Sciences, Professor Garrett clearly acknowledged that his study did not seek to quantify the *leading causes* of wrongful convictions. Instead, he simply sought to identify "*the leading types of evidence supporting* wrongful convictions [emphasis added]."[20] This clarification has fallen on deaf ears for reasons that have only been worsened by those in the innocence movement.

Whatever those reasons are, suffice it to say that the public were strongly encouraged to believe that 57% of the 200 overturned convictions were caused by faulty forensic science. This is not even remotely accurate.

First, it is true that 113 or 57% of the 200 overturned convictions involved the presentation of forensic evidence against defendants during their original trials. But as will be demonstrated later, the fact that 57% of these convictions involved the use of forensic evidence does not mean that 57% of all wrongful convictions are caused by faulty forensic science. This erroneous interpretation seems to exemplify the kind of statistical carelessness that Judge Hoffman complained about in his *Wall Street Journal* editorial.

Crime Lab Report carefully studied the Innocence Project's case profiles for each of the first 200 DNA exonerations and tabulated the number of cases in which specific "causes" occurred. Because many of the cases have more than one cause associated with them, the combined percentages exceed 100%. The following is a breakdown of these causes ranked from highest to lowest.

Causes by Number and Percent of Cases

Rank	% Cases	# Cases	Description
1	77%	153	Eyewitness misidentifications
2	**36%**	**71**	**Unreliable / limited science**
3	22%	43	False confessions
4	14%	27	Government misconduct
5	**13%**	**26**	**Forensic science misconduct**
6	13%	25	Informant snitches
7	2%	3	Bad lawyering

These numbers come directly from the Innocence Project's published information on DNA exonerations, yet the only two causes pertaining to forensic science (unreliable/limited science and forensic science misconduct) account for 97 or 49% of the cases, somewhat lower than what was quoted by the *New York Times*, Brandon Garrett, and Peter Neufeld.

The reason for this discrepancy is that 16 of the 113 cases involving forensic evidence were not labeled by Garrett and Neufeld as being problematic, suggesting that some kind of discriminating method was employed to distinguish legitimate forensic evidence from that which was actually faulty. But as Crime Lab Report uncovered, this was not the case. In fact, the number of cases involving actual instances of faulty forensic science is far less than the 97 cases tabulated above. And as will be demonstrated in the following section, the overall statistical weight that can be honestly assigned to faulty forensic science is very small.

Tabulation of *Probable Systemic Failures*

Both Brandon Garret and the Innocence Project have incorrectly relied on counting the types of evidence used against defendants at trial and then expressing the numbers as a percentage of the total number of cases. The problem with this method is its failure to account for cases where multiple types of evidence were used against the defendant.

For example, in the case against Bruce Godschalk[21], who was convicted of rape and burglary by a Pennsylvania jury in 1987, the Innocence Project identified five factors that contributed to the conviction: 1. false eyewitness identification; 2. unreliable / limited science; 3. false confession; 4. government misconduct; 5. bad informant/snitch.

Admittedly, the serology evidence failed to exclude Godschalk, but it did not conclusively associate him either. By all accounts, the forensic testing was not faulty, just too nonspecific to support an acquittal. Any confusion that might have been introduced by this evidence, however, was dwarfed in significance and weight by the other four instances of failure that directly incriminated Godschalk.

Because five different factors are associated with the Godschalk case, proper statistical sampling does not allow for any one factor to be fully blamed for the conviction. Yet this is exactly what has happened.

Crime Lab Report began to correct this problem by tabulating the total number of *probable systemic failures* cited by the Innocence Project, which were then expressed as a percentage of the total number of instances. In doing so, a more valuable statistical model was created. The following table illustrates the resulting data:

Probable Systemic Failures According to the Innocence Proj.

Rank	% Cases	# Cases	Description
1	44%	153	Eyewitness misidentifications
2	**20%**	**71**	**Unreliable / limited science**
3	12%	43	False confessions
4	8%	27	Government misconduct
5	**7%**	**26**	**Forensic science misconduct**
6	7%	25	Informant snitches
7	1%	3	Bad lawyering
		348	

When expressed as a percentage of the total number of instances, not cases, unreliable/limited science occurred 20% of the time while forensic science misconduct occurred only 7% of the time. Collectively, this demonstrates that even the most aggressive interpretation of the Innocence Project's own published data can only attribute 27% of all probable systemic failures to forensic science, a far reach from the 57% cited by the *New York Times*.

But as the research continued, the data became increasingly favorable to forensic science.

The Case Studies

Crime Lab Report randomly selected and examined the exonerations of Steven Avery, Kerry Kotler, Clyde Charles, William Gregory, and Bruce Godschalk. In each of these cases, forensic evidence was used by the prosecution to dem-

onstrate guilt. As a result, they are included among the 113 cases (57%) cited by the *New York Times* as being caused by faulty forensic science. They also include the 97 (27%) instances of probable systemic failure tabulated by *Crime Lab Report*.

But just how faulty was this evidence?

A review of each of the following cases revealed that the forensic evidence was very nonspecific and could not scientifically or exclusively justify the acquittal of the defendant; however, no indication could be found that the testimony or analyses were faulty. Brief descriptions of the scientific evidence in these cases have been quoted directly from authoritative sources.

It remains a mystery as to why the Innocence Project only identified 3 instances of bad lawyering in the 200 cases studied. Even a cursory review of the case profiles shows ample evidence to demonstrate how pervasive and obvious the problem actually was.

Steven Avery—"He was charged with and convicted of [a] brutal attack on [a] beach in Manitowoc County, based almost entirely on eyewitness identification testimony of a single witness. The state also presented microscopic hair examination evidence indicating that a hair found on Avery was 'consistent' with the victim's hair. Avery was sentenced to 32 years in prison in March 1986."[22]

Kerry Kotler—"The prosecution based its case on several points:

- "The victim identified Kotler from a group of 500 photographs."
- "The victim identified Kotler by sight and voice from a police lineup."
- "County laboratory tests showed that Kotler had three non-DNA genetic markers (ABO, PGM, and GLO) that matched those of the semen stain left on the victim's underpants."[23]

Clyde Charles—"Clyde was tried by an all-white jury of 10 women and two men. The prosecution's evidence included the victim's identification and her testimony that the rapist called himself 'Clyde.' A criminalist testified that two Caucasian hairs on Clyde's shirt were microscopically similar (but not conclusively identical) to hair from the victim's head. The police officer testified that Clyde had been wearing a dark jogging jacket with white stripes when he saw him outside the bar, corroborating the victim's description of her assailant's dark jogging suit with stripes. The officer also testified that Clyde had been wearing a red cap and blue jacket tied around his neck when he saw him hitchhiking. A red baseball hat and blue jean jacket were found near the scene of the rape."[24]

William Gregory—"William Gregory, an African-American, was arrested, charged, and sentenced for the attempted rape of a Caucasian woman in his apartment complex after the victim identified him in a suspect lineup. There was no other evidence in the case except for six "Negroid" head hairs discovered in pantyhose used as a mask at the crime scene. The pantyhose had been washed and hung in the victim's bathroom prior to the crime. At the 1993 trial a hair microscopist stated that the hairs could have come from Gregory, and this testimony was helpful to the prosecution."[25]

Bruce Godschalk—"In May of 1987, Mr. Godschalk was convicted of [two] rapes and sentenced to 10 to 20 years in prison. The police had recovered semen samples from both rapes but, in 1987, did not have the DNA technology to test this evidence. Mr. Godschalk's conviction was affirmed on appeal."[26]

As mentioned previously, although extensive research revealed no indication that the forensic evidence in the above cases was anything but valid, each of them has been rhetorically and statistically attributed to faulty forensic science. In other words, because the evidence did not prevent the conviction, it was assumed to have been faulty.

In criminal trials, it is frequently necessary for prosecutors to present weak or limited forensic evidence against defendants. By default, physical evidence that cannot exclude a defendant as being associated with a crime is fair-game to be used as evidence of guilt, and the jury may benefit from hearing it. This demands ethical restraint and judicial vigilance to ensure that the evidence is not confused for being stronger than it actually is. Therefore, competent lawyering is a critical component in the justice system's efforts to protect the rights of defendants and the overall fairness of the adjudicative process.

Failure to Credit Evidence Favorable to the Defendant

Perhaps the most startling data uncovered in *Crime Lab Report's* research was the fact that 36 out of 200 cases (18%) were identified as having forensic evidence that was actually *favorable* to the defendant. Various reasons account for why this evidence was either not presented at trial or failed to cause an acquittal, but the fact remains that these instances did not temper the Innocence Project's rhetoric blaming forensic science for wrongful convictions.

For example, in his research, Professor Garrett found two cases where fingerprint evidence was used against the defendants. But in a third case, the trial of Antonio Beaver, he failed to give credit to forensic scientists who, according to the Innocence Project, concluded that "fingerprints collected from the victim's car – including prints from the driver's side and the rearview mirror – did not match the victim or Beaver."[27]

To the credit of the Innocence Project, they do not associate Antonio Beaver's case with any questionable forensic evidence. The same, however, cannot be said for the convictions of James Ochoa, Drew Whitley, and Roy Brown. In each case, Innocence Project case profiles cite unreliable / limited science as being a factor contributing to the conviction despite the knowledge of exculpatory forensic results before trial.

James Ochoa[28], for example, was convicted of armed robbery and carjacking in 2005. Prosecutors were certain of his guilt even though DNA and fingerprint evidence excluded Ochoa prior to trial. Yet his conviction is blamed by the Innocence Project on unreliable / limited science and is included by Garrett and Neufeld as an example of faulty forensic science.

Drew Whitley[29] was convicted of murder in 1989. A laboratory technician testified that a saliva sample associated with the crime scene did not match Whitley. Yet his conviction is blamed on unreliable / limited science.

Roy Brown[30] was convicted of murder in 1992. A bite-mark expert retained by the defense testified during trial that six of seven bite-marks were not sufficient for analysis and that "the seventh excluded Brown because it had two more upper

teeth than he had." Yet his conviction is blamed on unreliable / limited science.

Ironically, the number of such cases where forensic evidence was favorable to the defendant exceeds the total number of cases that *Crime Lab Report* found to be tainted by actual forensic science malpractice.

The following section will explain how this was determined.

Forensic Science Malpractice

As *Crime Lab Report's* research progressed into the summer of 2007, it became increasingly evident that there were significant problems with the Innocence Project's accounting and characterization of cases involving forensic evidence. Up to that point, the published case profiles and reports, such as the ones reviewed in the Bruce Godschalk case, revealed multiple contributing factors without appropriate weight being assigned to any of them.

Because *Crime Lab Report* was concerned only with the role of forensic science in the overturned convictions, a second review of all 200 case profiles, supplemented by news reports for many of those cases, was conducted with a focus only on the role of forensic science. As a result of this review, the 200 cases under consideration were broken down into the following categories, all specific to forensic science:

1. Conviction not supported by forensic evidence
2. Non-specific science failed to exclude the defendant
3. **Forensic Science Malpractice**
4. Forensic evidence was favorable to the defendant

By evaluating the cases in this manner, the actual role of forensic evidence could be more clearly and constructively estimated. The following table shows how the cases ranked using this method.

The Role of Forensic Science—by No. and % of Cases

Rank	% Cases	# Cases	Description
1	35%	69	Non-specific science failed to exclude the defendant
2	32%	63	Conviction was not supported by forensic evidence
3	18%	36	Forensic evidence was favorable to the defendant
4	**16%**	**32**	**Forensic science malpractice**
		200	

Based upon this review, only 16% could be associated with probable instances of forensic science malpractice. But as mentioned earlier, there is a problem with this approach. Expressing systemic failures as a percentage of cases does not account for cases with multiple failures contributing to the convictions.

Therefore, *Crime Lab Report* extracted the above 32 instances of probable forensic-science malpractice and ranked them against other instances of failure identified by the Innocence Project. This time, the total number of failures dropped from 348 to 283 due to so many forensic-related cases having been questionably or improperly cited by the Innocence Project as being caused by faulty forensic evidence.

Probable Systemic Failures—by Number and Percent

Rank	% Cases	# Cases	Description
1	54%	153	Eyewitness misidentifications
2	15%	43	False confessions
3	**11%**	**32**	**Forensic Science Malpractice**
4	10%	27	Government misconduct
5	9%	25	Informant snitches
6	1%	3	Bad lawyering
		283	

The above table provides some of the most compelling evidence that vindicates forensic science from the accusations of critics in the innocence movement. Only 11% of all probable systemic failures identified by *Crime Lab Report* were attributed to forensic science malpractice using the available data.

For those who correctly argue that 11% is unacceptably high, the following section will demonstrate why the percentage continues to shrink in favor of forensic science.

Bad Lawyering and Government Misconduct

As mentioned in the Executive Summary on the first page of this report, it was noted that the number of convictions attributed by the Innocence Project and Professor Garrett to bad lawyering was remarkably low, only 3 cases out of 200, or 1.1%. Government misconduct was blamed in 27 cases (14%). *Crime Lab Report's* study, however, suggests, at least preliminarily, that nearly all of the overturned convictions would have been prevented by more competent and ethical legal counsel on both sides. This finding seems to be intuitively reasonable mainly because lawyers are critical to ensuring that our criminal justice system is fair to all parties. It is also consistent with standards adopted by the American Bar Association.

