

The CACNews

News of the California Association of Criminalists • First Quarter 2009



The President's Desk

Get S.M.A.R.T.

This is the beginning of a new year. Everyone wants to start fresh with new visions of what the year 2009 will bring. So let's take a moment to evaluate what these visions can be for you, the members of the CAC, and the CAC as a professional organization.

What is a vision? A vision is a source of inspiration that is Specific, Measurable, Achievable, Relevant, and Timebound (S.M.A.R.T.). The origin of the term is unknown, but Peter Drucker, in his 1954 seminal work, "The Practice of Management," outlined a system that was very similar to SMART objectives while discussing objective-based management (*Wikipedia*). Does the CAC have a vision statement? I believe the objectives and purposes of the corporation as outlined in *The Bylaws of the California Association of Criminalists* provide the inspiration from many visions. The By-Laws have 16 objectives and purposes.

The first three objectives and purposes incorporate specific goals: exchange of ideas and information, friendship and cooperation among the various laboratory personnel, and encourage worthy research projects. I can easily define my visions for the next twelve months based only on the first three sections of the CAC Bylaws.

My exchange of ideas and information amongst the scientists in the Oakland Police Department Criminalistics Laboratory happens on a daily basis. I am also in continual communication regarding scientific information with the clients of our laboratory: the investigators and the attorneys. This is my SMART vision for this inspiration for outside of the OPD Lab:

Specific	I will present a scientific paper at a professional meeting.
Measurable	Abstract will be submitted to the Spring 2009 CAC Seminar.
Achievable	The underlying research for the paper has to be completed before the submission of the abstract.
Relevant	The data obtained will be directly relatable to the analysis of biological material.
Timebound	The paper will be presented (if accepted) at the Spring 2009 CAC Seminar

The encouragement of friendship and cooperation among the various laboratory personnel seems really simple. Can SMART be applied to my vision for this objective?

Specific	I encourage the CAC membership to bring a colleague to a study group meeting or a dinner/lunch meeting.
Measurable	The number of attendees at the study group meetings and the dinner/lunch meetings will increase.
Achievable	If only one individual brings a colleague to either meeting this is achievable. I will be a CAC member that brings a colleague to a meeting.
Relevant	I will introduce this colleague to attending members.
Timebound	The meeting(s) will be within the next twelve months.

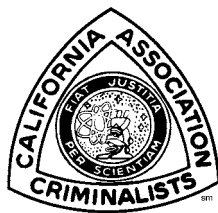
The encouragement of worthy research projects is rather easy for me. I have five colleagues at the OPD Lab who are obtaining their Master's of Forensic Science. All are in various stages of conducting research for their thesis. I cannot apply SMART to their individual projects. However, I can apply it to how I view the research conducted by the scientists in the Forensic Biology Unit.

Specific	I will discuss and assist in the preparation of research project proposals.
Measurable	The research project proposals will be accepted by the students' research advisors (two projects have been accepted).
Achievable	I will suggest projects to be divided into smaller mini-projects. Thus, once all of the smaller projects are completed the main project can be readily pulled together.
Relevant	The data obtained will be directly relatable to the analysis of biological material.
Timebound	My assistance in the research projects will be completed within twelve months.

Based solely on the first three objectives and purposes of the CAC, it looks like I will have a very full year. Placing my professional visions on paper (or electronically) has given me the inspiration to expand my individual professionalism, my colleagues' professionalism, and the professionalism of the California Association of Criminalists. I now encourage each of you prepare a vision inspired by one or more of the objectives and purposes of the CAC.



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CAC President



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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.

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

On the cover...

Chris Coleman demonstrates a technique for shooting scene reconstruction while co-instructor Bruce Moran watches. More scenes from the Fall 2008 CAC Seminar inside this issue.



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CACBits



CAC Life Member Patty Lough analyzes the bloodstain patterns from a knife wound in "Pinned by the Evidence," a *Forensic Files* episode on Tru TV. (Originally aired February, 2004.)

Please share your news!

If you have a tidbit of news about yourself or another CAC member that deserves recognition in "CACBits," a job opening, or an upcoming class, please send it to Editorial Secretary Ron Nichols, ronald.g.nichols@usdoj.gov.

CAC Award Winners

Posing with CAC President Jennifer Mihalovich is **Pam Hofsass** (left) winner of the Al Biasotti Most Outstanding Presentation Award for her paper, "The Recovery, Characterization and Assessment of Contact DNA Collected from Firearms Using a qPCR Triplex Method and STR Analysis," presented at the fall 2007 CAC meeting.

Laura Silva (right), was named winner of the 2008 Paul Kirk Presidents Award. This award is given to outstanding members employed in the profession for fewer than six years and who demonstrate an interest in a professional organization, not limited to the CAC. In 1994, it was established that the recipient of the Paul Kirk Award is also the recipient of the Presidents Award. The Presidents Award was created to encourage a collegial relationship between the CAC and the Forensic Science Society by promoting scientific exchange and fellowship between members.

International Conference Announced

The Center for the Study of Law, Science, and Technology at the Sandra Day O'Connor College of Law at Arizona State University will hold an international conference on April 3-4, 2009, in Tempe, Ariz., on the future of forensic science, with special attention to the highly anticipated report of the U.S. National Academy of Sciences, "Identifying the Needs of the Forensic Sciences Community."

In addition to experts from universities such as the University of California, Berkeley, Harvard Law School, the University of Michigan Law School, the University of California, Irvine, the University of Virginia and ASU, among others, participants will include state and federal judges, the NAS committee chairmen, the president of the American Associa-

forensic science
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The National Academy of Sciences Report and Beyond

tion of Forensic Sciences, directors of the FBI laboratory and the Innocence Project, and prosecutors, defense attorneys, forensic scientists, and criminalists. Papers will be published in the ABA-ASU journal, *Jurimetrics: The Journal of Law, Science, and Technology*, and in the Oxford University Press journal, *Law, Probability & Risk*.

For more information about the conference, co-sponsored by the National Judicial College and sections of the American Bar Association, and to register, go to 1st.law.asu.edu or e-mail any of the conference organizers, David Kaye at david.kaye@asu.edu, Jay Koehler at jay.koehler@asu.edu or Michael Saks at michael.saks@asu.edu





Your 2008-9 CAC Board of Directors

Clockwise from left: Jeanette Wallin, Reg. Director, North; Mary Hong, Pres. Elect; Ron Nichols, Ed. Secretary; Jennifer Mihalovich, President; Jamie Miller, Recording Sec.; Julie Leon, Immediate Past Pres., Michael Parigian, Treasurer; Patricia Huck, Membership Sec. Not pictured: Janet Seaquist, Reg, Director, South.

From Our Association to Yours

This year's traditional CAC president's gift to the Forensic Science Society's president is a ceremonial academic stole embroidered with symbols representing the members. *Clockwise from left:* English rose, Irish (Northern and Republic) shamrock, California poppy, Welsh daffodil, and Scottish thistle.



CAC Members in JFS

Three CAC members had papers published in the current issue of the *Journal of Forensic Sciences*. Theresa F. Spear, Sreetharan Kanthatswamy coauthored (with eight others), "Analysis of Forensic SNPs in the Canine mtDNA Mutational Hotspot Region." Also, Vicki Clawson was the co-author of a review of John Lentini's new book, "Scientific Protocols for Fire Investigation."

Fishing for Clues



CAC Spring 2009 • Lake Arrowhead • May 11-15, 2009

The Editor's Desk

Background Noise

Right from the beginning you can tell something is different. There is not the collection of the sometimes relevant and arguably witty opening snippets that have marked this column for the last five years. Check that – last five and one-half years. In a way, this has been among the most difficult of editorials to write, not because there is a lack of things to write about but because there is potentially so much to write about. Let me explain.

My mom recently visited and was surprised that I really do not follow my hometown football team, the *Buffalo Bills*, as I once did. In fact, October and November used to be very interesting when I was growing up—that is when the four seasons would all seemingly converge. In case you are wondering, by seasons I do not mean winter, spring, summer and fall either. I mean baseball, football, basketball and hockey. So many games to choose from, not to mention listening to one game on radio while watching another on television.

Then I invited my mom to look at my board game collection in a hall closet—yes, I play board games and many different kinds. Her eyes grew a bit when she saw the collection but that was nothing compared to the collection that once graced our closets (plural back then). It was so bad that I would spend so much time choosing a game to play that by the time I made the choice, I no longer had the time to play it!

Looking out in the vast community we call society there are many things that we could discuss, many things that are going to be impacting us—the recent presidential election, the economy that has seen more tanks than World War I, the upside down housing market, the debacle in the Detroit crime lab, accreditation, certification, *Daubert* challenges for firearms and tool marks would be just a few. With the recent Christmas season and New Year we likely found ourselves absorbed with

going here, going there, shopping here, shopping there (well, assuming “there” is still open), visiting friends and relatives and having them storm the house. There is so much going on, so many things from which to choose, sometimes the very act of choosing causes us to be paralyzed. A friend, one of my best friends, with whom I played quite a few of those board games had what I called “analysis paralysis”—strategic decisions did not come easily. It was the source of some pretty good natured ribbing right up to the day he passed away from a massive heart attack leaving a wife pregnant with their eighth child.

Pretty sobering huh? Here’s another. Recently a son received a phone call from a father he had not known for close to 40 years. His father had not visited nor contacted his son since the son was 8 years old. His father had two weeks left to live and wanted to reach out to his sons one of the few days he had any lucidity at all. As you might imagine, it was a most awkward conversation. The father was never much of a conversationalist and the son, well, he was caught so off-guard that the only thing he could think of saying was, “So, how are you doing?” However, an awkward beginning turned into a conversation that will have eternal meaning and purpose as repentance, sorrow and forgiveness was extended and received. Almost two weeks to the day, the son received the news that his father, a father he had not known for forty years had passed.

It’s interesting that of all the things I could choose to write about, I write about the passing of my best friend in 2005 and the passing of my father but weeks ago. As I do, I think about the analytical instruments that we use on a daily basis—you know, all those instruments in which we have to battle through background noise to find the peaks of interest. As I think about the last quarter of 2008, there is a tremendous amount of background noise in our lives, both professionally and personally. The question I have is how well are we able to pick up those things of interest and importance through all those choices that have come to be our background noise?



Ron Nichols

CAC Editorial Secretary

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Here’s a choice to consider for the new year, a choice that by itself will help to reduce the background noise of our lives—a choice of gratitude. I know I will be working hard on this myself.

Administer This!



If men were angels, no government would be necessary. If angels were to govern men, neither external nor internal controls on government would be necessary.

— James Madison, *Federalist 51*

Almost exactly one year ago, we jammed into a room with 9 other scientists of various expertise to hammer out a letter on a topic subsequently dubbed sequential unmasking. While we knew many of the participants either from past experience or by reputation, one person was completely new and unfamiliar to us. He introduced himself as Dr. Roger Koppl, an economist, the director of an Institute on the East Coast. When he revealed that the Institute studied the administration of forensic science, we sorta said, “Huh?” (although I think, to our credit, not to his face). Over the next two days we became increasingly impressed with this quiet man’s grasp of things forensic, and, excited by his creativity and discernment, decided that we would like to introduce him to you, our friends and colleagues.¹

Alas, because a few thousand miles separate us, a meal was out of the question. We decided on a one-time deferral of the lunch-time repast, and have adopted an NPR-like interview format. We have tried to ask the kind of questions that we imagine you would ask were you sitting with Roger, skeptically wondering about the kind of work done at some place that studies how forensic science is administered in the United States. Herewith our questions and his answers.

What the heck is an Institute of Forensic Science Administration?

Have you been talking to my dean? He keeps asking me the same question. Forensic science administration studies how to reduce error rates in forensic science by reorganizing forensic work. Many of my colleagues are still trying to understand why a business professor is talking about forensic science. But if we want our crime labs to be “high reliability organizations,” then we’d better have some input from the business disciplines, including my discipline of economics.

Here’s what our webpage (www.fdu.edu/ifsa) says:

The Institute for Forensic Science Administration (IFSA, pronounced IF-sah) promotes 1) improved forensic science administration within the criminal justice system and 2) improved understanding of forensic science as a legal, social, and political phenomenon.

The purposes of IFSA are pursued through research, education, outreach, and policy espousal.

Isn’t administering a crime lab just a matter of putting someone in charge (hopefully, someone with crime lab experience) and letting them manage it? Aren’t they supposed to just make sure we get enough money to do a good job?

That’s the pray-hard solution: Hire someone and pray hard for a good outcome. I think everyone recognizes the need for high standards of professionalism, quality processes, and best practices. IFSA research points to something to which we might be less sensitive. We need more structural redundancy in the system. Your car has five tires, not four. There’s one in the trunk and that’s redundancy. We want drivers to be careful, skilled, and polite. But we also have traffic lights, guardrails, and air bags. That’s redundancy. To have that kind of structural redundancy in forensic science, we need to think of ways to allow crime labs to check one another. We need checks and balances. That’s something that goes beyond good practice within the lab. It’s a systems issue.

A “systems” issue ... tell us a little more about that. What are some other examples of “systems”, both in the world in general and in other professions?

The “system” is all the pieces, plus how they fit together. The US Constitution gives us a political system. It’s all the citizens, plus how they fit together. We have voting, representation, and the divided powers of government. That’s the systems part. Health care is provided through the medical system. It’s the doctors, patients, and others, plus how they fit together. Different people have different rights and responsibilities. Phlebotomists, for example, are not allowed to perform brain surgery. That’s a systems issue. The legal exposure of phlebotomists is also very different from that of surgeons. Again, it’s a systems issue. You’re engaged in “systems thinking” when you are paying attention to how the pieces fit together rather than what this or that piece is like.