Kelly Pyrek, author of *Forensic Science Under Siege*, noted the following:

"The American Bar Association's (ABA) Model Rules of Professional Conduct outline a number of important tenets of responsibility and professional conduct for attorneys, including 'A lawyer shall provide competent representation to a client. Competent representation requires the legal knowledge, skill, thoroughness, and preparation reasonably necessary for the representation' and 'A lawyer shall act with reasonable diligence and promptness in representing a client.'"[31]

Considering the critical role that trial attorneys play before and during a criminal trial, one would expect the Innocence Project to identify more than three instances of bad lawyering in 200 overturned convictions.

This understatement, however, creates a massive statistical vacuum that has contributed heavily to the wrongful conviction of forensic science in the court of public opinion.

For example, if one were to estimate that 100 instances of bad lawyering are actually represented in the 200 convictions studied, it would raise the total number of systemic failures to 380 and lower the percent attributable to forensic malpractice to 8.4%.

On the other hand, if the most liberal (but not necessarily the most reasonable) interpretation is applied such that all 200 cases are assigned one instance of bad lawyering and one instance of government misconduct, it would raise the total number of systemic failures to 653 and lower the percent attributable to forensic science malpractice to only 4.9%.

These hypothetical estimates demonstrate how important it is to accurately and *completely* tabulate the causes of wrongful convictions before assigning a specific share of the blame to any of them. Because bad lawyering is so understated in the Innocence Project's data, the blame assigned to forensic science malpractice has become inflated beyond reason.

Future studies conducted with the assistance of reputable forensic science experts will hopefully look closer at the 200 overturned convictions to determine exactly how they happened and if, in fact, the 32 instances of forensic science malpractice can be fairly labeled as such. Preliminary information collected in this study strongly suggests that many are not. This includes the disturbing and tragic case against Ray Krone.

The Conviction of Ray Krone

According to *MSNBC*, it was the ultimate example of faulty forensic science—an erroneous identification reported by a prosecution expert who testified that Ray Krone, and only Ray Krone, was responsible for leaving a bite-mark on the breast of a dead woman found in a local tavern. She was a waitress and Ray Krone was a frequent patron.[32]

With little other evidence to speak of, Krone was convicted of murder and sentenced to death by an Arizona jury. According to the Innocence Project, "At his 1992 trial, Krone maintained his innocence, claiming to be asleep in his bed at the time of the crime. Experts for the prosecution, however, testified that the bite-marks found on the victim's body matched the impression that Krone had made on [a Styrofoam cup] and a jury convicted him on the counts of murder and kidnapping."[33]

The Innocence Project needs attention and money to drive its public policy agenda. In the age of *CSI*, *New Detectives*, *Cold Case Files*, and *Crossing Jordan*, taking on crime laboratories will turn heads more quickly than esoteric procedural debates among litigators.

At first glance, Krone's conviction seems to be another glaring example of faulty forensic science.

Unfortunately, critical pieces of information were left out of the Innocence Project's case profile for Ray Krone. Prior to Krone's trial, a forensic bite-mark expert, Dr. Skip Sperber, was hired by the prosecution to examine the bite-mark evidence. Sperber concluded that Krone, in fact, did not leave the bite-mark found on the victim's breast and, according to *MSNBC*, advised prosecutors that the police "have the wrong guy."[34]

Apparently unhappy with Sperber's result, prosecutors took the evidence to an inexperienced local odontologist who conclusively identified Krone as leaving the bite-mark in question. The Krone case was his first, according to *MSNBC*.

As attorney's continued to uncover problems with Krone's trial, it was learned that more conventional and scientifically respected evidence, including fingerprints and footwear impressions, had also been examined prior to trial and excluded Krone as being the contributor.

Maricopa County Attorney Rick Romley eventually apologized for the obvious miscarriage of justice, but he conveniently passed blame for his own possible misconduct onto forensic science by suggesting that Krone's conviction was simply the result of inadequate science.

In a case that has been touted as the quintessential example of faulty forensic science, it was forensic science that got it right from the start.

It is true that bite-mark analysis is a discipline with little peer-oversight and no significant place in America's crime laboratories. But the inability of Krone's team to mount an adequate defense and the failure of prosecutors to act on the totality of forensic evidence pointing to another perpetrator should have raised the ire of the Innocence Project enough to convince them that bad lawyering and government misconduct were the primary causes of Krone's wrongful conviction.

But for reasons that are difficult to understand, the Innocence Project case profile for Ray Krone[35] failed to emphasize government misconduct or bad lawyering as factors contributing to Krone's conviction.

Closing Arguments

The leading causes of wrongful convictions are false eyewitness identifications exacerbated by bad lawyering, and in some cases, government misconduct. As a total percentage of all systemic failures contributing to wrongful convictions, faulty forensic science comprises a small percentage. But more importantly, this percentage decreases considerably as stricter and more controlled methods are employed to analyze the available exoneration data. More work should be done in this regard.

In the meantime, the compiled data and information studied by Crime Lab Report demonstrate faulty and incomplete statistics magnified by rhetorical misrepresentations on the part of innocence advocates and the media. These misrepresentations have come to bear heavily on the profession of forensic science, which is not accustomed to withstanding sustained attacks from well-funded activists. Forensic scientists are simply too busy. For this reason, the profession is vulnerable to being bullied.

The case of Ray Krone is among the most disturbing in terms of the blame unfairly placed on forensic science and the turmoil that Krone endured as a result of government misconduct, bad lawyering, or possibly both. But the cases of Steven Avery, Antonio Beaver, Clyde Charles, William Gregory, Kerry Kotler, and Bruce Godschalk tell a story of their own, and they all raise very serious questions about the lengths to which the innocence movement is willing to go in carrying out its public policy and legislative efforts.

The authors hope that this report is subjected to fair and rigorous scrutiny. But whatever the outcome, all stakeholders should be reminded that any public policy agenda being advanced with exaggerations and mischaracterizations, whether intentionally fabricated or not, should be subjected to equally rigorous scrutiny or rejected entirely.

Authors' Comments and Public Policy Considerations

While this study seems to defend the profession of forensic science, the authors recognize that it is very good practice for trial lawyers, judges, and juries to look cautiously, and sometimes skeptically, at the testimony of subject-matter experts. This means that expert conclusions and associated testimony should always be subjected to a level of scrutiny that is commensurate with the seriousness of the matter at hand. Consequently, the adversarial system of justice in the United States places a tremendous responsibility on lawyers and judges to be vigilant, honest, and fair.

It remains a mystery as to why the Innocence Project only identified 3 instances of bad lawyering in the 200 cases studied. Even a cursory review of the case profiles shows ample evidence to demonstrate how pervasive and obvious the problem actually was. Even the 27 cases cited as involving government misconduct was probably much too low. That the Innocence Project's public policy efforts focus so intently on forensic science would leave a reasonable person to suspect that forensic science is simply a more attractive target, not because it is justified, but because the fight attracts more attention.

The Innocence Project needs attention and money to drive its public policy agenda. In the age of *CSI, New Detectives, Cold Case Files,* and *Crossing Jordan*, taking on crime laboratories will turn heads more quickly than esoteric procedural debates among litigators.

The major public policy question that this study hoped to answer was whether or not governmental oversight of crime laboratories is statistically and economically justified. The opinion held by many in the innocence movement is that such oversight is needed; however, this opinion depends on two assumptions that were invalidated by this study:

1. That forensic science malpractice is a leading cause of wrongful convictions.

2. That crime laboratory accreditation fails on its own to provide the structure and accountability necessary to minimize the occurrences of forensic science malpractice.

Crime Lab Report found only one case involving forensic science malpractice in an accredited laboratory; however, it was a false exclusion of a rape victim's husband as being the contributor of semen found on a rape-kit swab and bedding from the victim's home. The error did not directly incriminate the defendant and appeared to be completely unintentional. Also, the incident occurred in 1988 when crime laboratory accreditation was in its infancy.[36]

In fact, 74% of the 200 overturned convictions occurred before 1990. Since then, accreditation has grown in scope and complexity. Of all laboratories currently accredited by the American Society of Crime Laboratory Directors / Laboratory Accreditation Board (ASCLD/LAB), 73% achieved accreditation for the first time after 1992.[37] While accreditation is not a promise of perfection, it enforces a kind of professional accountability and transparency that has benefited all stakeholders of forensic science for over 25 years.

Peter Marone is the Chairman of the *Consortium of Forensic Science Organizations (CFSO)*. On April 10, 2008, he testified before the United States House Subcommittee on Crime, Terrorism, and Homeland Security. In his comments, Marone warned of the problems that state oversight commissions can present:

"Many laboratories, if asked, will state that their oversight is provided by the accrediting body under which they operate. Some people would say that this is the fox guarding the hen house and there is something inherently wrong with this process. However every other oversight board, whether it be commercial, medical, legislative or the legal, has oversight bodies which are comprised of the practitioners in that profession. It makes sense that the most knowledgeable individuals about a particular topic would come from that discipline. But that does not seem to meet the current needs. The key to appropriate and proper oversight is to have individuals representing the stakeholders, but that these individuals must be there for the right reason, to provide the best possible scientific analysis. There cannot be any room for preconceived positions and agenda driven positions. Unfortunately, we have seen this occur in some States."[38]

Critics of accreditation, including Peter Neufeld, have argued that accreditation cannot be trusted because it calls for laboratories to be inspected by other forensic experts—a kind of self-regulation that supposedly fails to establish the oversight necessary to ensure that laboratories are held to account.

What these critics fail to recognize is what the authors term the "economy of accreditation," where a pool of specially trained and monitored assessors have a strong incentive to be brutally thorough and objective during their inspection of a laboratory. The very reputations of the assessors, the likelihood that they will be allowed to participate in future inspections, and the desire to make good use of their valuable time (usually requiring several days away from home and work) are all compromised by failing to conduct a comprehensive and rigorous inspection. It is this economy of incentives that ensures the effectiveness of professional peer-based accreditation, and is why it is used so frequently and successfully in other industries.

But peer-assessors also have another incentive to hold a laboratory accountable for compliance to accreditation standards. A laboratory that fails to do good work damages the reputation, fairly or not, of everyone who calls themselves a forensic scientist.

No competent and thoughtful assessor is willing to tolerate that.

About the Authors

John Collins, B.S., M.A. is the Chief Editor of *Crime Lab Report*. Jay Jarvis, B.S., M.S. serves as the Associate Editor. Both are experienced accreditation inspectors and have extensive management and casework experience in the forensic sciences. They served on the board of directors of the American Society of Crime Laboratory Directors (ASCLD) from 2005 through 2007 (Note: ASCLD and ASCLD/LAB are separate entities).

John Collins may be reached for questions or comments at crimelabreport@gmail.com or (630) 476-2223.

Jay Jarvis may be reached for questions or comments at jay.jarvis@comcast.net or (706) 331-9971.

Works Cited

1 The Innocence Project, Crime Lab Oversight, accessed 9 April 2008, www.innocenceproject.org/fix/Crime-Lab-Oversight.php

2 Garrett, Brandon L., "Judging Innocence." *Columbia Law Review* 100, no. 2 (2007): 177-178.

3 U. of Virginia School of Law, "Home Page for Brandon L. Garrett". Accessed 12 February 2008, www.law.virginia.edu/lawweb/Faculty.nsf/FHPbI/B569

4 The Innocence Project, Browse the Profiles, accessed 9 April 2008, www.innocenceproject.org/know/Browse-Profiles.php

5 The Innocence Project, About the Innocence Project, accessed 9 April 2008, www.innocenceproject.org/about/

6 Beaupre, Becky and Eisler, Peter. "Crime Lab Crisis: Staff, Funding Haven't Kept Up with Caseload." *USA Today*, p. 1A, August 20, 1996

7 Flynn McRoberts, et al. "Forensics Under the Microscope: Unproven techniques sway courts, erode justice." *Chicago Tribune*, October 17, 2004.

8 *CNN*, "Reasonable Doubt: Can Crime Labs Be Trusted," Aired January 13, 2005. Transcript accessed on 9 April 2008. transcripts.cnn.com/TRANSCRIPTS/0501/13/pzn.01.html

9 *MSNBC*, "When Forensics Fail," Aired October 18 and 25, 2007.

10 Moore, Solomon. "Exoneration Using DNA Brings Change in Legal System," *New York Times*, p. 1A, October 1, 2007.

11 Johnson, Kevin. "DNA tests fuel urgency to free the innocence," *USA Today*, p. 1A, February 19, 2008.

12 Garrett, Brandon and Neufeld, Peter. "Improper Use of Forensic Science in the First 200 Post-Conviction DNA Exonerations," National Academy of Sciences, Washington, D.C., September 20, 2007.