Dr. Roger Koppl

In my scholarly research I define “epistemic systems²,” as “social processes viewed from the perspective of their tendency to help or frustrate the production of true judgments.” The criminal justice system is a good example. The structure of the system influences the chances of getting true judgments about who the bad guys are. What if we dispensed with criminal trials and let the police jail any-

one they liked for as long as they liked? Clearly, that system would do a bad job of sorting out the good guys and the bad guys. Even when the police were trying to be good, the absence of trials would remove an important source of information and argument about who is and is not guilty. It’s no criticism of the police to say that such a system would have more errors than our current system. Similarly, forensic science has been a big improvement to the criminal justice system. Scientific examination of physical evidence reduced the incidence of false convictions and erroneous acquittals alike. We prefer the system with forensic science to the system without forensic science. Forensic science is also an epistemic system. The structure of the system influences the incidence of mistaken forensic analyses.

Why do we need an institute to study the administration of forensic science?

You’ve definitely been talking to my dean. I’m sure of it now. We need lots more than just one institute. We need many researchers to pursue the many questions involved. IFSA has focused on its experiments with human subjects. We’re trying to figure out the best design principles for redundancy in forensic science. And we’re making progress. I think we’ve learned, for example, that when you have multiple tests, you need at least three tests, but you don’t need more. That’s good information on how much redundancy we need to build into the system.

Is the “three is enough” doctrine published somewhere? Has it been peer-reviewed?

Yes, that result has been published in a peer-reviewed journal. Koppl, R., Kurzban, R., and Kobilinsky, L., *Epistemics for Forensics*, *Episteme: J. Soc. Epistemology*, 2008, 5(2):141-159³.

¹ In the interest of disclosure, it should be noted that Keith agreed in October 2008 to be a member of the Scientific Advisory Board of the Institute of Forensic Science Administration, and will participate in teaching activities sponsored, in part, by IFSA.

² Because the word “epistemic” and its cousins will appear a few times in the article, we provide here a definition: epistemology primarily addresses the following questions: “What is knowledge?”, “How is knowledge acquired?”, “What do people know?”, “How do we know what we know?” It also deals with the means of production of knowledge, as well as skepticism about different knowledge claims. Keith has threatened on more than a few occasions to address an “epistemology of forensic science,” but Norah keeps saying “Later.”

³ Looks like he beat Keith to it.

...forensic science has been a big improvement to the criminal justice system. Scientific examination of physical evidence reduced the incidence of false convictions and erroneous acquittals alike.

Is it like administering any other science lab? How is it the same? Is there anything special about forensic science labs that make it different from other science labs?

You are trying to do something different in forensic science. Research scientists are looking for general laws, for “universals” if you will. Forensic scientists are trying to associate unique bits: this scrap of blood-soaked cloth originates from that named person. With such a difference you can’t expect the two areas to look completely the same. But the way forensic science is organized today isn’t at all similar to the organization of research science. I’d like to see it move closer.

I just participated in a panel on “Debating the Science in Forensic Science” at the annual meeting of the Northeastern Association of Forensic Scientists. I argued that there are two forms of redundancy we see in research science, but are underdeveloped in forensic science: structural redundancy, and organized disagreement. The second form could be implemented by creating a defense right to forensic expertise. I was happy to see that idea approved by some folks in the room who were otherwise skeptical of my comments. I think it’s vital to create a defense right to forensic experts. The defense and prosecution should both have the services of a skilled forensic scientist who can interpret the evidence, suggest needed tests, and so on.

Doesn’t accreditation or certification cover the concerns that you have about administering forensic science labs?

Research scientists are certified when they get their PhDs. They have something like accreditation when their labs are located in accredited universities. These are good things. But no one in research science thinks that this type of accreditation and certification are enough for PhD’s in academic universities. In research science, any one lab may challenge the results of any other lab. That’s a system of checks and balances. It’s that system that makes research science self-regulating. No one is calling for oversight of science, only for oversight of forensic science. Why? Because forensic science doesn’t have the same sort self-regulatory structures we see in research science. We should think about how to create such structures for forensic science.

So are research scientists with PhDs certified to do forensic science? Or does it require additional special certification?

Ah! I see I was being a little cryptic. Sorry about that. I’m saying that a PhD gives the research scientists a kind of certification *for doing research*, and affiliation with an accredited university gives research labs a kind of accreditation *for doing research*. In spite of these safeguards against error, research science has both structural redundancy and organized

disagreement to promote truth and discourage error. So I'm saying that certification and accreditation are certainly good things, but they are not substitutes for redundancy, sequential unmasking, a defense right to forensic expertise and other changes some of us have been suggesting.

What have you found so far in your studies that should make us want to know more about administering forensic science labs?

The subject is growing more important. I think the NAS report⁴ (currently scheduled for a February 2009 release) may be a big stimulus to improving our understanding of forensic science administration. Two results of our research have surprised me.

First, triplicate testing improves system results even if the average performance on each test goes down. Let me explain. We asked some experimental subjects (college undergraduates mostly) to act like crime labs by looking at some simple evidence. We had them report their observations to another subject who acted like a jury by guessing what the first subject saw. Our "evidence" was absurdly simple and we're talking about how to reduce error rates, so we needed to do something to induce inaccurate reports. We gave our surrogate crime labs an incentive to give inaccurate reports. When the incentive was small they mostly produced accurate reports; when the incentive was big they produced inaccurate reports about half the time. In all versions of this experiment the guesses of the surrogate juries improved when they got three independent reports rather than just one. In one version, however, the surrogate crime labs produced more inaccurate reports when three independent reports were provided to the surrogate jury instead of one. Redundancy degraded the performance of the parts of the system charged with examining the evidence. In spite of that, the overall system worked better; the surrogate juries were better at guessing the truth when they had multiple reports. We hadn't expected that. But it shows you the difference between a chain and net. A chain is only as strong as its weakest link. A net, however, is stronger than any of its knots. More knots make a stronger net, even if each knot is a little weaker.

Second, we have learned that the sort of redundancy I have been calling for saves cost. This was another surprise. But in hindsight it makes perfect sense. False positive errors are costly. The costs of incarceration alone exceed \$20,000 per year. The average felony sentence is about five years. Thus, even considering the "present value," you're looking at a *minimum* of \$100,000 per false felony conviction. We could add an extra two independent fingerprint examinations in a case for about \$100. That's a 1,000:1 ratio. More precisely, for 2002 values, if the rate of false positives exceeds 0.115%⁵, then establishing independent triplicate fingerprint exams in all felony cases going to trial will lower the costs of administering the criminal justice system. Forensic science is a bargain for the criminal justice system, and we need more of it.

You're an economist. What do you know about forensic science labs, or any other lab, for that matter?

It's been quite a learning experience, I can tell you! Fortunately, I've had the help of some high-caliber forensic scientists. Sometimes that help came in the form of harsh criticism from skeptical readers. Often, however, it came from scientists who thought I was onto something and volunteered to make me smarter about forensic science. Larry Kobilinsky was an early supporter and I will always appreciate his help.

Dan Krane taught me quite a bit about DNA profiling. It is weird for me to be talking about something so distant from what other economists have done. But forensic science, like research science, is work. As an economist I have been trained to see how the *organization* of work influences the work product. In this case the issue is error rates. And sure enough, the organization of forensic science influences error rates. That's why we need to study forensic science administration.

The term "error rate" has become a hot button topic in forensic science. One argument has been raised that it is impossible to determine any kind of error rate because the moment an error is detected, procedures are put in place to make sure it doesn't happen again. Another argument is that the only issue is whether an error has been committed in the case under consideration? This is obviously a huge topic, but can you respond briefly to these issues?

This issue has been a real head-scratcher for me. I can't understand some of the objections raised to the idea that we have a positive error rate in forensic science. Of course we do! You can't have a human activity with a zero error rate. We're humans, not gods. Bruce Budowle famously said, "An error rate is a wispy thing like smoke" and "to say there's an error rate that's definable would be a misrepresentation." (See Judge Pollack's January 2002 decision in *Lellra v. Plaza* Cr.No.98-362-10,11,12 at p. 32.) That completely stumps me. Sure, maybe the error rate is high in June, low in July and August, then high again in September. You can still define an error rate for June or July or the year as a whole. I really can't understand how our difficulty in measuring error rates is supposed to mean that we shouldn't think about them or deal with them. I don't know if that's what Bruce Budowle was trying to say, but some people seem to have drawn that inference.

We don't know what the error rates are in forensic science. Therefore, we don't know how variable they may be across time and space. But they're still there and we have evidence for it. If error rates are not zero, we should probably think about why errors happen. Some of the causes may be random and hard to prevent. That's why I like redundancy. But some of the causes are likely to be systematic. Several of us proposed sequential unmasking to reduce the observer effects noted by Michael Risinger, Itiel Dror and others. I have argued that the very organization of forensics can be another source of systematic error. I'd like to see more research on these topics. I would be particularly happy to see more cooperation between crime labs and university researchers on how to reduce error rates.

We encourage CACNews readers to check out Roger's website, explore the various research projects in which he is engaged, and read articles that he and his colleagues have published. If this is your first exposure to Roger, we're pretty sure it won't be your last!

⁴ www8.nationalacademies.org/cp/projectview.aspx?key=48741

⁵ Once study estimates the false conviction rate at just less than 1% (Huff, Ratner, Sagarin. Guilty until proven innocent: Wrongful convictions and public policy. *Crime and Delinquency*. 32:518-544. 1986)

The Imprecision of the Expert's Language

Raymond J. Davis *

I have had the privilege of listening to thousands of experts testify in the Courtroom Presentation of Evidence course over the past twenty years. Fingerprint examiners, forensic specialists, firearm examiners, DNA experts, controlled substance analysts and, DUI experts have been well represented in the 135 courses I have taught. In addition, there have been a few engineers, several police officers and approximately one hundred sexual assault nurse examiners who have also attended the courtroom course.

I have listened to how people speak in the courtroom and I have come to a disheartening observation. One, I believe, which affects the stature of the expert witness in the courtroom. It's not a person's educational level, or years of experience nor even their area of expertise that jeopardizes their credibility in the courtroom. It's their ability to speak more formal English in the courtroom. The law is, after all, about words. Not necessarily about finding the truth and seeking justice, but about words and how those words are used in the courtroom. That is, how well skilled the expert witness uses words and terms that accurately and precisely describe the work performed while on the witness stand.

The reason for the present situation is the fact that over one hundred and eighty five languages are spoken in America. Add to this, our penchant for not correcting one another and thereby allowing the language to deteriorate to the point that our communication skill is to us the vernacular in the courtroom. Webster defines, vernacular as, "using a language, native to a country rather than a literary or cultured language, a substandard language." Americans are forgiving people when it comes to the spoken language. If a foreigner or one not well educated in English misspeaks we rarely correct them. Preferring, instead to be accommodating rather than instructive.

I should point out that I am not the oracle when it comes to all things, English. I had two English professors in college. One thought me an imbecile while the other one, thought me a genius. I have never been able to reconcile the disparities between the two assessments. However, I still recall the time when I first became aware of my spoken English when I traveled to Europe. There were several embarrassing episodes when foreigners corrected my English. They were specific about the rules I had violated and pointed them out, not to belittle, rather to look for confirmation on my part.

From those red faced moments, I vowed to be vigilant with the spoken language. As a result, I have become an expert at listening to others speak, questioning why some spoke better than others. Those who did speak well were often well read and mindful of using a more formal use of English. Also, they often helped others when they misspoke. I remember once, a friend telling me there was no such word as 'irregardless.' Embarrassing! I soon learned that it only takes one correction and the 'word' is soon banished from one's dictionary.

I appreciate when people correct my language. Two words come to mind I used recently where a friend advised me of my mispronunciation and misuse of two words. The

first word was, inexorable. I mispronounced it. I had put the emphasis on third syllable when it belongs on the second syllable. The other word I misused was 'penultimate'. I was told that penultimate was just below ultimate. I thought penultimate meant the top. It sure sounds like it should. In any event, I thanked him for both corrections.

Before I launch into my diatribe, I want to mention that I have found a number of students in my classes over the years that spoke so well that I was completely captivated by their prowess with the spoken language. From them I have learned a great deal.

Let me take this forum to highlight some of the more egregious examples I have heard and continue to hear in the courtroom classes. I will be offering recommendations that I am convinced will enhance the expert's stature in the courtroom. The first, is the use of the word 'you' and 'your'. We should be very careful about using these two words in the courtroom because doing so draws the jurors into your testimony. Jurors should be kept at a comfortable distance preferring to be a bystander and not part of the testimony. The following are some examples:

Example one: A medical examiner was describing injuries suffered by the assailant as he had cut himself while stabbing another man. He was asked how the assailant could have



She said, while pointing directly at me, "They are the cells in your mouth, on your skin and in **your** vagina." I was astounded by this news! I couldn't help myself, I looked down.

cut himself. I heard him say, "When **you're** stabbing someone in the chest and the blood begins to gush all over **your** hand it can then slip over the hilt and end up cutting **your** hand." I saw several jurors wince at the visual image painted by the ME. He should have said, "When *someone* is stabbing . . ."

Example two: A sexual assault nurse examiner was asked how she normally performs her examination of a victim of a rape. She began, "I'll ask **you** to drop **your** panties and then have **you** to sit up on the table. Then I'll begin a general examination of **your** vaginal area followed by insert-

*CourtSkills

First presented at the Spring 2008 CAC Seminar in San Diego.

ing a speculum in **your** vagina.” I saw the women on the jury become slightly uncomfortable but nothing compared to the men listening to her description. Again, she should have said, “I’ll have the patient remove her panties and have her sit up on the table . . .”