13 Garrett, B. "Judging Innocence," p. 130-131

14 *Ibid*., 133

15 Garrett and Neufeld. "Improper Use of Forensic Science"

16 United States Senate, "Oversight of the Justice for All Act: Has the Justice Department Effectively Administered the Bloodsworth and Coverdell DNA Grant Programs?" Testimony of Peter Neufeld, January 23, 2008

17 Ibid., Testimony of U.S. Inspector General Glenn A. Fine

18 Hoffman, Morris B. "The Innocence Myth," *Wall Street J*., April 26, 2007

19 Adam Liptak, "Study of Wrongful Convictions Raises Questions Beyond DNA," *New York Times*, July 23, 2007.

20 Garrett, B. "Judging Innocence," p. 101

21 The Innocence Project, Bruce Godschalk, accessed 9 April 2008, www.innocenceproject.org/Content/154.php

22 Wisconsin Innocence Project, Steven Avery, accessed 9 April 2008, www.law.wisc.edu/fjr/innocence/avery_summary.htm

23 President's DNA Initiative, Kerry Kotler (Suffolk County, New York), accessed 9 April 2008, www.dna.gov/case_studies/convicted_exonerated/kotler

24 Public Broadcasting System: *Frontline*, Clyde Charles, accessed 9 April 2008, available from http://www.pbs.org/wgbh/pages/frontline/shows/burden/profiles/charles.html

25 Richard H. Walton, *Cold Case Homicides: Practical Investigation Techniques*, CRC Press, 2006, p. 342.

26 United States House of Representatives, "Innocence Protection Act of 2001," House Judiciary Subcommittee on Crime, Terrorism, and Homeland Security, Testimony by Peter Neufeld [online] accessed on 9 April 2008, www.thejusticeproject.org/press/statements/testimony-by-peter-neufeld-at.html

27 The Innocence Project, Antonio Beaver, accessed 9 April 2008, www.innocenceproject.org/Content/470.php

28 The Innocence Project, James Ochoa, accessed 9 April 2008, www.innocenceproject.org/Content/43.php

29 The Innocence Project, Drew Whitley, accessed 9 April 2008, www.innocenceproject.org/Content/292.php

30 The Innocence Project, Roy Brown, accessed 9 April 2008, www.innocenceproject.org/Content/425.php

31 Pyrek, Kelly. *Forensic Science Under Siege*, Academic Press, 2007, p. 27

32 *MSNBC*, "When Forensics Fail"

33 *Ibid*.

34 *Ibid*.

35 The Innocence Project, Ray Krone, accessed 9 April 2008, www.innocenceproject.org/Content/196.php

36 The Innocence Project, Brandon Moon

37 The American Society of Crime Laboratory Directors / Laboratory Accreditation Board, [online] accessed on March 20, 2008, www.ascld-lab.org/dual/aslabdualhistory.html and http://www.ascld-lab.org/legacy/aslablegacylaboratories.html

38 United States House of Representatives, "Reauthorization and Improvement of DNA Initiatives of the Justice For All Act of 2004," House Judiciary Subcommittee on Crime, Terrorism, and Homeland Security, Testimony by Peter M. Marone, accessed on 10 April 2008, judiciary.house.gov/media/pdfs/Marone080410.pdf

For more information about data tabulated for this study, please visit the *Crime Lab Report* library at www.crimelabreport.com.

Cautions on Brand Identification of Ignitable Liquids

*Wayne Moorehead, MSc, F-ABC**

Keywords: Ignitable liquids, brand identification

Introduction

Arson is the act of intentionally and maliciously setting a fire to buildings, vehicles, forested lands, or other property or persons. According to the United States Fire Administration there were an estimated 31,000 intentionally set fires that resulted in losses over $755 million(1). An accelerant material is often used in intentionally set fires. Accelerant material aids the initial advancement of an intentionally set fire. An accelerant material can be as diverse as newspaper, clothing, incendiary material or ignitable liquids.

The ignitable liquids range from very easily ignitable liquids like diethyl ether and gasoline to the more difficult diesel fuel. Many different kinds of consumer and industrial products contain flammable liquids such as: carburetor cleaner, paint thinner, specialty solvents, torch fuels, and more. When a liquid accelerant is suspected of being used in a fire, a forensic scientist is tasked with finding these ignitable liquid products in the fire debris.

After analysis of the fire debris, the fire investigator often asks the forensic scientist: can you tell what brand was used?

The Orange County Sheriff-Coroner Department Forensic Science Services has collected numerous ignitable liquids of various brands (and in some cases several of the same brand) over many years. The following chromatograms provide examples of similarities among ignitable liquids of different brands, while other brands have formulations that have changed over the years.

Method

While the typical method for recovery of ignitable liquids from fire debris requires activated charcoal strips (ACS) and a solvent such as carbon disulfide (CS2) (J.T. Baker, Ultra Resi-analyzed E350-01, Phillipsburg, NJ) for eluting the ACS, establishment of ignitable liquid standards only requires dilution of the standard in an appropriate solvent. To maximize chromatography, one drop of the ignitable liquid standard was diluted with between 40 and 100 drops of CS2 in Teflon® lined-septum screw cap clear glass containers (Sun International, Wilmington, NC).

A HP 5890 Series II (GC) having a 7673 ALS and a 5970 mass selective detector (MS) running ChemStation G1034C software were used to analyze the diluted ignitable liquid standards. The gas chromatograph contained a DB-1, 15m x 0.25mm i.d. x 0.25 um film thickness (J & W Scientific, Folsom, CA). Helium was used as the carrier gas. The mass spectral detector was turned on at injection, turned off for the CS2 solvent peak, then turned on after the solvent front passed through the detector. The GC method (Table 1) results in a 14.4 minute analysis time illustrated by the n-alkane standard (Figure 1) total ion chromatogram (TIC). Because no TIC exceeds seven minutes, only the first half of the total chromatogram will be displayed (Figure 2).

Samples

The standard samples represented in this paper fall into the medium petroleum distillate and medium isoparaffin classes for ignitable liquids (3). The samples were collected from the 1980's and 1990's and analyzed from 1997 to 2000, with the majority completed in 1997. Alphanumeric designations (e.g., 2d09) accompanying the chromatograms provide a unique acquisition number for the sample to delineate different brands and same brands acquired at different times (Table 2).

Results

The chromatograms resulting from the analyses of the ignitable liquid standards are compared directly by pattern recognition.

In examining Figures 3-9, the similarity between the various brands becomes apparent. The ratio of undecane (C-11) varies, but not consistently in the same brand (e.g., Figure 3&4 and Figure 5&6). The slight ratio variations of the low volume early eluting peaks should be ignored because these are frequently the first to evaporate with heat or fire and typically would not be present for consideration in brand identification in casework. Taking into consideration TIC variations in casework, mostly due to the presence of pyrolysates, the forensic scientist should refrain from associating recovered volatiles with a brand.

Based on the TIC, some companies may provide the same apparent product with different names. For instance, the blended aliphatic solvent Actrel 3338L, an Exxon product used as a cleaner and in oil removal from copper wire windings (4), has a very similar appearance to Exxon Isopar G (Figures 10 & 11 respectively). Alternatively, different companies may have starting products which are reasonably similar such as Shell Sol 71 and Chevron Isoparaffin 370 (Figures 12 & 13). In a recovered ignitable liquid case sample, could one of these two liquids be confused with one of the Wizard products (Figure 14)? Another example that argues against the forensic scientist assigning brand to an ignitable liquid.

Over the years, the manufacturers of Wizard have changed formulations (Figures 14 – 19 are arranged in chronological order) moving through several ASTM ignitable liquid categories. While the collection of Wizard standards has taken place every several years, there may have been additional changes in the Wizard formulation in intervening years with no collection.

Databases involving ignitable liquids should be updated on a frequent basis due to formulation changes and different companies using similar or identical formulations. For fire debris samples, forensic scientists should only categorize the ignitable liquid recovered, provide relevant examples of possible products and not identify any specific brands associated with the recovered ignitable liquid in written reports.

*Orange County Sheriff-Coroner Department
320 North Flower Street, Santa Ana, CA 92703

Acknowledgements

I would like to thank Richard Patron (Forensic Scientist Orange County Sheriff-Coroner Dept. Forensic Science Services (OCSD-FSS), Santa Ana, CA, and Jack Wallace (Former Forensic Scientist at OCSD-FSS, currently at Ventura Sheriff Dept. Forensic Sciences Laboratory, Ventura, CA) who were significantly involved in the establishment of the over 400 ignitable liquids database at Orange County Sheriff-Coroner Department.

Bibliography

1) www.usfa.dhs.gov/statistics/arson/ U.S. Fire Administration, 16825 S. Seton Ave., Emmitsburg, MD 21727: Copyright: October 11, 2007
2) American Chemical Society (2007, September 24). Fast, Portable Test Promises To Help Detect Flammable Liquids In Arson. *ScienceDaily*. Retrieved August 9, 2008, from www.sciencedaily.com /releases/2007/09/070917145823.htm
3) ASTM Standard E 1618, "Standard Guide for Identification of Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography-Mass Spectrometry," American Society for Testing and Materials, West Conshohocken, PA, www.astm.org
4) Minnesota Technical Assistance Program, 2008. Petroleum Solvents and Production Changes Replace Chlorinated Cleaning Solvents, available at www.mntap.umn.edu/mach/95 Windings. htm. Accessed August 10, 2008.

Table 1.

Oven	
Initial Temp	40oC
Initial Time	2 minutes
Ramp Rate	25oC
Final Temp	300oC
Final Time	2 minutes
Injector Temp	250oC
Detector Temp	300oC
Split	80:1

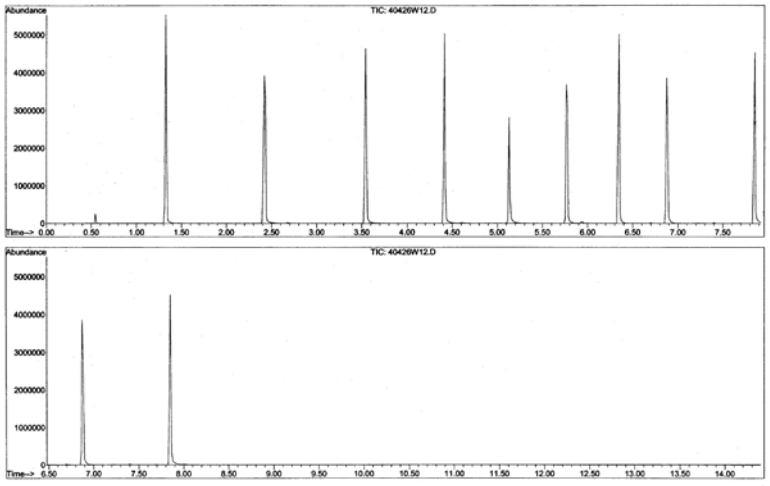


Figure 1. Normal alkane standard series in full 14.4 minute run. The short peak in the middle of the chromatogram is undecane (C-11).

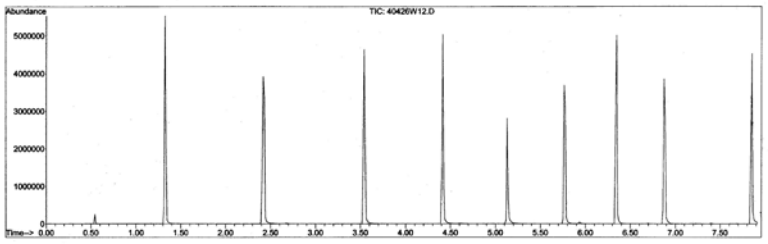


Figure 2. Normal alkane standard series in abbreviated to 7.8 minutes.

Table 2.