Example three: I asked a DNA case worker what epithelial cells were. She said, while pointing directly at me, “They are the cells in your mouth, on your skin and in **your** vagina.” I was astounded by this news! I couldn’t help myself, I looked down.

Example four: While listening to a colleague testify in a DUI he kept mentioning that, ‘ . . . when **you** consume alcohol it affects **your** ability to perform physical tests and safely drive a car.’ There were additional points on how ‘ . . . **you** are affected by alcohol’. And, “How much **you** would have to drink to reach this blood alcohol level.” Suddenly there was a commotion in the courtroom and I saw the judge and lawyers race to chambers while the jurors were ushered to their room. My colleague and I were the only ones left in the courtroom and he asked me how he was doing. I complimented him on his presentation skills and technical knowledge. I did advise him to avoid using the word ‘you’. Just then, the prosecutor returned and told my colleague that they were on the verge of a mistrial as a member of the jury was upset that my colleague was telling him that he was drinking when he had been alcohol free for eight years and was a member of AA.

From sports stars to actors, we often hear them exclaim, “It feels great when **you** win a gold medal at the Olympics.” Not in my lifetime. Or, “When **you** hit a grand slam home run to win the World Series, **you** know **you’re** playing at the top of your game.” Hey, I never hit a home run in Little League. Once, I heard the actor Robert DeNiro say in an interview, “ . . . that when you work in Hollywood . . .” Well, Robert, that’s not going to happen either.

Recommendation: Do not use the word ‘you’ or ‘your’ with your audience unless you want them to be included in your testimony. For example, I heard a fingerprint expert tell the jury, “If you look at your fingerprints you’ll notice whorls and loops.” That’s fine with me.

Another sign indicating a lack of precision on the part of the witness is to say ‘we’ when they mean, ‘I’. I often hear students use the phrase, “We then extracted the . . .”, when they meant, “I then extracted . . .” If there is a ‘we’ then the witness should mention the name of other person. It’s fine to say, “We conducted a search of the crime scene . . .” when someone has assisted you. Plus, there is added value in using the word ‘I’ to describe your work. It gives you ownership of the work. It is impressive to say, “I did this.” Or, “I did that.” The court requires us to use more precise language and anything less leaves everyone wondering who the witness is talking about.

Recommendation: Avoid using the word ‘we’ when you mean ‘I’. Be specific in describing who performed the work and who the author of the work is. I don’t believe Mozart ever said, “We wrote beautiful music.”

Another use of the vernacular that is a cause for concern is how poorly witnesses describe their qualifications. I hear phrases such as ‘On the Job Training, or OJT’. OJT is what a teenager gets at Burger King his first day on the job. Here’s another one that fails to describe how well criminalists are trained. ‘I received in-house training by my lab.’ What? As opposed to out-house training. There is nothing descriptive or noble about ‘in-house’ training. Expert witnesses should be

more specific when describing their training. For example: ‘I received specialized training sponsored by my department/agency that required me to satisfactorily pass a competency test.’ Or, ‘I was trained by a senior member of the technical staff in the analysis of controlled substances and after completing an eight week course was assigned to case work.’ I also hear experts say, ‘I took a 240 hour course in fingerprint identification.’ As if the sheer number of hours was the value and not the content of the course. Number of hours, days or weeks does not sway jurors and lawyers alike. Forget the 240 hours; tell jurors the depth of your training during those six weeks of training. The hours are not important; it’s what the expert learned that is important.

Recommendation: Use accurate terms to describe the depth and breadth of your training and expertise. Not only will this put the expert in the best light possible it does so in the most accurate way. Most jurors are left with little insight to the extent with which experts are trained.

Another element of the use of the vernacular in the courtroom is the use of words such as, essentially, basically, only, mainly, and actually. Any words ending in -ly are diminishing words that do not add to the witness’s credibility in the courtroom. Also, using a word or phrase repeatedly such as, ‘again’, ‘OK’, ‘as I said’, ‘if you will’, ‘That’s my understanding’, or ‘I believe that to be true.’

These are all filler words and phrases and detract from the credibility of the expert witness. Add to this list, the non-words used by everyone: ums, ahs, ers, etc that is used when silence is best while looking for the next word. I once counted fifty ahs and ums during a fifteen minute period of testimony from a student recently. It’s distracting and erodes the expert’s credibility.

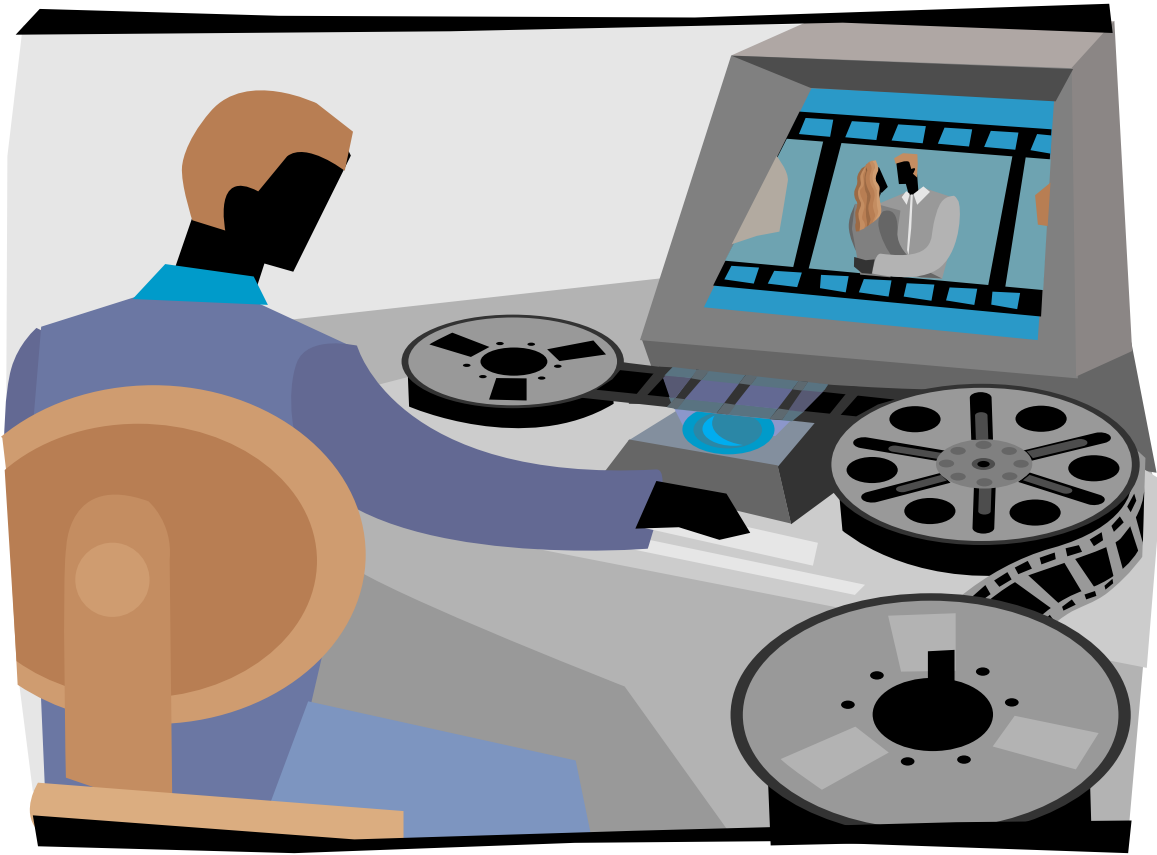
Recommendations: The expert witness should endeavor to strike these repetitive words and phrases from their testimony.

Another element I encounter in my classes is how people will use two words that contradict one another. Example; ‘I was a bit overwhelmed.’ That’s as bad as saying, ‘She is a bit pregnant.’ One is or isn’t pregnant. Here’s another one, ‘I was a little stressed out.’ Adding a modifier in front of these words robs these words of their true value. It’s as bad as saying jumbo shrimp.

Words chosen thoughtfully and well spoken create in the expert witness a stature and credibility not lost on the listener. English is the richest language on the planet and we have the opportunity to use the vast resources of this language to become the persuasive and competent expert witnesses we all seek to become. And, to remind the reader again, the law requires that experts use a more formal use of English in the courtroom. My final recommendation is to speak well all the time. Choose now to do so. Ask friends and colleagues to bring to your notice those times when you fail to speak correctly. Or, those times when you fail to use a word properly. The benefit and credit will be all yours.

I want to thank the judges at the San Diego 2008 meeting of the California Association of Criminalists for finding my presentation worthy of the Alfred A. Biasotti Most Outstanding Presentation Award. Thank you.

Have you ever wondered what it would be like to be the “Technical Advisor” on a show such as CSI? Greg Laskowski takes us behind the scenes . . .



The Proceedings of: Craft Service

by Gregory E. Laskowski

While sharing a dining experience with the illustrious publisher of the *CACNews* on the eve of the October meeting, a series of topics were discussed during the dinner service. The elephant was not in the room but rather at the bar, The Elephant Bar. John Houde expressed a desire to have members contribute interesting articles. He suggested that I share with the readers some of the experiences I have as a technical advisor with television series *Bones* and *CSI: Crime Scene Investigation*. After some quick thought over the matter, I thought that it would be a good idea. Perhaps it would dispel some of the myths or misconceptions as to what they are about and what these shows portray.

Make no mistake, I understand that these television shows are crime dramas, the key word being 'drama.' My association with the two series initially occurred merely by happenstance. Perhaps, I should start at the beginning. I was sitting in my office about nine years ago doing some of the mundane tasks that befall a supervisor in a crime laboratory when I received a telephone call from an individual identifying himself as a researcher for the new CBS television crime drama *CSI: Crime Scene Investigations*. The caller went further stating that he had gotten my name from American Academy of Forensic Sciences as an expert in firearms and explosives. He asked for permission to question me about matter of physical evidence in a "forensics" context. At first, I was a bit perplexed over the situation, but decided to ask him a few questions to establish the legitimacy of the caller. I did remember having given several papers on those subjects at a few academy meetings, so it seemed to make sense. Then, as I was about to continue my interview with the caller, I received a phone call on the other line from a representative of the AAFS stating that they had given my name to a television show researcher, and that he would be contacting me. I told the AAFS representative that the person in question was on the other line, and thanked her for her notification. I then returned to the caller and asked him why he was calling me? Since he was in Holly-

Valley? To my surprise, he replied that the studio was located in Santa Clarita, which is north of Los Angeles, and the reason my name came up is that we share the same telephone area code. So, here is probably the most popular television series of all time calling me because the studio can save money on a long distance telephone call. About three years ago, the series moved to Universal Studios near Hollywood so I guess the cost of a phone call is now small potatoes.

I hadn't realized that they try to complete an episode just days prior to it airing. In fact, one evening while taking my family on a tour of the studio in the early days of the first season of the show, I was corralled by the producers (writers) to assist them on some technical matters. They were in a quandary because it turned out that they were close to being four minutes short of story, and need some meaningful filler. As I sat on the couch in writers' studio, I realized that my tour time would be extended that evening. I had my wife and young son with me, and it was a school night. My son was in awe of the writers because he was ushered into a small alcove that can be described as containing a virtual cornucopia of candy and snack treats. Fortunately, the four-minute time shortage was quickly resolved, and we were able to complete our tour in a timely manner. My tour guide and host that evening was my initial caller, David Berman. David is not only the head researcher for *CSI*: but he is an actor on the show as well. He plays Dr. David Philips, the assistant coroner. As David's standing in the show has increased, he has now taken on an assistant researcher, Jon Wellner. Jon also has a role in *CSI*:. He plays Harry Andrews, the toxicologist. Because of my association with these two individuals and others, I have been asked to offer technical advice on other television series as well. These include *Law and Order*, *Numbers*, *CSI: Miami*, *CSI: New York*, *Without a Trace*, *Killer Instinct*, and *Vanished*. Some of these shows are still popular and others have literally vanished, excuse the pun.

What kind of advice does a technical advisor give to a television crime drama that features forensic science? First, I must state that I am not the only advisor. It is my understanding that the series has a cadre of advisors with various levels of expertise in a variety of areas. I have been informed that sometimes producers or directors will shop their experts for the answer or answers they deem appropriate. One must remember that the LVPD Crime Lab depicted on the show is the ultimate laboratory on par with the FBI Laboratory; it can perform clinical chemistry in addition forensic analysis. If the situation or the technology is remotely feasible, it will be portrayed within reason. They do, however, make an effort to be accurate and correct but artistic license may trump factual science.

I reviewed some of the questions that have been posed to me over the last nine years. That's right, *CSI*: is now entering its ninth season. Here are some of the questions posed:

We need to find out if you can tell anything from a depressed footprint in dirt or mud. For instance, could you tell from how deep the print goes, the approximate weight of the person who stepped in it? Are there any other things besides shoe size that we could find out from taking a cast of the print?

If a gunshot is accidentally recorded on tape, is there a library of gunshots and their acoustic signatures that could be used to roughly identify the gun at least to its caliber?