Fig.	Product Brand	Unique ID	Acquired
3	Ralph's Charcoal Starter	2D09	Oct-99
4	Ralph's Charcoal Starter	7B03	Feb-97
5	Kingsford Charcoal Starter	2D10	Aug-92
6	Kingsf'd Char. Strtr. odorless	7B06	Feb-97
7	Bortzoil Charcoal Starter	2C09	Aug-86
8	Royal Oak Charcoal Starter	7B04	Feb-97
9	Lucky's Charcoal Starter	7B02	Feb-97
10	Exxon Actrel 3338L	10B01	Mar-98
11	Exxon Isopar G	10B10	Mar-96
12	Shell Sol 71	3D04	Nov-94
13	Chevron Isoparaffin 370	3B06	Nov-94
14	Wizard	2C08	Aug-86
15	Wizard	7D09	Oct-92
16	Wizard	5B08	Nov-96
17	Wizard	8B05	Feb-97
18	Wizard	11A07	Jun-98
19	Wizard	9C06	Jan-99

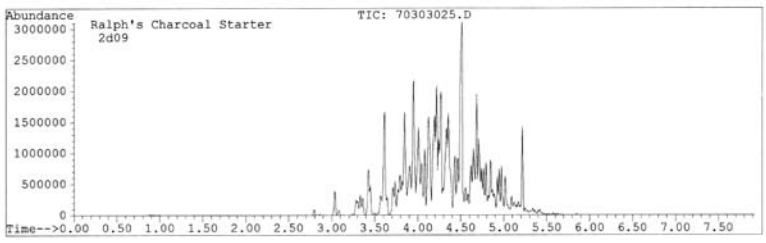


Figure 3 – Ralph's Charcoal Starter, 2D09

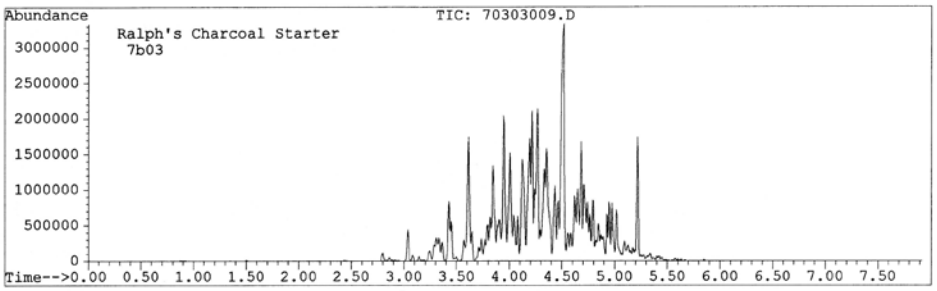


Figure 4
Ralph's Charcoal Starter, 7B03

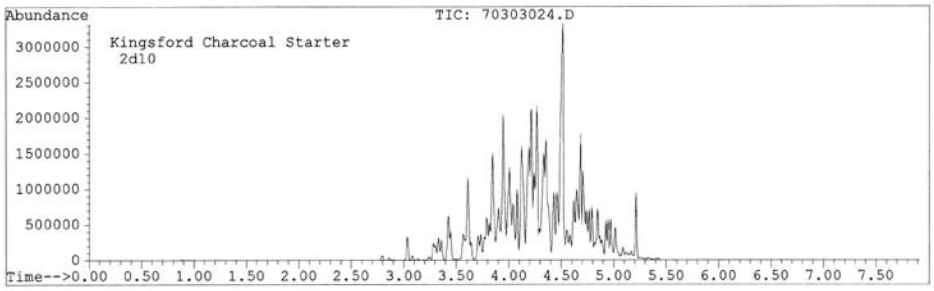


Figure 5
Kingsford Charcoal Starter, 2D10

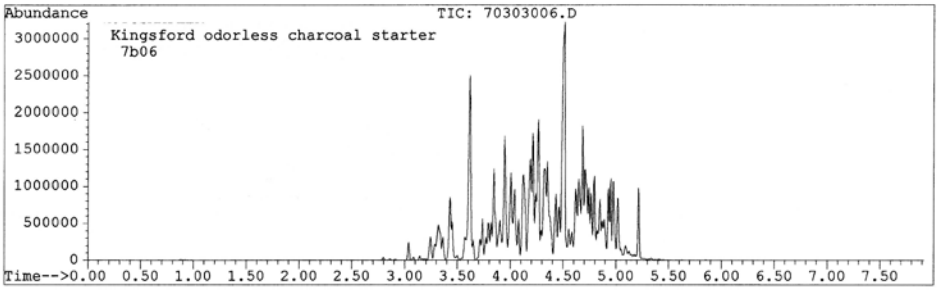


Figure 6
Kingsford Charcoal Starter
- odorless, 7B06

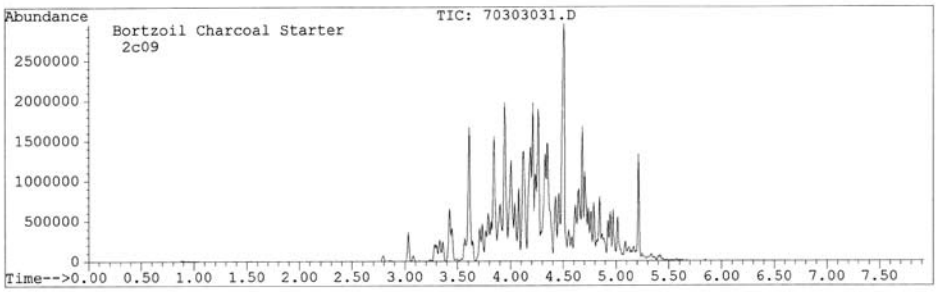


Figure 7
Bortzoil Charcoal Starter, 2C09

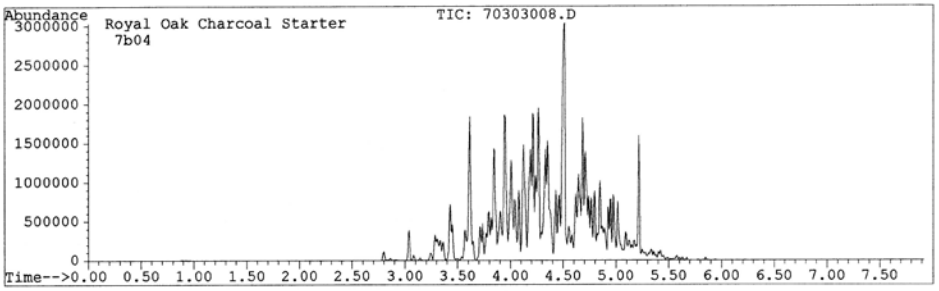


Figure 8
Royal Oak Charcoal Starter, 7B04

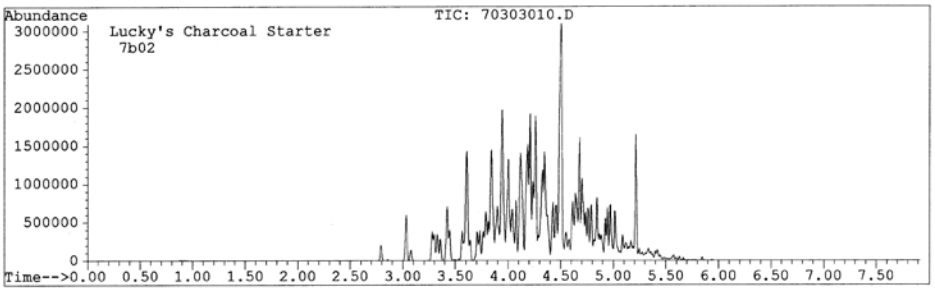


Figure 9
Lucky's Charcoal Starter, 7B02

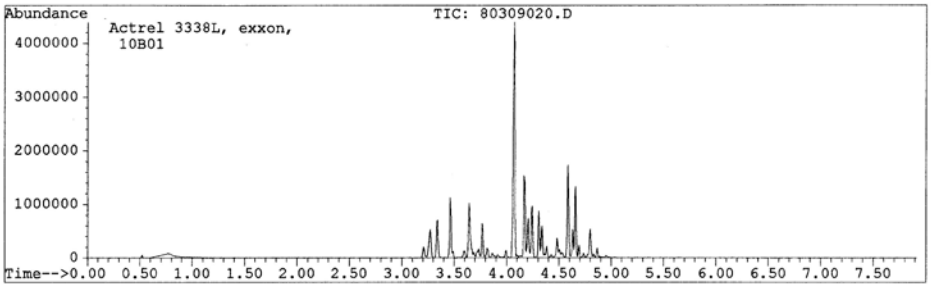


Figure 10
Actrel 3338L, 10B01

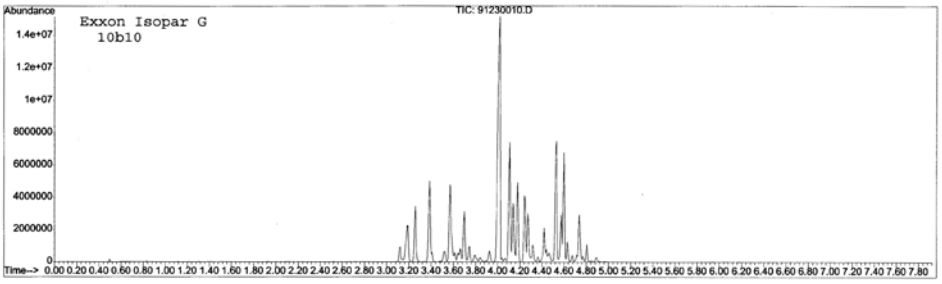


Figure 11
Exxon Isopar G, 10B10

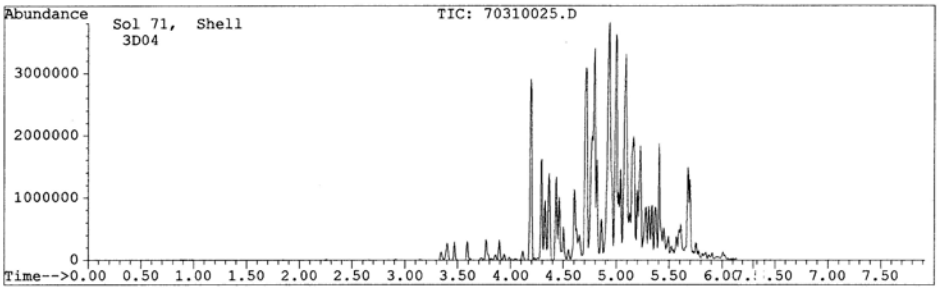


Figure 12
Shell Sol 71, 3D04

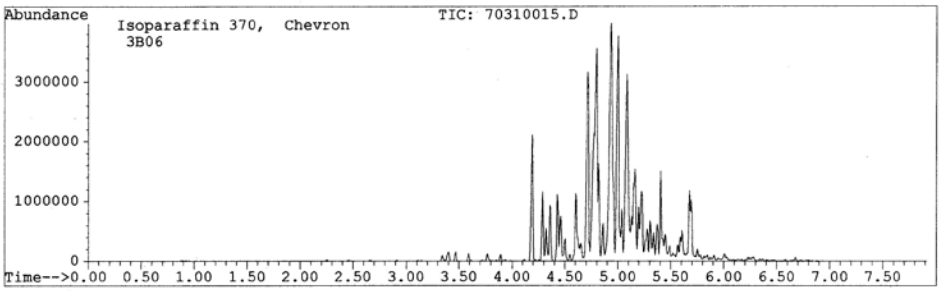


Figure 13
Chevron Isoparaffin 370, 3B06

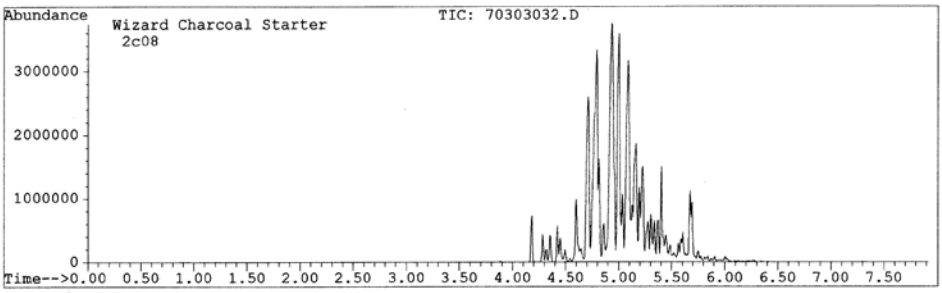


Figure 14
Wizard, 2C08

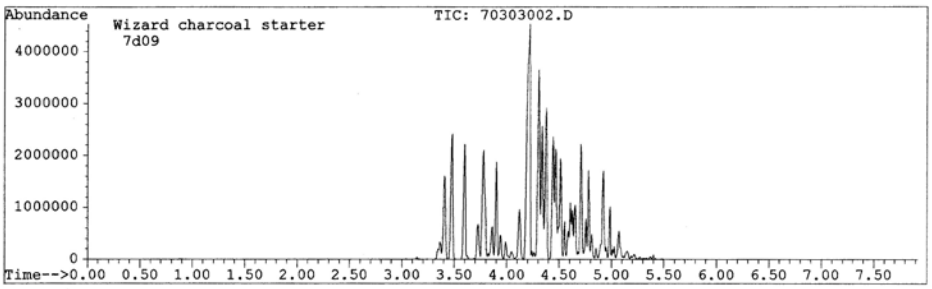


Figure 15
Wizard, 7D09

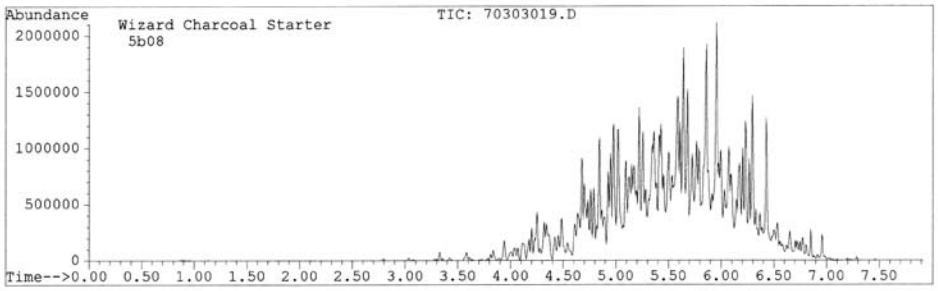


Figure 16
Wizard, 5B08

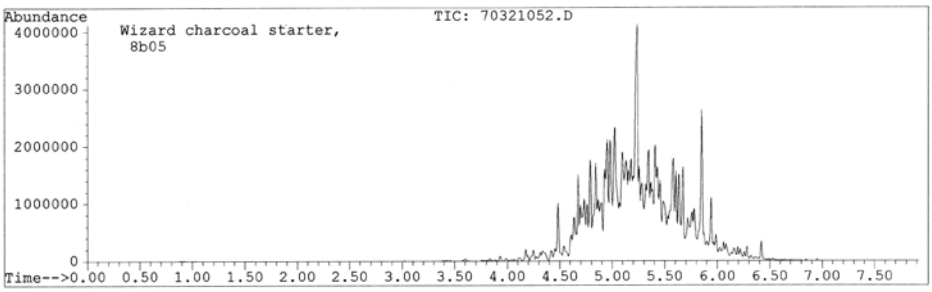


Figure 17
Wizard, 8B05

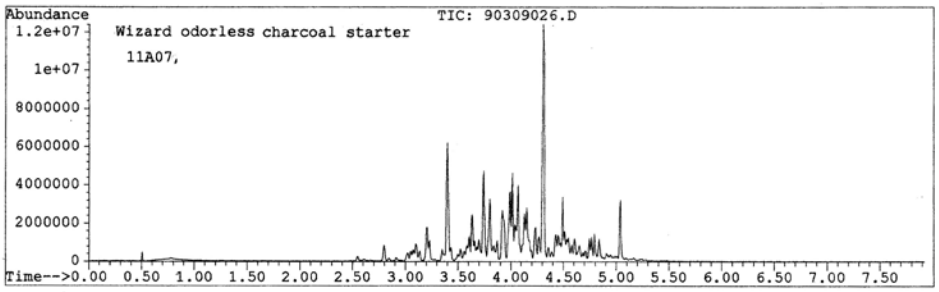


Figure 18
Wizard, 11A07

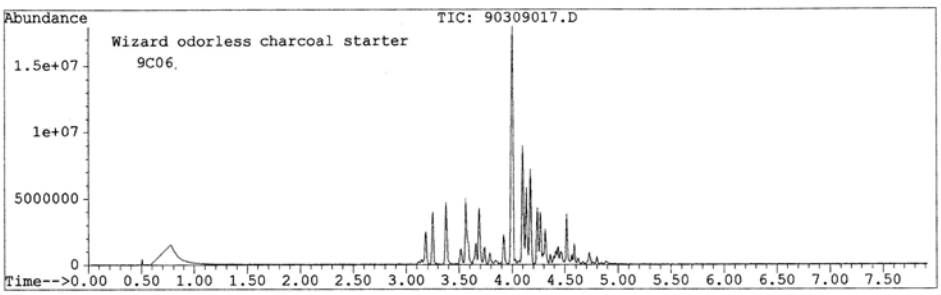


Figure 19
Wizard, 9C06

Study of Nylon Bags for Packaging Fire Debris

Christina L. Henry, Santa Clara County District Attorney's Criminalistics Laboratory, San Jose, CA

Introduction

Evidence for ignitable liquids analysis must be packaged in airtight containers in order to prevent loss of vapors and cross-contamination. Kapak FireDebrisPAK™ has been a highly versatile and useful container for packaging fire debris and ignitable liquids evidence, particularly objects which are too large or awkwardly shaped to fit inside a pressure-sealed paint can. As Kapak is no longer producing their FireDebrisPAK™, finding an alternative container was necessary.

There are several forensic supply companies marketing nylon bags for use in packaging fire debris evidence. Two brands of nylon bags marketed for containing fire debris were examined, Grand River and Sirchie. The Grand River Nylon bag was selected because it had been recommended by several colleagues; in addition, it is the container that CTS (Collaborative Testing Services) will be using for proficiency testing. Grand River bags come in several sizes and rollstock. The Sirchie bag was selected because of the variety of sizes available. These two brands of nylon bag were evaluated and compared to Kapak FireDebrisPAK™.

Supplies and Instrumentation

The Grand River and Sirchie Nylon bags were obtained from their respective suppliers and had the dimensions of 5" x 10". The FireDebrisPAK™ rollstock, previously obtained from Kapak, was cut into pieces of a similar size to the other bags. Activated charcoal strips were obtained from Albrayco (Lot# 092006D) and were cut into half pieces of approximately 5mm x 30mm. The gas-diesel standard was made up of equal parts 87 octane gasoline and diesel fuel, both obtained from Shell Oil at 1705 Berryessa Road in San Jose, California on September 7, 2007 by the author.

The charcoal strips for all tests were eluted with ~200 microliters of carbon disulfide (EMD Lot# 45020505) and then injected on a Varian Saturn 2100T GC/MS. The GC/MS method used has a split ratio of 20:1, with an initial temperature of 40ºC. After a 3 minute hold, it ramps at 15ºC per minute to 300ºC and then holds for 2 minutes. The instrument is equipped with an HP-1 column, 25 meters long, with a 0.20mm ID and 0.33um film thickness.

Testing Procedure

The bags were tested for the following: background interferences, because it is important that any container used for packaging items for ignitable liquids analysis be free of anything that could be classified as an ignitable liquid or that could interfere with a classification; potential loss of vapors from a bag; and cross-contamination between two bags.

Background interferences: This was tested by placing a charcoal strip inside an empty bag and heating it inside a 60ºC oven for 24 hours.

Loss/Cross-contamination: These tests were done simultaneously in order to control the test conditions and were repeated for each brand of bag. Inside a large container (FireDebrisPAK™), the following items were placed: one Kimwipe® soaked in the 1:1 gas-diesel mixture; one single heat-sealed bag containing a charcoal strip, representing loss of vapors through a single layer of bag; one heat-sealed bag containing a second heat-sealed bag containing a charcoal strip, representing cross-contamination from one bag to another, or vapors passing through two layers of bag; and one loose charcoal strip as a control. [See Figure 1.]

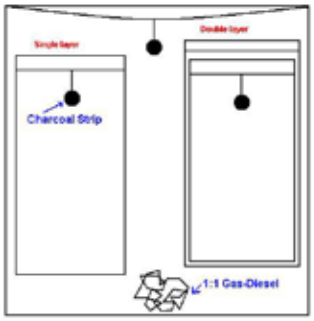


Figure 1: Diagram of loss / cross contamination test

The tests for potential loss of vapors and cross-contamination were conducted under three conditions: heated for 24 hours in a 60°C oven, representing how evidence is analyzed; at room temperature (26ºC) for 1 to 2 weeks, representing how evidence is most likely stored by the agencies; and inside a laboratory freezer (-14ºC) for 2 weeks, representing how the evidence is stored at the lab.

Results

Background interferences: Kapak FireDebrisPAK™ had a fairly clean baseline, with only a low-level cluster of peaks consistent with phenols. The Grand River and Sirchie bags had similar chromatograms to each other, both having a low-level peak around 10 minutes consistent with caprolactum. [See Figure 2.] This compound does not co-elute with or have a similar profile to any significant components of an ignitable liquid.

Loss/Cross-contamination when heated: Kapak showed no transfer through either one or two layers. [See Figure 3.] Grand River and Sirchie both had very low level transfer through one layer and none through the second layer. [See Figures 4 and 5.] This test was repeated three times with similar results.

Loss/Cross-contamination at room temperature: After two weeks, Kapak showed no transfer through either one or two layers. Grand River had some transfer through one layer and only very low levels of transfer through two layers. [See Figure 6.] Sirchie had substantial transfer through both one and two layers. [See Figure 7.] The same test was repeated storing for only one week at room temperature. Grand River showed very little transfer through one layer and none for two layers, but Sirchie still had significant transfer through both one and two layers.

Loss/Cross-contamination inside freezer: After two weeks, Kapak again had no transfer through either one or two layers. Grand River also had no transfer through one or two layers, but Sirchie again had significant transfer through both. [See Figure 8.]

Conclusion

Storing evidence at colder temperatures does appear to reduce loss and contamination issues. Kapak FireDebrisPAK™ was found to be a superior container to both Grand River and Sirchie, however, Grand River nylon bags were found to be adequate for containing fire debris. The Sirchie bags were found to have too much potential for cross-contamination and, therefore, were determined to be unsuitable for storing fire debris evidence in Santa Clara County. Not all brands of nylon "fire debris bags" appear to be appropriate for holding ignitable liquids, so testing of new bags is recommended prior to use.

Acknowledgements

I would like to thank Miss Brittany Pacheco of the Santa Clara County District Attorney's Crime Laboratory for her assistance in completing this project.

References

Demers-Kohls, J., Ouderkirk, S., Buckle, J., Norman, E., Cartwright, N., Dagenais, C. "An Evaluation of Different Evidence Bags Used for Sampling and Storage of Fire Debris," *Canadian Society of Forensic Science*, 27(3), 143-170.

Williams, M., Sigman,M., "Performance Testing of Commercial Containers for Collection and Storage of Fire Debris Evidence," *Journal of Forensic Sciences*, 52(3), 579-585.

Mann, Dale C., "In Search of the Perfect Container for Fire Debris Evidence," *Fire & Arson Investigator*, 30(3), 21-25.

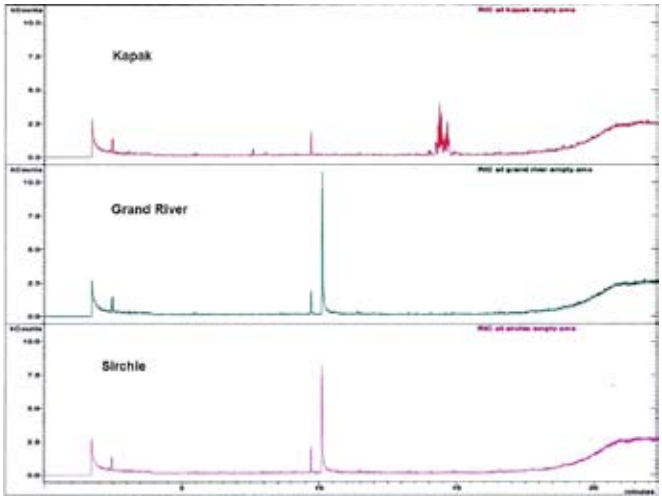


Figure 2: Chromatograms of empty bags heated at 60°C for 24 hours

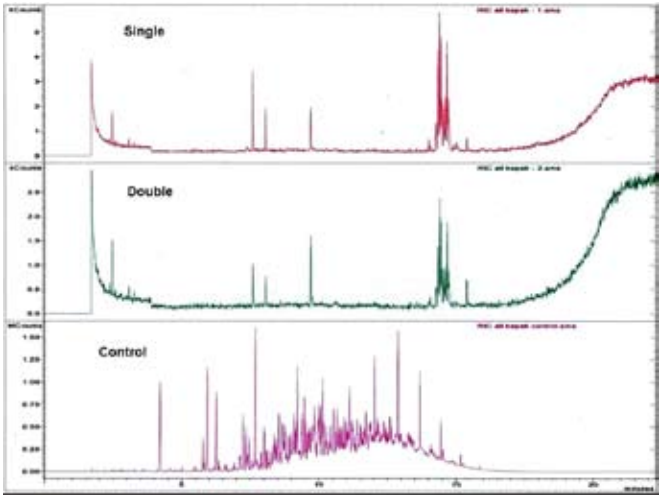


Figure 3: Chromatograms of single- and double-layered Kapak FireDebrisPAK™ bags heated at 60°C for 24 hours with 1:1 gas-diesel

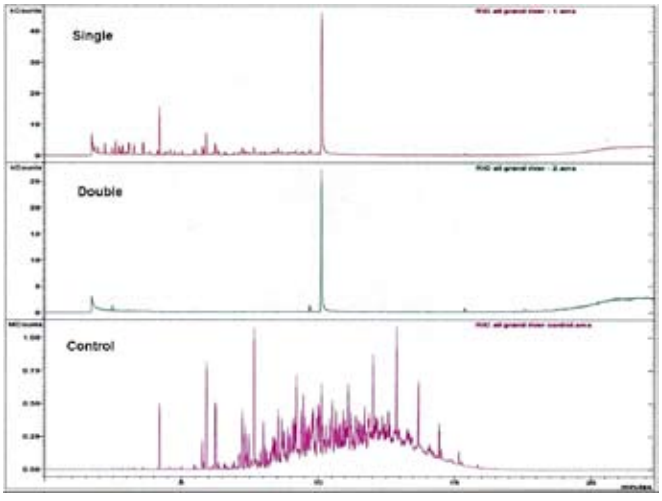


Figure 4: Chromatograms of single- and double-layered Grand River nylon bags heated at 60°C for 24 hours with 1:1 gas-diesel