**To my surprise,
he replied that
the studio was
located in Santa
Clarita, which
is north of Los
Angeles, and the
reason my name
came up is that
we share the
same telephone
area code**

wood, why wouldn't he be talking to someone from the LAPD or the Los Angeles County Sheriff's Department? They would have far more experts, and would be close by should he wish a face-to-face interview. I had not seen the first or pilot episode, so was not familiar with program, although I was aware that the show had kindled an interest in the television-viewing public. My caller stated that they were working on the second episode, and had run into some technical roadblocks. I then re-asked him, why he is calling me, a criminalist working in an obscure laboratory in southern portion of the San Joaquin

Situation: We have two strands of hair. One collected from the crime scene—no DNA tag—the other, an exemplar taken from a suspect.

Questions: I know that I can't make a one hundred percent match without DNA, but I'm wondering about other characteristics, other than medulla and cortex, that I could use to compare these two hairs to make a very reasonable assumption that they are a "match"...or consistent I should say. What are the characteristics? What do they look like under the microscope? Also, the hair collected at the scene has been treated to been straightened...does this matter?

1. Is there a urine test or anything forensic other than a blood test to check for CO exposure? Possibly in vomit, blood in vomit, paramedic test, condensation from an oxygen mask?

2. What devices are used to detect levels of CO in the air? What level is considered safe?

3. In an active investigation of a CO death in a house, in which the source has not yet been determined, who makes the decision of when the residents can go back in the house?

4. What devices are used to track back to the source of a CO leak?

Situation: A 20 year old girl is found dead.

Questions: Would they check to see if she was raped? At what point in the investigation would they do this? Would they use a rape kit, and when? Do investigators always check to see if a victim was raped?

... there's apparently some process called "liquid extraction" which one will do to test blood for a wide spectrum of chemical components. The room says it's a separate, advanced process unto itself, more specific than an ordinary tox screen – actually a prelim to the GC/Mass Spec. Can you tell me if it's a real test, and what it looks like, exactly, for a possible process montage?

Let's assume that the body had been dismembered. Every saw or cutting utensil will leave behind unique tool marks. An analysis of the dismembered bone can yield interesting facts about the weapon used. Once authorities apprehend a suspect, they can then test all of his cutting equipment to see if any of them were used to dismember the girl.

Situation: A non-duty police officer is in line at the bank when a robbery takes place. The robbers are about to kill a woman. The officer reaches for his gun. From across the street, a sniper fires his Remington 700. The bullet crashes through the window and kills the officer.

Questions: 1. What would the bullet do to the plate glass window? Would it shatter it or cause the glass to spider?

2. If the plate glass would in fact shatter, is there a different type of glass that would spider?

3. By examining the glass, either at the crime scene or in the lab, would we be able to tell anything about the position of the shoot-

er? For instance, would we be able to tell that the bullet came from outside the bank? If the majority of the glass were found scattered inside the bank would that indicate that the shot was made from outside?

Anything unusual about glass and the way it would be positioned would be great.

4. If the glass were tinted, would that aid in the investigation or provide any kind of interesting forensic clue.

Situation: A man is shot in one of those large walk-in freezers. Blood splatter sprays on the floor and onto the freezer walls. It is so cold that the moment the blood exits the body it freezes. In other words, the blood mist/drops freezes immediately into little bloodsickles.

Question: Basically, it needs to be so cold that the blood freezes on impact with the air. Is that possible? At what temperature would the blood freeze?

In some parts of the country, it gets so cold that when you spit, the spit turns to ice before it even hits the ground. We want to do the same thing with blood.

As one can see, the questions range from the techni-

**Days on set can be both
challenging and monotonous.
The positive side is that there
is plenty of good food on set.
Actors, crew, and technical
advisors eat well.**

cally complex to the bizarre. Over the past nine years, I have researched and responded to over six hundred questions or scenarios in addition to reviewing scripts and offering dialogue advice. Some of these take only a few minutes to answer while others require more time to research. Fortunately, I was initially trained as a generalist, so if I do not know the precise answer, I at least know where to look for it. Sometimes I have to seek advice from other experts and ask them. They will often respond to me instead of talking to a researcher or writer on the show.

Over the past few years, I have had the opportunity to fill in and actually work on set as a technical advisor. You won't find my name in the credits, but I was there. I have the check stubs to prove it. Being an on set technical advisor is akin to being the Maytag repairman. You are required to be on set, ready to assist the director or writers at a moment's notice. The on set work may consist of just answering a technical question, assisting with the wording in dialogue, assisting the set dresser in staging a crime scene or making the blood flow pattern appear plausible. On occasion, one might be asked to assist one of the actors with a technique such as ap-

plying fingerprint powder to an evidence item, collecting a buccal swab from a suspect, or using one's hand to waft air in order to detect an odor. Days on set can be both challenging and monotonous. The positive side is that there is plenty of good food on set. Actors, crew, and technical advisors eat well.

I must admit that there has been more than one occasion when I have been frustrated and dumfounded with some glaring errors portrayed on the show. "It is a fictitious crime drama," I have to keep telling myself. Then, there are the sneers and snickers I see and hear when I attend professional meetings. I always hear the same things, such as "That show doesn't depict reality, I never watch it." Yet, that same person will go on in detail about the errors they observed on a particular episode, so much for never having watched the show.

Lastly, I can remember when I was asked to provide a guest speaker for one of the professional organizations to which I belong. The speaker was one of the producers of *CSI*. He was eager to come and speak at the banquet. Of course, before the person arrived, I had to listen to all the criticisms about the show, and complaints at why anyone in our profession would be associated with it. When the speaker arrived early for the pre-banquet cocktail hour I noticed that he was immediately besieged by the same people who were offering him their business cards, and regaling him with some of their most interesting cases, fodder for the show, I suppose. In fact, as the speaker left the banquet hall at the end of his speech, he was followed out the door by some newfound forensic groupies, who forgot that the new president-elect of the organization was about to begin his acceptance speech.

Overall, *CSI*: has been very good to my agency and me. In 2005, when our laboratory was facing a time of fiscal crisis *CSI*: staff and an actor came to our facility and participated in an open house for the public. The outpouring of support from the public was tremendous. We gave many tours to hundreds of people. Because of this event, the laboratory received not only a large infusion of money but also an increase of staff from the county board of supervisors that year. In addition, a local car dealership donated two brand new SUVs to serve as crime scene response vehicles. In conclusion, I would have to say that both my lab and I have benefitted from the *CSI* effect. To paraphrase the words of the old *Saturday Night Live* character Chico Escuela played by comedian Garrett Morris, "*CSI*: has been berry, berry good to me."

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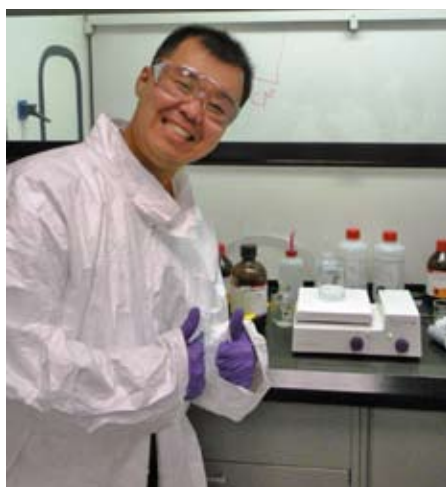
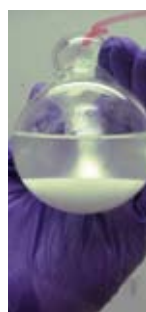
A close-up photograph of a bullet hole in a wooden surface. The wood grain is visible, and the hole is surrounded by a circular pattern of cracks. A spiderweb is in the foreground, partially obscuring the hole. The text is overlaid on the image.

Sacramento Seminar

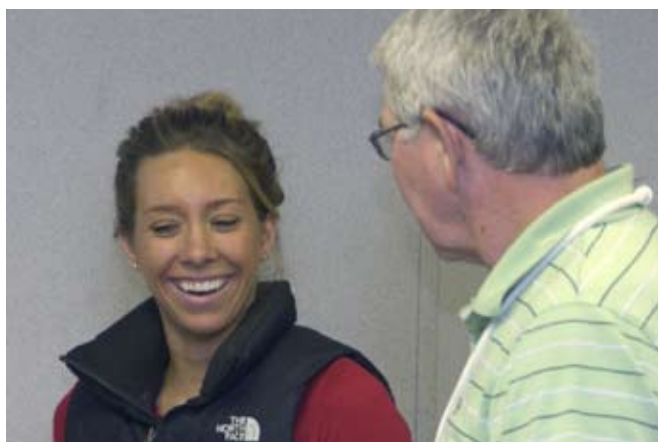
Fall 2008

Capital Crimes
in the
Capitol City

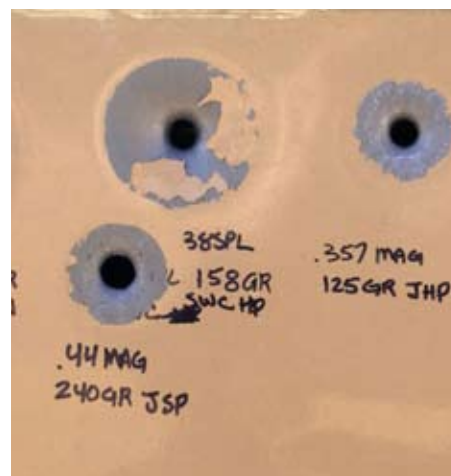
The seminar week began with a couple of hands-on opportunities. The photos on this page were provided by Rochelle Hranac, who attended the PCP and MDMA Synthesis Workshop.



The classroom session of the Shooting Scene Reconstruction Workshop included experience using strings and protractors to calculate bullet path angle estimations.



During the practical portion of the workshop, instructor Chris Coleman demonstrates the effect of lead on fine German engineering.







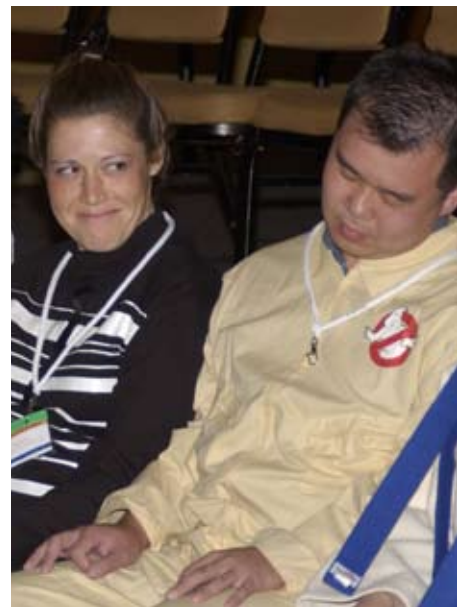
A "deadly" weapon was included in each registration pack. A foam pumpkin was loaded up and ready to shoot at your "target," a person named on the back of your seminar badge. To win the game, you must collect the most "targets."

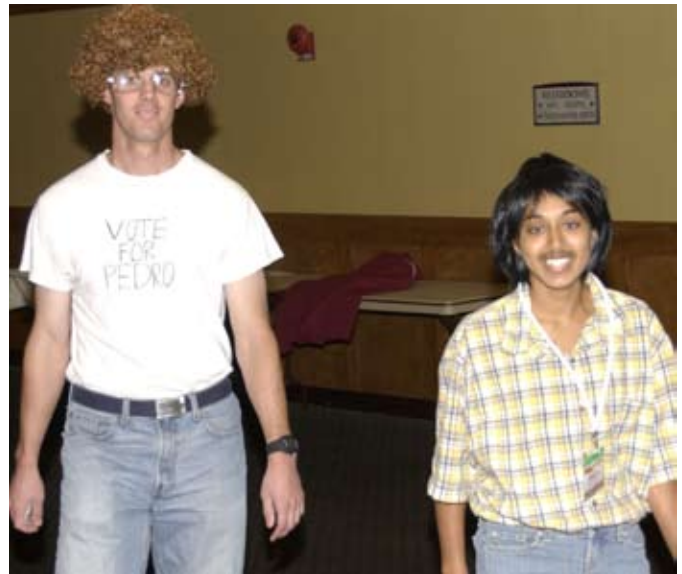
And then there was. . . the Banquet!





*Dr. Dave Hill,
hypnotist of
renown, weaves
his magical
spell over those
CAC members
brave enough to
"submit."*





The Parigian's theme (below) took the prize for scariest costume winner (Wicked Witch). Photo courtesy Michael Parigian.



"Hi" from the Einsteins at the Oakland PD .



The Dawn of the “Forensic Science Provocateur”

Brian J. Gestring, M.S.*

There is no greater failure of the judicial system than when an innocent person is convicted of a crime they did not commit. In addition to destroying the life of the falsely accused and that of their family, the real perpetrator is still on the loose and may commit more crimes. While this fundamental tenet seems obvious, I believe that it is important that we all start from a point of universal agreement. It is natural to want to understand how the “the system” failed these individuals and to try uncover ways to improve this process to prevent future injustice. Unfortunately these analyses, ostensibly intended to improve the process, have some systemic flaws. This paper will re-examine some of these issues and assess the role forensic scientist’s play in advocating for their profession.



One of the most visible organizations to address wrongful convictions is the New York based Innocence Project. For almost two decades the Innocence Project has been looking for cases with questions regarding an individual’s guilt which could readily be answered through a simple DNA test. At the time of this writing, the Innocence Project has achieved 225 post conviction exonerations. They have a comprehensive website that details their cases [1].

In 2005 Saks and Koehler published their article in *Science* using data from the Innocence Project to ascertain what they termed “Factors Associated with Wrongful Conviction” [2]. Based upon their analysis the second largest cause of wrongful convictions was forensic science testing errors which was surpassed only by eyewitness errors. Anyone within the field of forensic science, even mildly familiar with the myriad of problems associated with eyewitness testimony, looked at this analysis with the same question burning in their head: “are we really that bad?” The answer might be more elusive than it appears.