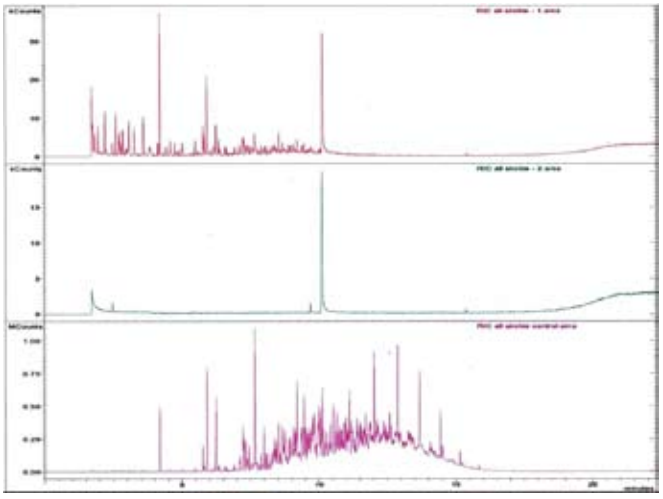


Figure 5: Chromatograms of single- and double-layered Sirchie nylon bags heated at 60°C for 24 hours with 1:1 gas-diesel

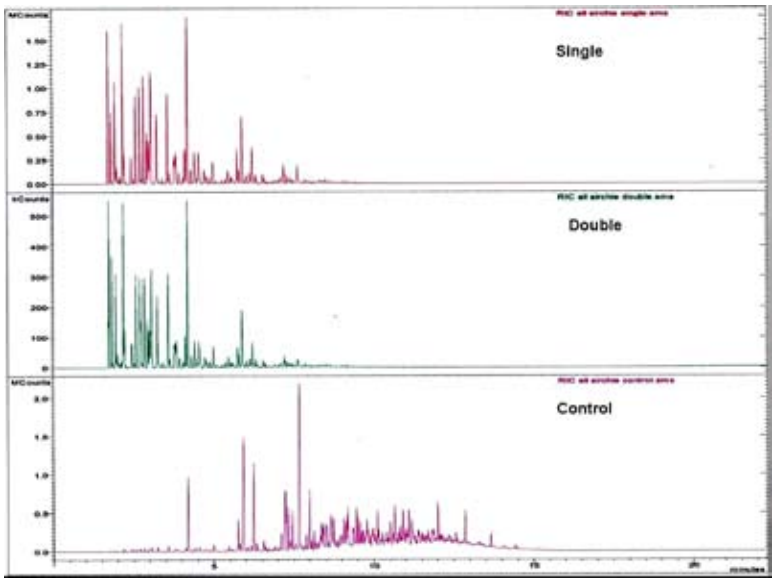


Figure 6: Chromatograms of single- and double-layered Grand River nylon bags at room temperature for 2 weeks with 1:1 gas-diesel

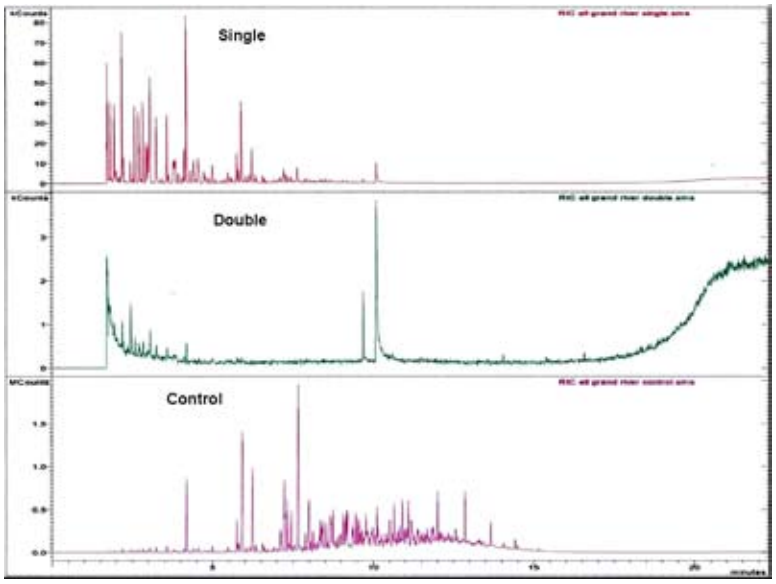


Figure 7: Chromatograms of single- and double-layered Sirchie nylon bags heated at room temperature for 2 weeks with 1:1 gas-diesel

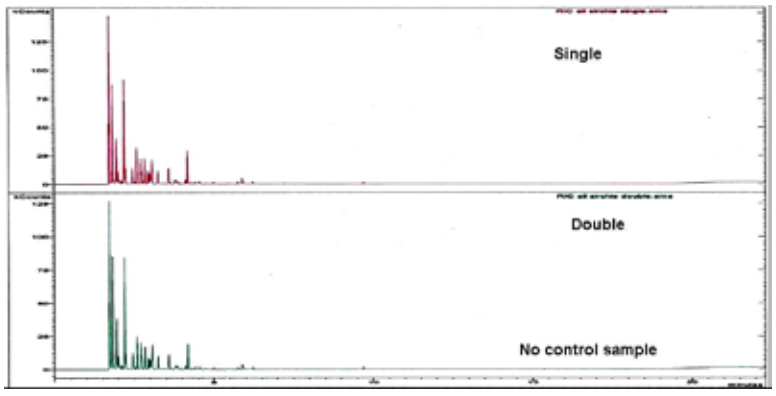


Figure 8: Chromatograms of single- and double-layered Sirchie nylon bags at -14°C for 2 weeks with 1:1 gas-diesel

Commentary:

"Bayesian"—Trace Evidence's Best Friend?

By Bob Blackledge

In his essay, *Self-Reliance*,[1] Ralph Waldo Emerson states:

A foolish consistency is the hobgoblin of little minds, adored by little statesmen and philosophers and divines. With consistency a great soul has simply nothing to do. He may as well concern himself with his shadow on the wall. Speak what you think now in hard words, and tomorrow speak what tomorrow thinks in hard words again, though it contradict every thing you said to-day.—'Ah, so you shall be sure to be misunderstood.'—Is it so bad, then, to be misunderstood? Pythagoras was misunderstood, and Socrates, and Jesus, and Luther, and Copernicus, and Galileo, and Newton, and every pure and wise spirit that ever took flesh. To be great is to be misunderstood.

In August 2007, I attended the Trace Evidence Symposium sponsored by the NIJ and the FBI, and held in Clearwater Beach, Florida. In all respects it was outstanding. However, the catalyst for this commentary was "Statistical Issues and Applicability to the Sub-Disciplines," the title of a General Session. First, Bob Koons, Research Chemist with the FBI, gave his personal (and more traditional) view of the application of evidence categories. I've known Bob for many years and I have great respect for him both as a forensic scientist and as a person. He is truly one of the "good guys." Bob's views on statistics were a close approximation of my own (past and up to that moment).

The second and final presenter was Louise McKenna, Deputy Director, Garda Headquarters, Forensic Science Laboratory, Dublin, Ireland. "Bayesian" could not possibly find a more gracious and articulate advocate! By the end of her presentation I can't quite say that I had been converted, but I had determined that this was a subject to which I would devote serious study. A source that was recommended was the book, *Interpreting Evidence—Evaluating Forensic Science in the Courtroom*, Bernard Robertson and G. A. Vignaux, (John Wiley & Sons, 1995, ISBN 0471 96026 8). Unfortunately, it's out of print. I couldn't even find it on Amazon.com. However, I got lucky and managed to borrow a copy from the University of San Diego Law Library. It is far easier to read than any of the articles on Bayes Theory that I've seen in the forensic science journals. Nevertheless, there is a definite need for someone to pen, Bayesian for Forensic Dummies.

As I read through the book I gradually became aware that my conversion was not something that had happened in a flash of light, but rather was a process that had begun many years ago. When I first received my initial training in forensic science I was a probationary employee in the chemistry section of the Florida Department of Law Enforcement's Tallahassee Crime Laboratory. I recall that my trainers said that my analysis notes should be as succinct as possible. Although I did use abbreviations, this never really worked for me. My notes were written for my benefit, and months or years later I couldn't rely on my memory. I needed to know just what steps I had carried out in my analysis.

I was also taught to make the report of my analysis succinct. Although this worked for the most part, over the years there have been a number of unusual cases where I felt a need to say something more than the absolute minimum. Whatever lab director I had at the time would disagree and hand my report back to me for changes. I even showed an article that Jan Bashinski had published in the *CACNews*[2] to one lab director. Although it clearly supported my position, I still lost.

So I had a great feeling of vindication as one symposium speaker after another said one's report should include not just the analysis findings, it should at least mention the methodology used, and especially for trace cases should include some statement that would assess the significance of the results.

Someone mentioned doing a footwear impression examination/comparison that lacked individual characteristics, but the Q and K impressions were clearly in agreement in terms of size and outsole pattern. Having DNA, the prosecutor declined to use that evidence since they were merely "class characteristics." Studies[3,4] have shown that in a large crowded room it is far, far more likely that two or more people will have the same birthday than that two people will be wearing shoes of the same size and tread design, not even considering wear. Had the lab report on the footwear impression comparison shown how these findings when included with the DNA findings, as well as any other evidence, could significantly increase the odds against a match by chance, by someone other than the accused, the prosecutor might well have been persuaded to include it.

Since the symposium, and as I worked my way through the book, I've been thinking about how the significance of various types of evidence could be augmented by some form of statistics. This might take the form of likelihood ratios or perhaps might just be a series of agreed upon terms that in increasing order would provide a general assessment for the results of a particular item of evidence.

Glitter—I'm already on it.[5,6] At a Cosmetics/Glitter Workshop as a part of the symposium, I gave a presentation on glitter and provided the beginning of a reference collection (~ 120 separate individual samples of different types) to the roughly 45 attendees. These samples were originally purchased from a CAC research grant. Should anyone be interested in heading up a collaborative study involving these glitter samples, I can provide the contact information for the recipients.

Shimmer—Similar to glitter, but is usually tiny pieces of mica that have received some surface treatment (coating with TiO2, iron oxides, bismuth oxychloride, etc.). We need compilation of a database.

Fibers—In the *Westerfield* case tried in San Diego, CAC members Tanya Dulaney and Jennifer Shen testified to the significance of orange fibers that were found on the victim and also in various locations associated with the suspect. Tanya and Jennifer clearly showed that these fibers had greater significance because orange is a far rarer fiber color than say, blue, black, brown, etc. Mike Grieve and others have published target studies indicating the likelihood of finding various colored target fibers.[7,8]

Glass—Elmer Miller of the FBI lab was a pioneer in the use of statistics that would show the likelihood of a match by chance for glass fragments. There have also been target studies indicting the odds for finding one or more glass fragments on clothing turned in for dry cleaning.[9]

Vehicle paint—Data are available for production numbers for year, make, model, and finish.

Architectural paint—For a specific breaking and entering case, a symposium speaker presented results compiled for the

frequency of various colors used on doors of residences.[10]

Paint transfers from tools—If a pry bar is used in a B & E, you may have a two-way transfer of paint. A database could be compiled on the color and chemistry of paint used on tools.

Plastic and rubber trim on vehicles—Again, a database could be compiled.

Hard clear plastic used on brake lights and turn signals—Another need for compilation of a database.

Lipstick—Ditto.

Photocopy toners—Various databases already exist, but need some assessment of rarity.

Buttons—Ditto.[11]

Air bag trace evidence—See Glenn Shubert of the Illinois State Police Lab in Carbondale.[12]

Bitemarks—What is the frequency of that pattern in the general population?

Hair—Where you can't do genomic DNA, only mDNA and PLM. Say the Q and K hairs are a natural red; how does the natural red color (rarer than black, brown, etc.) change the odds of a match by chance?

Condom trace evidence—Various published articles and a book chapter, but need data for an assessment of rarity.[13]

Condom packets—An empty condom packet is found at the scene of a sexual assault. A suspect is found and arrested and in his possession are found several unopened packets of the same brand and lot number. Even before we attempt a possible fracture match,[14] wouldn't it be useful to have an idea of the odds that a male picked at random would be in possession of condom packets of the same brand and lot number?

Acrylic fingernails—Suppose in the *Spector* trial that the "alleged" fingernail had been found, collected, and compared with those from the victim. Let's say it's too damaged to show a perfect fracture match with broken remains of an acrylic fingernail on one of the victim's fingers, but is a match in other regards (color, design, chemistry). The defense claims it could have originated from just about any female (or possibly Rue Paul) that visited the *Spector* residence. How much variance is there in acrylic fingernails?