While the Innocence Project maintains a comprehensive website, their methods of screening and selecting cases, defining causes of wrongful conviction, or even attributing error to these causes has never been published in a peer-reviewed journal. This, unfortunately, complicates using their data as Saks and Koehler and so many others have subsequently done. Further questions concerning the materials and methods used by either Saks and Koehler or the Innocence Project become readily apparent under even a cursory examination.

As an example, the Innocence Project’s website only lists seven causes of wrongful conviction. Saks and Kohler list nine causes in their 2005 publication. Did Saks and Kohler go

through all of the case transcripts as the Innocence Project presumably did? In their initial writing it is unclear how these new categories were developed or how error was attributed to them. This was eventually clarified to CAC members in a testy response to Rudin & Inman’s critique of the initial Science publication [3]. Apparently Saks and Koehler had first started looking at information contained in an appendix of a book put out by Scheck, Neufeld, and Dwyer about the Innocence Project [4]. They perceived problems with the initial data and through conversations with Scheck and Neufeld, obtained a more complete database that allowed them to fix some “(honest) errors.”

It is these “(honest) errors” that concern me. The subjective nature of how information is collected by the Innocence Project, including how error is attributed, makes it hard for me to believe that initial errors could be corrected at a later date by someone with less information than the individual that compiled the initial data in the first place. It is also unclear if the Innocence Project acknowledges that these were errors, and if so, has corrected them.

Another source of concern is a fundamental lack of information as to how the Innocence Project screens their cases and how many cases they accept each year. Their website indicates that in 2006 the Innocence Project received 200 requests per month to evaluate cases. With this as the only source of information, we can only speculate as to how many requests they have received over the life of the project. However, it is possible to make some baseline assumptions from what has been made available to permit an educated guess.

The project started in 1992. Currently they have 225 ex-

Like a flock of peasants with flaming torches and pitchforks, their rhetoric abounds and obscures substance. In the age of the sound bite, comments like “why there is no ‘science’ in forensic science” catch media attention.

operations. If we make the assumption that they received 200 requests per month for their entire 16 years of operation; that would mean that they screened 38,400 cases. Since they probably did not receive as many requests in the beginning of the project, we will reduce this total by 25% leaving 28,800 cases screened to obtain the 225 exonerations they currently have. This translates to a 0.78 % rate of false convictions for the narrow category of cases that they will even consider. If we now take the error rate attributed by Saks & Koehler to forensic science testing errors (63%) and multiply it by the rate of false convictions ascertained by the Innocence Project (0.78%), the value for forensic science testing errors for all the cases they screened is a more modest value of 0.49 %.

So what does this mean? Are we 63% responsible, 0.49 % responsible, somewhere in between, or even somewhere below 0.49%? The point of this deliberately shortsighted analysis is to

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Forensic Science Provocateur, cont'd

illustrate that we just do not know. In its current incarnation, this data can not be used to draw this type of conclusion.

To further illustrate this point, I would like to join Collins & Jarvis and Rudin & Inman in examining some of the cases highlighted on the Innocence Project's website. I do not want to belabor the point, but three previously unmentioned cases are somewhat illustrative and worthy of brief discussion.

While at a local supermarket four months after being raped, a woman saw the man that she believed attacked her. She found a police officer and Harold Buntin was arrested. According to the website, Mr. Buntin was convicted in 1986 of a rape and robbery and subsequently exonerated in 2005 through post conviction DNA testing. They indicate that the contributing causes to the false conviction were "eyewitness misidentification, unreliable/limited science." Under their trial narrative they state, "Buntin was charged with rape and robbery and a jury trial was held April 21-23, 1986. Between days of the trial, Buntin left the county and did not return for court. The trial continued without him. The state's evidence included the victim's identification of Buntin as her attacker, and forensic test results showing that sperm cells recovered from the victim's body after the attack came from a person with type O blood – which was also Buntin's blood type. The jury was told that 36 percent of the population has this blood type"[1].

Based upon the Innocence Project's presentation of the facts, I strongly disagree with attributing a false conviction to scientific testimony that was performed properly and accurately conveyed. As Rudin and Inman point out, "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"[5]. I would argue that in this case, the defendant fleeing during the trial was a far more significant aggravating factor to the jury than the fact that 36 percent of the population had the same blood type as the semen found in the victim. It would be interesting to see what the jury really thought.

Kerry Kotler is another interesting case. Mr. Kotler was convicted in 1982 for raping the same victim on two different occasions (1978 & 1981). The Innocence Project cites "eyewitness misidentification, unreliable/limited science, government misconduct" [1] as the contributing causes to his false conviction. A mixture of DNA was recovered from the victim, and Mr. Kotler could not be excluded via serology. In 1989 samples from the case were sent for DNA testing. Three laboratories tested the samples. The first found insufficient DNA for typing. The second and third found mixtures of DNA, and they excluded Mr. Kotler. Using the new DNA evidence and the fact that the prosecution withheld an initial description of the suspect that did not match Mr. Kotler, the case was dismissed.

Ironically, the reason Mr. Kotler's case is interesting is not because of what happened before he was exonerated, but what happened after. Three years after he was exonerated, Mr. Kotler stalked a woman, impersonated a police officer, and then raped her. In an article about the incident in the New York Times, prosecutors allege that he brought a bottle of water with him to clean the victim and told her that he was "washing away the evidence"[6]. In light of Mr. Kotler's en-

One of the fundamental differences between forensic testing and that done by a traditional analytical laboratory is the size and nature of the samples. Forensic samples are often much smaller than any commercial laboratory would accept, not always homogeneous, and often degraded.

core performance, one can only wonder if he was actually innocent in the first case.

I do not bring these cases up to dispute the legitimacy of the Innocence Project. On the contrary, I think the work they do is valuable, and actually much more limited than I would like to see. I feel that defense counsel in general should have more access to forensic expertise and not just for cases where biological evidence is present. In this regard, pre-selecting only simple DNA cases is only going after the low hanging fruit.

So what is the real issue? To me, problematic data from any venue that has not undergone any significant peer review should not be used as the sole basis for a conclusion. If that data is compelling and speaks to an urgent issue, preliminary results should be released with the appropriate cautions provided regarding the providence of the data. Others in the community should be encouraged to try and duplicate these results and more systematic, long-term studies need to be conducted. Unfortunately, this has not occurred. Instead peripheral waves of lawyers and business professors that have not been involved in the exoneration processes in any way have found a new calling, that of Forensic Science Provocateur.

Uninhibited by their lack of understanding of forensic science, they have been using this problematic data as a holy scripture. Like a flock of peasants with flaming torches and pitchforks, their rhetoric abounds and obscures substance. In the age of the sound bite, comments like "why there is no 'science' in forensic science" catch media attention [7]. As these new, self-anointed crusaders continue essentially unchallenged, they only become more bombastic with titles like, "*Devil in a White Coat: The Temptation of Forensic Evidence in the Age of CSI*"[8].

In this polarizing environment, it does not surprise me that Collins and Jarvis have an edge to their policy statements. Their work exhibits a distinct pro-forensic scientist bias. While I disagree with Collins and Jarvis on a number of fundamental issues, and I wish that they would have a more nuanced approach to their presentation, I appreciate what they are trying to do. In Rudin and Inman's last commentary in this publication [5], they asked the valid question: "Who Speaks for Forensic Science?" While we might be hard pressed to find anyone that does, it is not so difficult to find someone that speaks against it. Part of this problem is due to the fact that practicing forensic scientists are constrained from involving themselves in public policy statements by their employment. Forensic scientists find themselves in an awkward role. They

are not able to say anything about the issues that affect them, and then must suffer the shortsighted policies that lacked their input.

A year ago Dr. Koppl, an economics professor, released a policy statement through the Reason Foundation [7]. One of his suggestions to minimize error in forensic analysis is for all forensic analysis to be done in triplicate by three different private laboratories. All of the laboratories would be blinded to the context of the case, and only when all three agreed in their analysis, would a result be reported. After Dr. Koppl presented his work at last year's annual meeting of the American Academy of Forensic Sciences, we had words which eventually moved to the hotel bar for several hours of friendly discourse. Clearly, Dr. Koppl's efforts and ideas demonstrate a sincere effort to improve forensic science. I really believe that Dr. Koppl thinks that this will help minimize error in forensic testing, but on so many levels I find the foundations of this argument flawed.

The most striking shortcoming of this approach is that of triplicate testing. One of the fundamental differences between forensic testing and that done by a traditional analytical laboratory is the size and nature of the samples. Forensic samples are often much smaller than any commercial laboratory would accept, not always homogeneous, and often degraded. All of these factors could hinder three separate laboratories from coming to the same conclusion.

From an analytical perspective it is also possible for three different laboratories to have three separate protocols for the same procedure. Current accreditation guidelines only require that laboratories have written protocols that have been validated, and that the laboratory conforms to those protocols. Since none of the accreditation bodies dictate the type of protocol or limits of detection, it is possible that three separate accredited laboratories could produce different results for the same small or degraded samples.

In addition to these significant issues, there are also the potential problems with material handling failures, (business slang for losing or damaging things that are being moved), and attempting to rectify all of the data from the different sources. Anyone familiar with mass disaster identification can speak to these issues.

It is also not clear that privatization will lead to this process becoming significantly cheaper or more impartial. The private forensic laboratory that deliberately withheld exculpatory results in the Duke Lacrosse case at the request of the prosecutor is an example of the latter. I would argue that private laboratories are under more pressure to please their clients than public labs because private labs have to compete for business.

All of these issues clearly separate the theoretical from the empirical. While I have not yet met a forensic scientist that has not instantly recognized these shortcomings, there has not been a significant response to Dr. Koppl's theory from the forensic community. This has allowed Dr. Koppl's theory to move from within the economics community to the National Academy of Sciences [9] and more recently to the mainstream media. This past June, his triplicate analysis theory was published in *Forbes* [10].

What Dr. Koppl's theory also does not take into account is that despite the scrutiny and scorn focused on laboratory based forensic science, it is not the most significant problem with forensic science today. In an overtly simplified picture of the criminal justice system, there are essentially three stages:

Forensic scientists find themselves
in an awkward role. They are not
able to say anything about the
issues that affect them, and then
must suffer the shortsighted poli-
cies that lacked their input.

1) The Crime Scene, 2) The Investigation, and 3) The Trial.

While forensic science should abound through all three stages, this is far from the reality. It would make sense to have scientific input at the crime scene. Clearly this is one of the most important stages of the entire process. If significant evidence is not properly identified, documented, and collected, then no subsequent laboratory marvel can overcome these shortcomings. Despite these obvious statements of fact, crime scenes in this country are routinely mishandled and essentially run by the case detective regardless of the scientific input that may be available.

This now leads to the investigation. If physical evidence can be recovered, it is then inserted into the black box that most modern forensic laboratories have become. The unfortunate reality is that the case detective will still define what the laboratory looks at, and what they are looking for. The forensic laboratories will do their magic, and then, obligingly spit an answer out. This answer is then interpreted in court by the attorneys. Forensic scientists will testify, but the questions asked and the spin placed on their answers in the remainder of the trial is at the sole discretion of the attorneys.

In the cases where no physical evidence exists (which are all too common), only eyewitness testimony will be left to sort things out. Recently a Georgia case received significant media attention. In 1989 Troy Anthony Davis was convicted of the murder of a police officer based solely on eyewitness testimony. Mr. Davis was subsequently sentenced to death. Since his trial, seven of the nine witnesses that testified against Mr. Davis have either recanted their testimony or given significantly conflicting testimony [11]. Is this a better alternative than physical evidence? Given this representation, I find it hard to believe that modern forensic labs are considered the weak link.

The last case I would like to evaluate from the Innocence Project archives speaks to this point. In November 1989 a 15 year old classmate of Jeffery Deskovic was raped and murdered. Even though he was only 16 at the time, police quickly focused in on Mr. Deskovic as a suspect. He was taken by car without parental consent or supervision to another location where, after a lengthy interview, he confessed. Both trace evidence found at the scene and DNA from the vaginal swab did not match Mr. Deskovic. Prosecutors asserted that the victim had consensual sex with a boyfriend. This fact was never verified at the trial. Hairs found on the body that did not match Mr. Deskovic were attributed to poor crime scene procedures. Despite these inconsistencies, Mr. Deskovic was convicted in 1990. It was not until 2006 that the charges against him were dropped. Since they already knew the DNA from the victim did not match him, the real issue in this case was entering the victim's vaginal swab into CODIS. Local politics prevented the swab from being entered into the DNA database. Once these

Forensic Science Provocateur, cont'd

issues were overcome, the profile was entered and found to match a convicted offender that was already in jail for an unrelated murder [12]. A murder that never would have taken place if not for significant problems with both the crime scene and the interpretation of the physical evidence collected in the Deskovic case.

The Deskovic case clearly illustrates the disconnect in how forensic science is applied in modern criminal investigations. When only allowed to operate in a limited reactive mode with non-scientists defining the analysis and interpreting results, forensic science can only be of limited value.

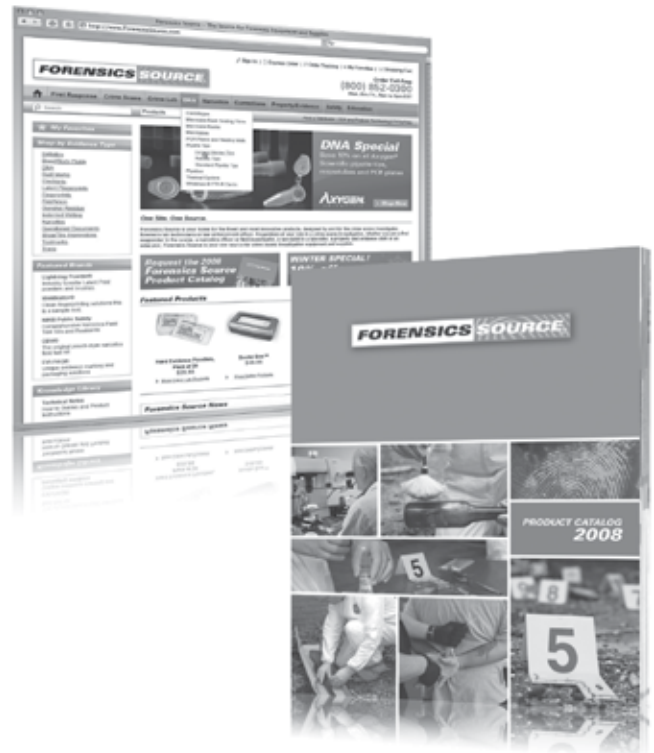
Over the past quarter century, forensic science has advanced more than anyone could have imagined. Changes in technology have allowed biological evidence to achieve levels of individualization previously thought unimaginable. Unfortunately, immersing in this technology often has the unintended consequence of forensic scientists becoming removed from the process of why we are testing the sample in the first place. The most important part of science in general is not always answering questions, but knowing what questions to ask.

It is also important to remember that like biology or chemistry, forensic science is neither good nor evil. It is a process that if applied properly, can shed significant light on many criminal investigations. While the application of forensic science can be imperfect, it is also not the sole problem in the criminal justice system as some would have you believe. Forensic scientists must take an active role in advocating for their profession. Detractors and supporters alike should be engaged in a productive dialog that examines the issues free of political agendas. If used properly from the inception of the investigation until the closing of the trial, forensic science can make false conviction much less likely.

References

- [1] www.innocenceproject.org
- [2] Saks, M.J. and Kohler, J.J. "The Coming Paradigm Shift in Forensic Identification Science", *Science*:309; 892-895
- [3] Saks, M.J. and Koehler, J.J. "Out to Lunch: Saks and Koehler respond to Inman & Rudin's commentary" *CAC News*, 1st Quarter 2007
- [4] Scheck, B., Neufeld, P. and Dwyer, J. 2000 *Actual Innocence: Five Days to Execution, and Other Dispatches from the Wrongly Convicted*. Doubleday Press, New York, NY
- [5] Rudin, N., Inman, K. "Who Speaks for Forensic Science? The Conviction and Exoneration of a Straw Man" *CAC News*, 4th Quarter 2008
- [6] McQuiston, J. 1997. Man Freed after a DNA Test is Sentenced in a Second Rape. *New York Times*, October 24
- [7] Koppl, R. "CSI for Real: How to improve Forensic Science," *Reason Foundation Policy Study* 364 December 2007
- [8] DiFonzo, J.H., Stern, R.C. "Devil in a White Coat: The Temptation of Forensic Evidence in the Age of CSI", 41 *New England Law Review*, 503 (2006-2007)
- [9] National Academy of Sciences committee on Identifying the Needs of the Forensic Sciences Community, 20 September 2007. www7.nationalacademies.org/stl/Forensics.html
- [10] Koppl, R., "What's Wrong With CSI: Forensic evidence doesn't always tell the truth," for "On my Mind" column, *Forbes*, 2 June 2008. www.forbes.com/opinions/forbes/2008/0602/038.html
- [11] Goodman, B. 2007. As Execution Nears, Last Push from Inmate's Supporters. *New York Times*, July 15
- [12] Report on the Conviction of Jeffrey Deskovic, June 2007, Westchester County District Attorney, www.da.westchester.ny.us/Jeffrey%20Deskovic%20Comm%20Rpt.pdf

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Estimation of Anthropometric Measurements in Gunshot Trajectory Reconstruction

John Thornton *

In the reconstruction of shooting incidents, issues dealing with the trajectory of gunshots frequently arise. Some questions concerning trajectory can only be answered through a consideration of the anthropometric measurements of the victim. For example, a given reconstruction may require the depth of the chest of the victim, or the lateral thickness of the victim's head.

Measurements such as these are rarely developed at autopsy. A typical autopsy may include a measurement of the point of entrance (and exit, if applicable) relative to some fixed anatomic point, but often that is about the extent of the measurements that are taken to document bullet entry and exit.



Photographs with probes in place are often taken, but often they are not, and often when they are taken, the camera angle will not permit a direct measurement of trajectory angle from the photograph. And by the time an effort is made to review the trajectory of the gunshot, the victim has been buried or cremated.

One option at this point is to locate a living subject with similar stature as the victim, and take the appropriate measurements of the living person. This option has some limitations. One limitation is that the approach is entirely subjective, and a measurement obtained in this fashion is a single, isolated measurement without the benefit of any knowledge concerning the statistical variation which might be expected among a larger population. An even more critical limitation is that in some circumstances a suitable living counterpart may not be readily accessible. The present author once had a case in which a large framed, grossly obese black woman with pendulant breasts was shot in the chest. Data were collected at autopsy of the entry and exit relative to the top of the head of the victim, but in order to determine the angle of the bullet trajectory through the body the thickness of her chest was required. It isn't feasible to walk down the street, stopping grossly obese black women with pendulant breasts and asking if measurements could be made of their chest.

Extensive and suitably tabulated anthropometric data does in fact exist for diverse populations. Much of this was compiled by NASA, and is in the public domain. Certain of these data have been redacted and are presented below. The full array of NASA data consists of 973 different measurements, including such obscure measurements as philtrum length, menton-sellion length, and ectocanthus to the top of the head. Illustrations are provided for each measurement; examples are given in Figure 1. The present discussion will

be limited to those few measurements that are likely to be of interest in the reconstruction of shooting incidents. For arcane measurements that would be required only on rare occasions, the reader is referred to the original NASA work. The data presented in Table 1 is for a large composite American population incorporating all of the major ethnic strains. The complete and unabridged NASA data contains information on diverse but specific populations as well – Czech lumberjacks, Japanese civilians, Thai pilots, Bantu miners, South Africans, Peruvian Indians, and many others.

The issue of stature, i.e., height, may serve to illustrate the manner in which the NASA data are presented. The NASA data provides the mean and standard deviation for each measurement. Measurements are also given for the first, fifth, ninety-fifth, and ninety-ninth percentile. This presentation of the data is not in a form that is likely to be useful to a person concerned with wound ballistics. To obtain intermediate percentiles, and to move from one measurement to another, the concept of the Z value must be utilized. Z refers to cumulative normal distribution, and is a common concept in statistics. Z data are given in Table 2. Given a mean and standard deviations, it is possible to 1) compute a percentile given a particular value (i.e., anthropometric measurement), or 2) compute a value (measurement) given a percentile. To make use of the NASA data for wound ballistics and gunshot trajectory reconstruction, both types of computations are required.

Problem: A male shooting victim is 5'7" in height. An entrance wound in the chest is located at 20" below the top of the head. An exit wound in the back is seen at 24" below the top of the head. What is the downward angle of this gunshot?

Procedure: This question may be answered by solving a right triangle. From the autopsy we have the opposite side of the triangle, but we don't know the thickness of the chest, would represent the adjacent side. From Table 1, we can learn that the mean chest depth of American males is 8.5 inches. But our victim is somewhat shorter than the average adult American male, and the average chest depth is likely to be in excess of our victim's actual chest depth. (As we will see, our victim is in the 6th percentile with respect to stature. This in itself might seem surprising to someone, like me, who doesn't understand the nature of the distribution of stature. If the mean is 70.8 inches and our victim is only 3 inches below the mean, does that drive him way down to the 6th percentile? The answer is yes, and that's the point. Intuitively we might think that a 5'7" person would be closer to the mean than is actually the case).

We can adjust for the difference in stature between the victim and the mean. From Table 1, the mean height for American male adults is 70.8 inches. The standard deviation is 2.4. From the mean is subtracted the product of the standard de-

* Napa Sheriff's Department

Estimation of Anthropometric Measurements, *cont'd*

viation times the Z value for a particular percentile. In this example we need the percentile that will deliver a height of 67 inches, the height of our shooting victim. In this instance the difference between the mean and our subject is $(70.8'' - 67'' = 3.8$ inches. The 3.8 inches is the product of the standard deviation for this measurement times the percentile for this subject. The product, viz., -3.8 (negative because the 3.8 inches is subtracted from the mean) divided by the standard deviation 2.4 gives the Z value of -1.58, which (from Table 2), which corresponds to the 6th percentile. An adult American male who is 5'7" is therefore in the 6th percentile of adult males with respect to height.

Now we must work this the other way for chest thickness. From Table 1 we learn that for chest depth the mean is 8.5 inches and the standard deviation is 0.7. But the mean chest depth would apply to a person who was also very close to the mean for height, or 70.8 inches. (This is of course an assumption, and may be refutable in a given instance). What we are interested in is the chest depth of a person in the 6th percentile rather than the 50th percentile. The Z value for the 6th percentile is -1.56. This Z value is multiplied times the standard deviation for chest depth (0.7) to give the product -1.05. This value is added to the mean for chest depth (8.5 inches) to give a value of $[8.5 + (-1.05)] = 7.45$ inches. A person who is 5'7" tall is in the 6th percentile with respect to height; a person who is in the 6th percentile with respect to chest depth could be expected to have a chest depth of 7.46 inches. This value is what we need for a trajectory calculation.

Solving the right triangle to give the angle of the gunshot through the body is then trivial. The different in height between entry and exit wounds if $(24'' - 20'') = 4''$, and is the opposite side of the triangle. And from our calculations above

we have estimated the adjacent side of the triangle as 7.46". $\text{Arctan}(4 / 7.45)$ gives the downward angle of the gunshot as 28 degrees, which is the value that we were seeking.

It should be understood that for this approach to be valid, stature and chest breath must be correlated, that is, the taller the person the thicker will be his chest, etc. This is in fact the case. The correlation coefficient, r , between these two variables is 0.82. (NASA provides correlation coefficients for many measurements, but not all 973 measurements for which data are presented). It should be recognized, however, that although the human body exhibits a considerable degree of proportionality, the correlation coefficients between body measurements are not unity. For example, a person of short stature may in fact be barrel-chested. It's relatively unlikely, but that's what statistics are for—to measure variation and to be able to manage it. Reference to autopsy photographs will be of value in evaluation whether the subject is likely to diverge from norms of symmetry and proportionality. The NASA data could be consulted for a more specific cohort from among the many diverse populations described. While the approach outlined here is better than a guess in all instances, in those instances where disproportionality is suspected, the correlation of body measurements should be assumed only with a certain measure of diffidence. In instances where this might apply, several assumptions may be made and a range of values offered.

Bibliography

National Aeronautics and Space Administration. *Anthropometric Sourcebook – Vol. I: Anthropometry for Designers, Vol. II: A Handbook of Anthropometric Data*. NASA Reference Publication 1024, 1978.

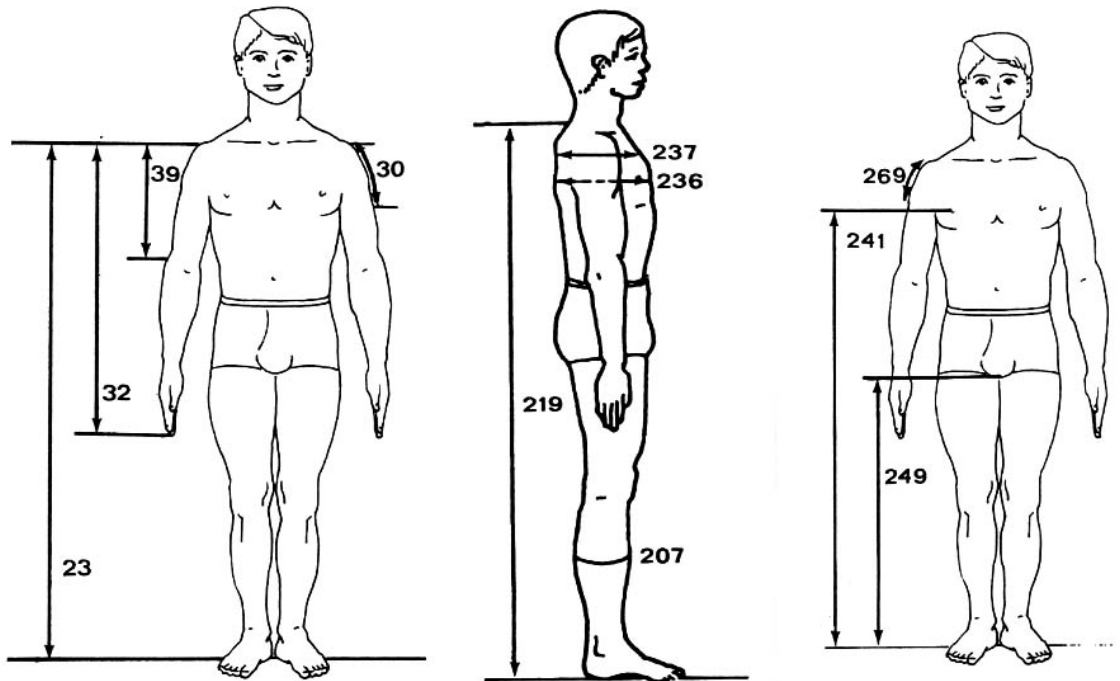
Table 1. Mean and Standard Deviation of Representative NASA Anthropometric measurements. (Mean values are in inches).