Paper matches—A used paper match is found at an arson scene. A suspect is detained and in his pocket is a match book with several paper matches missing. Although the paper match found at the scene is similar in all respects to the remaining matches in the book, it isn't possible to say for sure whether this match had to have been torn from this book. Hopen, et al have reported on the comparison of paper matches, but we need data for an assessment of rarity.[15]

Fingerprints—Latent print examiners usually only have three possible findings: 1) the developed print is of value for comparison and is a match—yes Pecksniffians, I wouldn't use "match" in an official report or in my testimony—for the record print of____ , 2) the developed print is of value but does not match any of the record prints of ___, 3) no prints of value for comparison were developed. But let's suppose we are investigating a homicide where the victim was grabbed from behind and their throat was slit with a motion starting to the left of the front and going deeply towards the right (i.e., in a direction towards the victims right shoulder). At the scene a box knife is found whose blade is covered with blood. The blood is from the victim and no blood traces from a possible attacker are found. The box knife is processed for prints and on one side of the handle (it would be the left side if the knife is held so that the tip of the blade points towards the top of this page and the blade edge is down parallel to the page) a poor quality print is seen near where the handle ends and the blade begins. From the print's location, size, and corresponding badly smudged prints below this side of the handle, the examiner can ascertain that this is a right thumb print. It is of poor quality and lacks sufficient minutia for a postive identification with the right thumb print of the suspect. However, the latent print examiner is able to determine that the general classification of the print is that of a tented arch. The record prints of the suspect show that his right thumb also has the general classification of a tented arch. Using AFIS it should be possible to determine the frequency of a tented arch on the right thumb in the record prints in the database. Is there any valid reason why this information along with liklihood ratios should not be reported?

Okay, no doubt there are many more categories of evidence that I could mention. What many of the above have in common is the lack of a database that would help in the assessment of rarity, generation of a liklihood ratio, etc. At the back of each issue of the *Journal of Forensic Sciences* there is a section called "For the Record." These consist of statistical DNA reports that are numbingly boring but are nevertheless vital. Having taught forensic science at the graduate level, I know there is virtually an unlimited supply of students who need a topic for their masters thesis. This source should be tapped to help provide the databases that at present are lacking in so many areas of trace evidence. These too could be reported in the "For the Record" section. This would be a win/win situation. Essential data necessary for liklihood ratio generation for various evidence classes would be published in a peer-reviewed journal, and the poor slaving students/interns would have a publication they could add to their resume.

References:

1 www.emersoncentral.com/selfreliance.htm

2 Bashinski, Jan S., "The Criminalistics Laboratory Report: An Editorial View", *CAC News*, 4th Quarter 2003, 9-13.

3 Putnam, Brad, Unpublished research, Oregon State Police Forensic Laboratory, Springfield, OR.

4 Parent, Sandy, "The Significance of Class Association in Footwear Comparisons", Texas Dept. of Public Safety, Austin, TX. Oral presentation at the 92th International Educational Conference of the International Association for Identification, Wed., July 25, 2007, San Diego, CA.

5 Aardahl, Klaya; Kirkowski, Scott; and Blackledge, Robert, "A Target Glitter Study", *Science & Justice*, Jan-Mar 2005.45(1), 7-12.

6 Blackledge, Robert and Jones, Edwin, "All that Glitters Is Gold", *Forensic Analysis on the Cutting Edge: New methods for Trace Evidence Analysis*, Chap. 1. Robert D. Blackledge, Editor, 2007, Wiley Interscience, ISBN 978-0-471-71644-0.

7 See 5, References 1-9, and 10 (and references therein).

8 Bennett, Susan, "The Significance of Fibre Transfer and Persistence—A Case Study", Scientific Officer, Forensic Services Group, New South Wales Police Force, Australia. Poster presentation at the Trace Evidence Symposium, Clearwater Beach, FL, Thurs., Aug. 16, 2007.

9 See 5, References 11-13.

10 Buzzini, Patrick, "The Interpretation of Paint Evidence Through the Use of Population Studies: Two Case Examples", Senior Lecturer, Forensic and Investigative Science, West Virginia University, Morgantown, WV. Oral presentation at the Trace Evidence Symposium, Clearwater Beach, FL, Thurs., Aug. 16, 2007.

11 Sulkava, Raili , "Fibers, Metal Buttons, Welding Fume Particles,

and Paint Chips as Incriminating Evidence in Solving Two Homicides Committed by the Same Person", Forensic Chemist, Crime Laboratory, National Bureau of Investigation, Vantana, Finland. Oral presentation at the Trace Evidence Symposium, Clearwater Beach, FL, Tues., Aug. 14, 2007.

12 Schubert, Glenn, "Forensic Analysis of Automotive Airbag Contact—Not Just a Bag of Hot Air", Illinois State Police , Forensic Science Command, Southern Illinois Forensic Science Centre, Carbondale, IL. Forensic Analysis on the Cutting Edge: New Methods for Trace Evidence Analysis, Chap. 2. Robert D. Blackledge, Editor, 2007, Wiley Interscience, ISBN 978-0-471-71644-0.

13 Keil, Wolfgang, "Condom Trace Evidence in Sexual Assault: Recovery and Characterization", Professor of Legal Medicine, Department of Legal Medicine, Ludwig-Maximilians-University of Munich, Munich, Germany. Forensic Analysis on the Cutting Edge: New Methods for Trace Evidence Analysis, Chap. 4. Robert D. Blackledge, Editor, 2007, Wiley Interscience, ISBN 978-0-471-71644-0.

14 Taylor, Chris, "Condom Wrappers Link Subject to Sexual Assault", Supervisor, Trace Evidence Branch, USACIL, Ft. Gillem, GA. *CAC News*, 3rd Quarter 2006, page 30.

15 Hopen, Thomas, "The Forensic Examination of Paper Matches", Forensic Chemist, Arson and Explosives Unit, Forensic Science Laboratory, BATF, Atlanta, GA. Poster presentation at the Trace Evidence Symposium, Clearwater Beach, FL, Wed., Aug. 13, 2007.

Request for Stipend

Joint Meeting between the
California Association of Criminalists
and the
Forensic Science Society

June 25 - 27, 2009
Lausanne, Switzerland

Deadline May 1, 2009

Mail request to:
Jennifer S. Mihalovich
455 7th Street, Room 608
Oakalnd CA 94607
510-238-3386

Or email to:
jsmihalovich@oaklandnet.com

Name	
Agency	
Address	
Email address	
Phone number	
Membership Status	
Presentation title and abstract	

Sampling Methods for Qualitative Analysis of Narcotics Evidence:

A Summary of Select Arbitrary and Statistical Approaches

*Amy C. McElroy**

Introduction

In the next couple of years, the San Diego Police Department, as well as other laboratories around the country, will be applying for International Organization for Standardization (ISO) Accreditation. As part of this process, laboratories will need to develop a sampling plan for narcotics analysis. In order to draw conclusions about the population as a whole, a sampling plan must be in place. It is a difficult task for an analyst to determine the number of items required to accurately reflect the population at hand, and to still meet turnaround times. What is the best sampling method to employ for impounded narcotics evidence? There is, unfortunately, no straightforward answer. The preferred method may differ depending on the types of items impounded. A statistical approach or a non-statistical approach (or both) may apply. Expert judgment, common sense, and known information may also play a role in determining the sample size selected. This article gives a general overview of a few methods that have been used or considered for narcotics analysis, their applications, and the advantages and disadvantages of each.

Non-Statistical Approaches

The best approach is to analyze all of the impounded evidence items. Then, of course, you can be 100% confident about the contents of the material. This may not be feasible due to the number of items in the case, the analysts' required turn-around times, the number of cases to be completed in a day, and the several other responsibilities required of criminalists outside of narcotics analysis.

If the impounded evidence, through visual examination, appears homogeneous, the easiest approach for an analyst is to sample and analyze just one item. This, of course, is very little work, and does not provide very much information regarding the characteristics of the population as a whole. Arbitrary percentages, such as 5% or 10% of the population, or the square root of the population (and variations of that); have been employed in laboratories, but with what basis? Unfortunately, when the populations are small, these techniques result in very small sample sizes, and provide only a limited amount of information about the population as a whole. The reverse may be true with large populations, resulting in unrealistic sample sizes.

The United Nations Drug Control has developed a sampling strategy based on three arbitrary values (X, Y, and Z). These numbers are chosen, at the analysts' discretion, and a decision about the sampled items is based on those value designations. Here are the suggested values: X=10, Y=100, Z=10

I.	Population < X	Do all
II.	X ≤ Population ≤Y	Do Z amount
III.	Population > Y	Do square root of the population

With this allocation of values, if you have a population in a range of 10 to 100, you simply analyze 10. This seems to be excessive if you have 11 items, but too few if you have 90. With an even larger population, your sample size may be extremely large and unreasonable.

Statistical Approaches

Mathematical models may be used to determine the sample size based on set parameters or model assumptions. The binomial distribution describes the number of successes in a sequence n (sample number) of draws from a finite population. The number of successes is defined as the number of "positives" or number of items that contain controlled substances. This model assumes independence, meaning that the occurrence of one event (selecting an item) makes it neither more nor less probable than another event (selecting another item). Independence is maintained by replacing the sampled item once it is analyzed. This is not something that we would want to do as analysts. Once it is confirmed to be a controlled substance (or not), we certainly do not want to analyze it again. A modification to the binomial distribution is called the hypergeometric distribution and it is better suited for our purposes. It is based on the same distribution as the Binomial; however, each sampled item is not returned to the overall population. This is called sampling without replacement. We assume that there is a fixed unknown proportion of the impounded evidence that contains drugs (defined as N_1) and the number of successes (x) is the number of "positives."

$$P(X = x \mid N_1, N, n) = \frac{\binom{N_1}{x}\binom{N - N_1}{n - x}}{\binom{N}{n}}$$

This model describes the probability that in a sample size n we have x successes, given there are successes in the entire population N. The value of the sample size required (what we are truly interested in) is determined by fixing the confidence level, establishing a hypothesis based on the minimum proportion of successes you expect to see, and then plugging in values for the sample size until the probabilities calculated satisfy your hypothesis. Table 1 lists the sample sizes for a given a proportion of successes (k), a confidence level, and a population size. This table assumes all items selected in the sample will be positive (contain drugs).

As the confidence level increases and/or the proportion (k) of positives expected increases, the sample size required also increases. For example, for a population size of 100, to be 95% confident that at least 90% of your items contain a controlled substance; a sample size of 23 is required. By changing the confidence level to 99%, but maintaining the same population size, the sample size required is increased to 33.

The model assumptions can be modified to include potential negatives in impounded evidence. In a large number of items, it is possible that one or more of the items do not contain drugs. Making this assumption in the beginning will

**Criminalist, San Diego Police Dept., Forensic Chemistry Unit*

Table 1. Sample Sizes for 95% and 99% Confidence Levels at Various Proportions of Success.[1]

Population Size	95%Confidence			99% Confidence		
	k=0.5	k=0.7	k=0.9	k=0.5	k=0.7	k=0.9
10	3	5	8	4	6	9
20	4	6	12	5	9	15
30	4	7	15	6	10	20
40	4	7	18	6	10	23
50	4	8	19	6	11	26
60	4	8	20	6	11	28
70	5	8	21	7	12	30
80	5	8	22	7	12	31
90	5	8	23	7	12	32
100	5	8	23	7	12	33
200	5	9	26	7	13	38
300	5	9	27	7	13	40
400	5	9	27	7	13	41
500	5	9	28	7	13	41
600	5	9	28	7	13	42
700	5	9	28	7	13	42
800	5	9	28	7	13	42
900	5	9	28	7	13	43
1000	5	9	28	7	13	43
5000	5	9	29	7	13	44
10000	5	9	29	7	13	44

Table 2. Sample Sizes for 95% and 99% Confidence Levels at Various Proportions of Success Accounting for One or Two Negatives.[1]

Population Size	95%Confidence						99% Confidence					
	k=0.5		k=0.7		k=0.9		k=0.5		k=0.7		k=0.9	
	1 neg	2 neg	1 neg	2 neg	1 neg	2 neg	1 neg	2 neg	1 neg	2 neg	1 neg	2 neg
10	5	5	7	7	9	9	5	5	7	7	9	9
20	6	8	10	13	17	18	8	10	12	14	18	18
30	7	9	11	14	22	27	8	11	14	17	25	27
40	7	9	12	15	26	32	9	11	15	18	30	35
50	7	10	12	16	29	36	9	12	16	20	34	41
60	7	10	12	16	31	39	9	12	16	20	38	45
70	7	10	13	17	32	41	10	12	17	21	40	48
80	7	10	13	17	34	43	10	12	17	21	42	51
90	7	10	13	17	35	45	10	13	17	21	44	54
100	7	10	13	17	36	46	10	13	17	22	46	56
200	8	10	14	18	40	53	10	13	18	24	54	67
300	8	10	14	19	42	55	10	13	19	24	57	71
400	8	11	14	19	43	57	10	13	19	24	58	74
500	8	11	14	19	44	58	10	14	19	24	59	75
600	8	11	14	19	44	58	10	14	19	25	60	76
700	8	11	14	19	44	59	11	14	19	25	61	77
800	8	11	14	19	44	59	11	14	19	25	61	77
900	8	11	14	19	45	59	11	14	19	25	61	78
1000	8	11	14	19	45	59	11	14	19	25	62	78
5000	8	11	14	19	46	59	11	14	20	25	64	81
10000	8	11	14	19	46	61	11	14	20	25	64	81

result in a larger sample size required. Table 2 lists the sample sizes for a given proportion of successes (k), a confidence level, and a population size. This table accounts for one or two of the sampled items being negative (not containing a controlled substance).