Measurement	Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.
Stature	70.6	2.4	54.1	2.4
Shoulder height	57.2	2.3	51.9	2.2
Waist height	41.9	1.9	39.5	1.8
Elbow height	44.5	1.8	40.4	1.7
Sitting height	36.9	1.3	33.9	1.3
Shoulder-elbow length	14.2	0.7	13.1	0.6
Forearm-hand length	19.3	0.8	16.9	1.0
Buttock-knee length	23.9	1.2	22.7	1.0
Shoulder breadth	19.0	1.0	16.5	0.9
Chest depth	8.5	0.7	9.5	0.7
Chest breadth	13.0	0.8	11.2	0.7
Hip breadth	14.0	0.7	14.0	0.9
Trunk depth	9.0	1.1	8.3	1.1
Interscye	15.3	1.5	14.0	0.9
Head length	7.8	0.3	7.2	0.3
Head breadth	6.1	0.2	5.8	0.2
Hand length	7.6	0.3	7.3	0.4
Hand breadth	3.5	0.2	3.0	0.2
Foot length	10.7	0.5	9.5	0.4
Thigh depth	6.6	0.5	4.9	0.5

Table 2. Percentile and Z (Cumulative Normal Distribution) Values

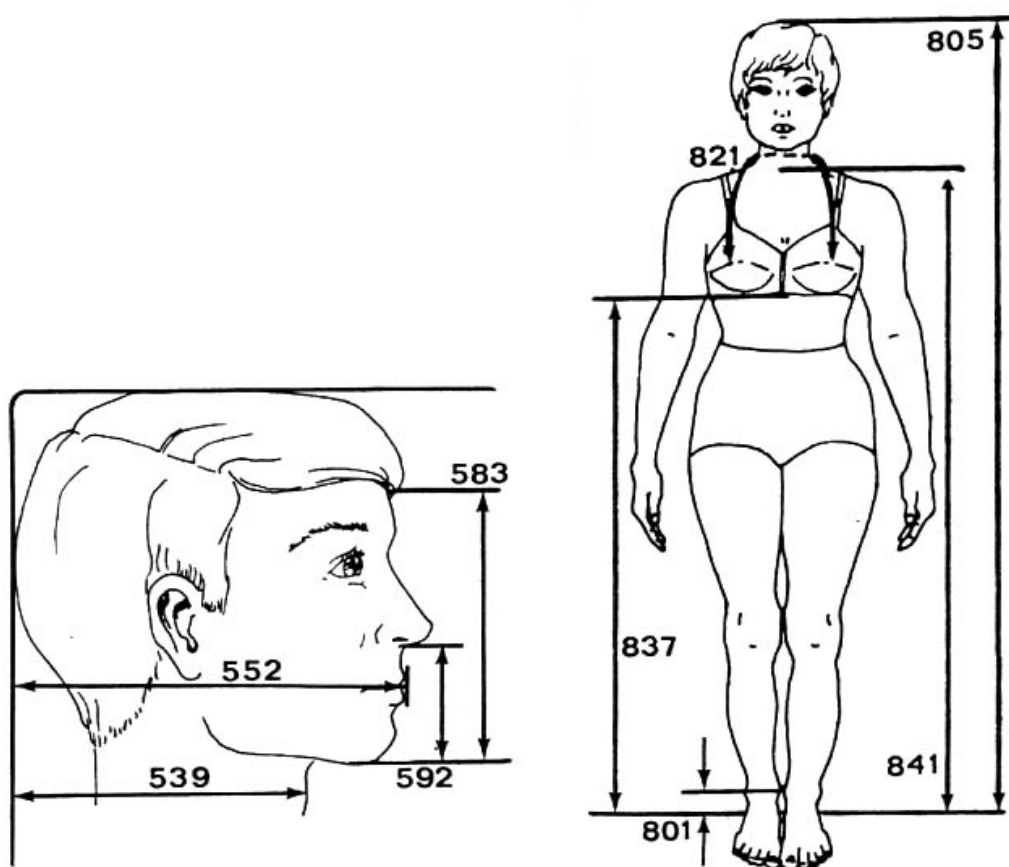
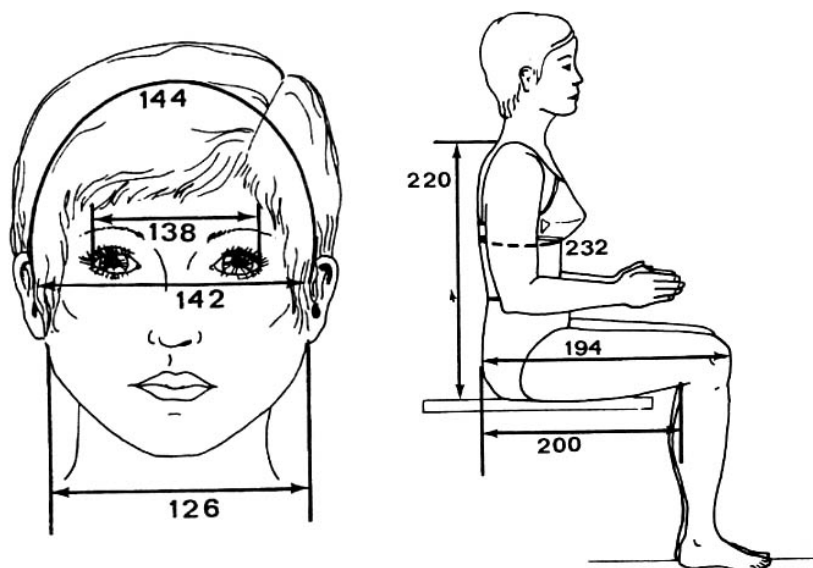
%ile	Z	%ile	Z	%ile	Z	%ile	Z
99	2.24	74	0.64	49	-0.03	24	-0.71
98	2.05	73	0.61	48	-0.05	23	-0.74
97	1.88	72	0.58	47	-0.08	22	-0.78
96	1.75	71	0.56	46	-0.10	21	-0.81
95	1.65	70	0.52	45	-0.13	20	-0.84
94	1.56	69	0.50	44	-0.15	19	-0.88
93	1.48	68	0.47	43	-0.18	18	-0.92
92	1.41	67	0.44	42	-0.20	17	-0.96
91	1.34	66	0.41	41	-0.23	16	-1.00
90	1.28	65	0.39	40	-0.25	15	-1.04
89	1.23	64	0.36	39	-0.28	14	-1.08
88	1.18	63	0.33	38	-0.31	13	-1.13
87	1.13	62	0.31	37	-0.33	12	-1.18
86	1.08	61	0.28	36	-0.36	11	-1.23
85	1.04	60	0.25	35	-0.39	10	-1.28
84	1.00	59	0.23	34	-0.41	9	-1.34
83	0.96	58	0.20	33	-0.44	8	-1.41
82	0.92	57	0.18	32	-0.47	7	-1.48
81	0.88	56	0.15	31	-0.50	6	-1.56
80	0.84	55	0.13	30	-0.52	5	-1.65
79	0.81	54	0.10	29	-0.56	4	-1.75
78	0.78	53	0.08	28	-0.58	3	-1.96
77	0.74	52	0.05	27	-0.61	2	-2.05
76	0.71	51	0.03	26	-0.64	1	-2.32
75	0.67	50	0	25	-0.67		

Figure 1. Representative NASA Anthropometric Measurements.
(The numbers refer to the NASA index numbers).



Estimation of Anthropometric Measurements, *cont'd*

Figure 1, *cont'd*.



ABSTRACTS

FROM THE

FALL 2008

CAC SEMINAR

Micro-Marked Firing Pins:

Character Durability and Micro Mark Legibility

Frederic Tulleners, MA and David Howitt, PhD*

UC Davis Forensic Science Graduate Program

Michael Beddow, MS

Phoenix Police Department

The laser machining of microscopic encoding structures on specific firearm components has been proposed to assist in the identification of expended ammunition components found at crime scenes. This study involved the testing of firing pins by placing up to 8 alpha numeric digits on a firing pin with a diameter of 0.075". These micro-marked firing pins contained three different forms of encoding: alphanumeric, gear and radial bar codes. The durability of these micro characters and legibility of their impressions were observed by the testing of eleven semi-automatic pistols, two semi-automatic rifles and a pump action shotgun with different ammunition.

The firing pins were evaluated before and after using the scanning electron microscope to document subsequent areas of firing pin encoding degradation. The micro serial impressed on the fired cartridge case primer was evaluated using a stereo microscope equipped with Schott ring light and a polarizer/analyzer. The legibility of the impressions produced by these micro-marked firing pins varied between firearms. Transfer rates were observed from zero to 100% for all encoding formats. Three major factors affected the legibility of the impressed characters for each of the firearms tested: ammunition brand, firing pin drag, and multiple strikes of the firing pin within the same impression.

Eliminating Subjectivity in the Evaluation of Impression Evidence

David Howitt, PhD

UC Davis, Forensic Science Graduate Program

With the advent of the Daubert decision and the precise statistical justification associated with DNA analysis there has been more and more criticism of forensic examiners and the subjectivity of their evidence. The requirement that examiners provide an assessment of the likelihood that the evidence they present could have come about by pure chance is long overdue. In the analysis of tool marks some forensic examiners have already adopted a simple methodology, consecutive line matching, that in combination with compiled databases

assures them that the probability that the match they identify is highly unlikely to have been coincidental. This paper outlines the general principles that determine the significance of a particular correspondence of impression evidence, what is known about these comparisons and the way in which the calculation of the corresponding probability, that it could have occurred by pure chance, can be done.

Dispersive and FT-Raman Analysis of Forensic Samples

Jesse Gallop, Sr. Sales Engineer

Thermo Fisher Scientific

The use of both macro and micro infrared spectroscopy is well-established in the crime lab. In a macro mode, it is used primarily for drug analysis while the micro mode is used for trace evidence. Recently, there has been a growing interest in using Raman spectroscopy as a compliment to infrared spectroscopy. Raman spectroscopy offers several advantages over infrared spectroscopy.

Raman analysis can be performed on solids and liquids (including water), in both macro and micro modes. In the macro mode, unknown liquid and solid samples can be analyzed through glass vials or plastic bags. In the micro mode, samples that are in the 1 to 2 micron range can be analyzed. This is ten times better spatial resolution than infrared spectroscopy. This allows the examination of individual drugs and crystals. It also allows the probing of individual paint layers "in situ" with little or no sample preparation. The utility of Raman spectroscopy for drug analysis, fiber identification, paint analysis, and explosives will be discussed. A comparison of the FT and dispersive Raman techniques will also be discussed.

Isomer Determination of Cathine in Khat

Rochelle Hranac

Arizona Department of Public Safety

Lon Anderson

Drug Enforcement Administration, Southwest Laboratory

Catha edulis (Khat) is an evergreen shrub native to the Horn of Africa. The leaves are chewed to obtain a "high" from the stimulant-type compounds found in the leaves. These compounds include cathinone and cathine, both listed as Scheduled Controlled Substances by the US federal government. Five extraction methods were performed on dried Khat leaves to successfully remove and identify cathinone and cathine. These methods were Methanol, two Basic Extracts, Dry Basic Extract, and Acid-Base Extract. Gas chromatography with flame-ionization and mass spectrometer detectors were used for analysis. Cathine, (+)-norpseudoephedrine, must be individualized from (-)-norpseudoephedrine and (+)-, (-)-norephedrine. A GC/FID with a chiral column was used for the identification of cathine. Each extract had positive and negative aspects, but the Acid-Base Extract had the best concentration with clear chromatography. These attributes made it most suitable for analysis with the chiral GC/FID.

A Technique for Improved Low-Light Bloodstain Pattern Photographs

Phillip Hess

Sacramento County District Atty's Laboratory of Forensic Services

This presentation is a review of photographic techniques employed during the documentation of a 2007 homicide case

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which took place inside of the Folsom Prison. The suspect and victim were housed together in a jail cell in the maximum security area of the prison. This presentation focuses on the bloodstain evidence which required specific photographic techniques and the use of Blue Star Forensic (a luminol based product). A brief explanation of the photographic set up and the final product created using Photoshop CS3 will demonstrate some useful techniques. This method can be employed to create improved final images of extremely low light situations commonly encountered with the chemical enhancement of "hidden" bloodstain patterns.

A Qualitative Characterization of Lead-free 9mm Ammunition and its Significance on the Hands of a Shooter

Angela Hansen

UC Davis, Forensic Science Graduate Program

Faye Springer (contact)

Sacramento County District Atty's Laboratory of Forensic Services

Historically, gunshot residue has been characterized by the presence of lead (Pb), barium (Ba), and antimony (Sb). However, with an increase in environmental awareness about lead contamination in nature and at firing ranges, the need for lead-free ammunition is becoming more prevalent. Sixteen different types of 9mm ammunition advertised as lead-free ammunition from fourteen manufacturers (CCI Blazer Clean Fire TM, Sinterfire Lead-Free Ammunition TM, Winchester Super-X TM (Super Unleaded¹), Winchester Winclean TM, Winchester Superclean NT TM, Ruga Action 1 [+P] TM, DFA TM, Zero TM, Remington UMC TM, Remington Disintegrator TM, Speer Lawman Cleanfire TM, Simmunition CQTTM, Extreme Shock TM, Federal Ballisticlean TM, M&D TM, Precision FireFrangibleTM, PMC Green TM) were individually test fired and gunshot residue samples were collected from the shooters hand. Each brand of ammunitions was disassembled into the gunpowder, bullet, anvil (where applicable), primer cup and cartridge case. The primer cup was placed in a clean device and detonated directly onto a collection stub.