By predetermining the number of negatives expected prior to sampling, the sample size required to maintain the same confidence level and/or the proportion (k) of positives expected as in the previous example, will increase. For a population size of 100, with two negative sampled items expected, in order to be 95% confident that at least 90% of items contain a controlled substances, a sample size of 46 is required.

Another statistical method is the Bayesian approach, where a distinction is made between sampling with replacement and without replacement just as was done in the Hypergeometric approach. The former is much easier and is a good approximation when the number of items in the impounded evidence is at least 50. Only this approach will be discussed in this article. Unlike the hypergeometric, the calculations are independent of population size, and a prior distribution, based on past information and experience, also needs to be selected. The general Bayes' formula for the probability of the proportion of the population that tests positive for drugs (θ), given information (x) about the sample is:

$$P(\theta \mid x) = \frac{P(x \mid \theta)p(\theta)}{P(x)}$$

We will make statistical inferences about θ based on sample data and prior information, called the posterior distribution. The posterior distribution is a combination of prior information and sample data. The prior information is based on the beta distribution with parameters (a) and (b). It is a natural choice because it has two outcomes which represent the positives (a) and negatives (b) as seen in past similar situations.

The sum of these parameters represents the analysts' certainty in the proportion. For example, if there is no prior information, (a) and (b) can both be set equal to 0.50.

If there is prior knowledge that the probability of drugs is very likely, then the parameter (a) gets increased (ex. a=3, b=1). Intuitively, as the parameter (a) increases, the smaller the sample size required. These values are set at the discretion of the analyst. In addition to the prior information, the number of positives (x) and the number of negatives (n-x) in the sample must be determined ahead of time and combined with the prior information. Table 3 lists the sample sizes for a given proportion of successes (k), a confidence level, and defined parameters (a) and (b). The complete formulas are found in Appendix A at the end of this article.

Table 3. Sample Sizes for Different Values of a and b and Number of Negatives in the Population.[1]

	95%Confidence			99% Confidence		
a=1, b=1	k=0.5	k=0.7	k=0.9	k=0.5	k=0.7	k=0.9
0 negatives	4	8	28	6	12	43
1 negative	7	13	45	10	19	63
2 negatives	10	18	60	13	24	80
a=3, b=1						
0 negatives	2	6	26	4	10	41
1 negative	5	11	43	8	17	61
2 negatives	8	16	58	11	22	78
a=0.5, b=1						
0 negatives	3	6	18	5	10	32
1 negative	6	12	38	9	17	55
2 negatives	9	17	54	12	22	73

Notice that population size is not accounted for here. For example, if the population size was 500, and if it was reasonable to assume that all or most of the impound contained drugs, and the all sample items selected would contain drugs, the parameters could be set with the following values: a=3 and b=1. If we wanted to be 95% confident that the impound contained at least 90% drugs, we would need to sample 26 items. If the population was 1000, this value would be exactly the same. As the number of negatives we expect in our sample increases, the larger the sample size will be.

Discussion and Conclusions

Non-statistical methods are easy to employ and do not require an extensive mathematical background in order to understand the calculations. Unfortunately, there are no sound mathematical foundations to justify these methods. In addition, sample sizes may be too small or too large based on the population size, resulting in either an inadequate representation of the whole or an impractical number to analyze.

The statistical methods are based on mathematical models that require assumptions to be made about the parameters and/or the population that you are sampling from. The Hypergeometric model is advantageous when the population is small. It provides sample sizes on the conservative side because it is considered to be an objective approach. The model does not take into account any additional information that may be present such as smell, color, form, or packaging, nor does it incorporate the expertise and experience of the analyst. One drawback is it that it may lead to very large sample sizes with larger populations and may not be realistic for analysis turnaround times. In addition, the sample size will depend on the number of negatives expected. As an example, if you assume all of the sampled items will be positive (contain drugs) and you find that one of your items is a non-controlled substance, the assumptions of the model are then violated, and another strategy will have to be employed. Most likely, all of the items will need to be examined to be certain of the true composition of your impounded evidence.

The Bayesian model does not take into account population size, which can be an advantage or a disadvantage depending on your impounded evidence. With larger populations, incorporating prior knowledge into the model will result in a smaller sample size as compared to the Hypergeometric. However, if the population size happened to be small, the same sample size would be required by the model. One of the main advantages of the model is that the sample size is adaptable depending on what you see in your sample. The more information you have, the larger your parameters can be, and a smaller sample size will be required. The inferences drawn about your population are dependent on the prior information included in the model. This is considered a subjective approach and may be difficult to uphold in court when asked about "how" the values of the parameters were decided. The prior information allows a subjective opinion to influence the results and the Bayesian approach is often criticized for this. In addition, for the non-statistician, this approach is not very user friendly.

The decision to use a non-statistical approach, a statistical approach, or both is one that each individual laboratory will need to make. In our own laboratory, we analyze the minimum number of items needed to meet the possession for sales charge. However, in order to make assumptions about the whole, it is necessary for us to employ a statistical sampling method. There are statistical models other than the two presented in this article, and exploring the advantages and disadvantages of these would be worthwhile.

References

1. Guidelines on Representative Drug Sampling, European Network of Forensic Science Institutes (ENFSI), 2004, www.enfsi.org.

2. SWGDRUG, Sampling Seized Drugs for Qualitative Analysis, 2005, www.swgdrug.org.

Appendix A

1. Probability Density Function for N > 50

$$f(\theta \mid x,n,a,b) = \frac{\theta^{x+a-1}(1-\theta)^{n-x+b-1}}{B(x+a,n-x+b)}$$

2. If all sampled items contained drugs x=n then the formula reduces down to:

$$f(\theta \mid n,n,a,b) = \frac{\theta^{n+a-1}(1-\theta)^{b-1}}{B(n+a,b)}$$

3. To calculate the sample size n with a certain percent confidence that at least a certain percentage of the population contained drugs we need to calculate:

$$P(\theta > k \mid n,n,a,b) = \int_k^1 \frac{\theta^{n+a-1}(1-\theta)^{b-1}d\theta}{B(n+a,b)} = (1-\alpha)100\%$$

BOARD OF DIRECTORS

President:
Jennifer S. Mihalovich

Oakland Police Dept.
455 Seventh St., Room 608
Oakland, CA 94607
(510) 238-3386
jsmihalovich@oaklandnet.com

President-Elect:
Mary Hong

Orange County Sheriff-Coroner
320 N. Flower St.
Santa Ana, CA 92703
(714) 834-6383
mmh@fss.co.orange.ca.us

Recording Secretary:
Jaime Miller

Orange County Sheriff-Coroner
320 N. Flower St.
Santa Ana, CA 92703
(714) 834-4510
jemiller@fss.co.orange.ca.us

Treasurer:
Michael Parigian

Ventura Co. Sheriff's Lab
800 S. Victoria Ave.
Ventura, CA 93009
(805) 662-6803
michael.parigian@ventura.org

Regional Director: (North)
Jeanette Wallin

CA DOJ Jan Bashinski Lab
1001 W. Cutting Blvd, Ste 110
Richmond, CA 94804
(510) 620-3331
jeanette.wallin@doj.ca.gov

Regional Director: (South)
Janet Anderson-Seaquist

Ventura Co. Sheriff's Lab
800 S. Victoria Ave.
Ventura, CA 93009
(805) 662-6804
janet.seaquist@ventura.org

Membership Secretary:
Patricia A. Huck

LAPD SID-Serology/DNA Unit
1800 Paseo Rancho Castilla
Los Angeles, CA 90032
(323) 415-8815
N3190@lapd.lacity.org

Editorial Secretary:
Ron Nichols

Bureau Alcohol, Tobacco & Firearms
355 N. Wiget Lane
Walnut Creek, CA 94598-2413
(925) 280-3623
ronald.g.nichols@usdoj.gov

Immediate Past President:
Julie Leon

Ventura Co. Sheriff's Lab
800 S. Victoria Ave.
Ventura, CA 93009
(805) 477-7260
julie.leon@ventura.org

Can't Find It?

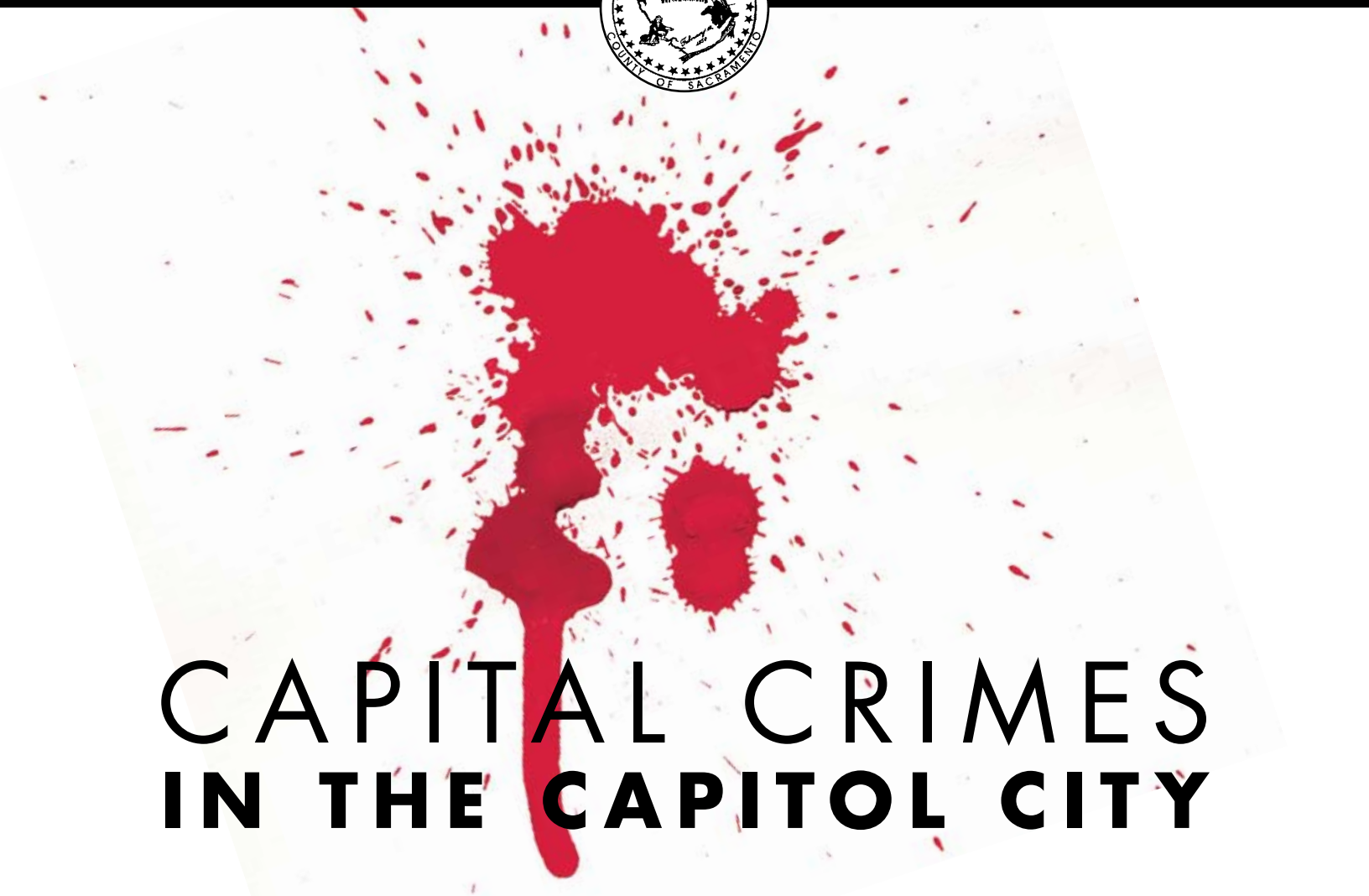
To reduce the costs of publication, the *CACNews* may place calls for nominations and other items that were previously found in the newsletter mailing as inserts or ON THE WEB. Visit **www.cacnews.org** to see what is offered. Content changes periodically, so visit often!

Interested in becoming a member?
Visit us online at
www.cacnews.org

If you see these great CAC T-shirts in COLOR then you've found the online version of the *CACNews*!
www.cacnews.org

CAC FALL SEMINAR 2008

SACRAMENTO • OCTOBER 20–24



CAPITAL CRIMES
IN THE CAPITOL CITY

YOU CAN'T AFFORD TO MISS THIS CONFERENCE

Here's your opportunity to learn new concepts and exchange technical knowledge with your peers. Come join us and "inject" yourself into the latest developments of forensic science!

WHAT'S INCLUDED?

- Featured workshops on: DNA, Firearms, Grant Writing, Controlled Substances
- Informative technical presentations each day
- Two days of exhibitors; over 30 manufacturers and suppliers.
- A memorable experience that's guaranteed to be both fun and informative.

DEADLINES

Pre-register by September 19, 2008 to receive the early registration discounted price.

Reserve your hotel room at the group rate ($109 single, $119 double, and $129 triple) by September 29, 2008.
1-800-222-TREE or (916) 929-8855
www.sacramento.doubletree.com

REGISTER AT WWW.CACNEWS.ORG