Additionally, samples were collected from the hands of employees of various occupations, in addition to direct sampling of different materials within that environment. All samples were then analyzed semi-qualitatively using a LEO Scanning Electron Microscope (SEM) with an INCA X-sight Energy Dispersive X-Ray Detector (EDS) and their elemental compositions were determined. The elemental compositions of the particles from these environmental and occupational samples were then compared to elemental composition of the different brands of ammunition.

Forensic Development of LA-ICP-MS: Elemental Profiling of Soda-lime Container Glass

Karen Harrington

Sacramento County District Atty's Laboratory of Forensic Services

Elemental analysis is a method of adding discrimination to glass evidence analyses. Laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) makes use of a high power laser to create an aerosol of fine glass particles by irradiating the surface of a glass fragment which can then be analyzed using ICP-MS. The natural elemental variation of

soda-lime container glass has continued to present difficulties in establishing the extent of discrimination possible between bottles manufactured from the same plant. The purpose of this project is to provide an evaluation of the degree of evidentiary value which may be attributed to indistinguishable soda-lime bottle samples. Ultimately, this project will aim to establish a set of match criteria that remains strict enough to minimize false positives but allows for enough variability to reduce false negatives (in essence, to treat a bottle as a uniform unit). Results indicate that within-bottle elemental variation requires the use of at least +/- 2 standard deviation range-overlap match criteria to allow for the treatment of bottles as a whole unit. Additionally, profiles of bottles originating from the same furnace within a day are likely not distinguishable. Profiles of bottles originating from the same furnace were consistently distinguishable outside of a 2 week production run. Profiles of different colored samples originating from different furnaces were found to be distinguishable. This demonstrates that LA-ICP-MS can reasonably be applied to soda-lime container glass evidence for assisting in distinguishing between samples when these time variable constraints are considered.

SEARCH, The National Consortium for Justice Information and Statistics

Rich Harris, Director

High Tech Crime Training Services, SEARCH

Mr. Harris will present an overview of SEARCH, the National Consortium for Justice Information and Statistics, including the history of the not-for-profit organization and a description of the services SEARCH provides to the criminal justice community. Mr. Harris will focus most of the presentation on the High-Tech crime Training Services that are available through SEARCH and will present an overview regarding the current state of cellular telephone investigations as well as current trends in other wireless technologies.

Validation of ABI AmpF/STR® MiniFiler™ Kit

Wanda Kuperus*, Ph. D

Cassie Johnson, M.S.

Orchid Cellmark

Most forensic laboratories are accustomed to using at least some of the commercially available STR kits such as ABI's ProfilerPlus®, COfiler®, Identifier®, as well as Promega's PowerPlex16® in the genotyping of DNA samples for human identification. These are the STR kits of choice for most DNA samples and have proven to be reliable products. However, the ability of these same laboratories to process the most challenging samples may benefit from the implementation of an amplification method that offers the ability to genotype shorter STR fragments, is more resistant to PCR inhibition, and also requires less DNA to produce results. Thus, the ABI AmpF/STR® MiniFiler™ Kit has been optimized for typing degraded DNA and samples containing PCR inhibitors.

To comply with Orchid Cellmark's Quality Program and to ascertain whether the MiniFiler system is an appropriate technology to introduce into the laboratory's forensic opera-

¹Winchester Super-X TM has also been referred to as Super Unleaded, however, this ammunition has been discontinued.

tions, a thorough internal validation study was conducted. This study include: (1) sensitivity, (2) reproducibility and precision, (3) mixture analysis, (4) inhibition, (5) degradation, (6) known and non-probative samples and (7) stutter analysis. Some of the results of this validation, as well as the results of OC's application of this forensic typing system into actual casework samples will be presented.

Validation of the Applied Biosystems' AmpF/STR® MiniFiler™ PCR Amplification Kit

Joy Viray

Sacramento County District Atty's Laboratory of Forensic Services

The Applied Biosystems' AmpF/STR® MiniFiler™ PCR amplification kit was validated for forensic casework use in the Biology Unit of the Sacramento County District Attorney's Laboratory of Forensic Services. A brief summary of validation results will be presented. In addition, an inhibition study was performed to compare the performance of both Identifiler™ and Minifiler™ on biological fluids applied to mock casework substrates. Contact DNA experiment results highlighted: 1) the exceptional sensitivity of the Minifiler™ kit, 2) the success of extracting contact DNA samples using an automated robotic platform with a modified protocol, and 3) high-contact laboratory surfaces as potential sources of cellular material that could be transferred and detected.

Nomenclature Development for Canine STR Panel

Bradley Tom, et. al.

UC Davis, Forensic Science Graduate Program

The American Pet Products Manufacturers Association 2007-2008 National Pet Owners survey found that 39% of U.S. households have at least one dog. With dogs being in such close contact with humans, information from the canine evidence is potentially crucial to crime scene investigation. When evidence from a dog is available, a method for match comparison and probability estimates would be advantageous to investigators. In conjunction with my PI's project, which aims to develop a standardized and validated canine STR panel for forensic use, my project was to develop an allelic nomenclature system for that panel.

The use of a panel of standardized loci in all investigations would make it easier for interlaboratory comparison of information. The allelic nomenclature that I propose will provide a more accurate picture of STR allele distribution pattern and frequencies among the various U.S. canine subpopulations. This information is absolutely relevant for the accuracy and precision of canine forensic genetic testing in the U.S.

Facilitating Communication and Collaboration Between the Forensic Science Community and the Innocence Movement

Keith Inman

Forensic Analytical, Cal State East Bay

Panel: Norah Rudin (private consultant), Linda Starr (NCIP), Gabriel Oberfield (TIP), forensic community representative (TBA)

In speaking with our colleagues in the forensic community and our associates in the innocence movement, it has become clear to us that strong feelings exist amongst and

betwixt both groups. We also began to understand that false assumptions, miscommunications, and misunderstandings were contributing to a growing tension. We addressed some of the issues in our editorial, Who speaks for Forensic Science, published in the recent *CACNews*, 4th quarter, 2008 (www.cacnews.org/news/4thq08.pdf).

This workshop will bring together the two communities in a forum intended to foster open communication and discussion. Representatives of both the Northern California Innocence Project (NCIP) and The Innocence Project (TIP) will be present to discuss both the specific workflow of an innocence case and public policy goals of the innocence movement. It is our hope and intent that this workshop will facilitate the continued collaboration of forensic science and the innocence movement.

People vs. Phillip Thompson

Trish Kelliher

El Dorado County District Attorney's Office

On June 19, 1971, victim Elizabeth Cloer's body, naked except for her bra, was found in El Dorado County. She had been shot and her face was crushed beyond recognition. Her panties were found several yards from her body.

Elizabeth was last seen leaving her Sacramento apartment with a man she had met earlier in the evening at a gas station.

All leads in the case were exhausted and the case lay dormant until 2002, when the evidence was re-examined as part of the Department of Justice Cold Hit Program. Criminalist Angelynn Moore examined the victim's panties and was able to extract DNA from sperm found in the panties. A profile was obtained and uploaded into CODIS. The profile matched that of prison inmate, Phillip Arthur Thompson, who was serving a life sentence for kidnapping and robbery.

Criminalist Moore was able to link the panties to the victim when she found that the DNA profile from the blood on the victim's bra matched the female profile found in the panties. Alleles foreign to both Thompson and the victim were found on the waistband of the panties. However, it was shown that in 1971, evidence was frequently handled without gloves by investigators and criminalists.

At trial, in an obvious attempt to explain the DNA findings, Thompson testified that he had at some point had sex with the victim, however, did not murder her.

Thompson was convicted of first degree murder and sentenced to 7 years to life, which was the sentence for the crime in 1971.

Summer of Terror

Faye Springer

Sacramento County District Atty's Laboratory of Forensic Services

In the summer of 1999, three Synagogues in the city of Sacramento were burned by arsonists in a period of a few hours. In the following month, a gay couple was murdered while asleep in their home in the Redding area of California. This incident was followed by the burning of an office building in Sacramento that housed an abortion clinic. A task force of federal and local law enforcement agencies was formed to investigate these crimes. Eventually, physical evidence linked two brothers from the Redding area to these crimes. The brothers harbored fanatical religious convictions that were

anti-Semitic and anti-homosexual. This paper will discuss the trace evidence that linked the Sacramento crimes to these brothers.

Recovery of DNA and Fingerprints from Touched Documents

Jonathan Sewell, et. al.

King's College London and London Metropolitan Police

This study investigated the various factors affecting DNA profiling from DNA recovered from fingerprints deposited on paper before and after fingerprint enhancement treatments. The DNeasy1 plant mini kit (QIAGEN1) was found to improve DNA recovery from paper by over 150% compared with the QIAamp1 mini-kit. A significant decrease in the amount of DNA recovered was observed following treatment with DFO and/or ninhydrin. This decrease in yield did not have a comparably significant effect on the quality of the SGM PlusTM profiles. Furthermore, this study found that whilst certain paper types, such as newspaper, magazine and filter paper allowed for the good recovery of DNA, common office paper and white card strongly interfered with the recovery of DNA resulting in poor quality profiles.

A Study of Unusual Quadruplex qPCR Data

Kyle Duke

UC Davis, Forensic Science Graduate Program

The Method Development Group at the CA DOJ Jan Bashinski DNA lab has recently implemented a quadruplex real-time PCR assay that can be used to estimate the quantity of DNA in an unknown sample as well as detect the presence of inhibitory substances and/or degraded DNA. This assay improves upon a previous design by adding a Y-chromosome amplification target to quantify male specific DNA in addition to the autosomal targets used in previous assays developed by the laboratory. Population studies using the new quadruplex identified three male samples that displayed abnormally low Y-chromosome signals. The objective of my thesis project was to study these samples in an effort to determine possible sources of the low male-specific signal. A variety of hypotheses explaining the phenomenon were explored using sequencing technology and STR typing with ABI's Identifiler and Y-filer kits, as well as a battery of quantification systems with divergent methods of DNA detection. None of the competing hypotheses satisfactorily accounted for the low Y quantifications. Double-strand breaks within the Y chromosome qPCR target remain as a possible source of the effect, but not one that could be explored in these series of experiments due to limited sample amounts.

Generating Forensic DNA Profiles from "Contact DNA" on Cartridge Casings and Gun Grips

Lisa Branch

California State University Sacramento

In the United States, ten thousand homicides occur each year involving the use of guns, making gunshot wounds the leading cause of death by homicide. Despite the best efforts of law enforcement agencies and prosecutors, more than thirty five percent of homicides are never solved. Thus, there is a great deal of interest in developing new methods to analyze

evidence from crime scenes in which firearms are used. In this study, 600 cartridge casings and 90 gun grips were examined to determine if it was possible to obtain DNA profiles from contact DNA. DNA extraction was performed using the BioRobot EZ1, and the samples were amplified first with AmpF STR[®]Minifiler[™] then quantitated using Quantifiler[™] to determine if amplification with AmpF STR[®]Identifiler[™] could be done. Only 7.6% of unfired cartridge casings contained significant DNA to generate a partial or full profile using Minifiler, and only 0.76% of fired cartridge casings contained significant DNA to generate profiles. While 55% of gun grips contained either a partial or full DNA profile. It was shown that even though it is possible to obtain a DNA profile from unfired cartridge casings using both Minifiler and Identifiler, it is very unlikely that a DNA profile will be obtained from cartridge casings collected at crime scenes.

Sodium Hydroxide Extraction of DNA from Buccal and Bloodstain Samples

Christopher Tanforan, Yeung Kung*

California Department of Justice, Jan Bashinski DNA Laboratory

The Jan Bashinski DNA Laboratory Data Bank processes samples from convicted offenders and qualified arrestees. The samples are extracted, amplified, analyzed, and genotyped. The genetic profiles of the samples are then entered into a searchable database.

The Data Bank is a high-throughput laboratory environment which requires the capability of processing upwards of thirty thousand samples a month. The sodium hydroxide extraction was developed and implemented in order to meet this need.

The sodium hydroxide extraction method provides a fast, efficient method for extracting DNA from buccal and bloodstain samples. The advantages of the sodium hydroxide extraction compared to a commercial extraction kit are discussed, as are some of the limitations of the sodium hydroxide extraction method.

Retention of Gunshot Residue on Fabrics

Samantha Frost

UC Davis, Forensic Science Graduate Program

Faye Springer, (contact) Sacramento County District Attorney's Laboratory of Forensic Services

The aim of this study is to determine how quickly gunshot residue (GSR) disappears from a subject's clothing during common, low intensity activities such as driving, walking and sitting, and high intensity activities, such as dancing and running. In this study, I placed 200 ul of ethyl alcohol containing approximately 200 GSR particles, 1-10 um in size, on 100% cotton fabrics, 100% polyester fabrics, and 50-50 cotton polyester blend fabrics. Subjects wore these fabrics for time intervals from 30 minutes to 4 hours. Then, gunshot residue samples were collected from the fabric using carbon adhesive on aluminum stubs. I also washed each type of fabric after depositing gunshot residue particles on the clothing and collected samples for analysis after the fabric was washed and laid out to dry. The analysis of gunshot residue particles was done using the scanning electron microscope (SEM) with energy dispersive spectroscopy (EDS). The result of this study will be presented.

Officer Involved Shootings and Suicide by Cop Phenomenon

Kenton S. Wong

Forensic Analytical Sciences, Inc.

The presentation will examine a case involving an officer involved shooting that had an apparent suicide by cop aspect to the case. The case presentation will highlight the forensic crime scene reconstruction of the case and alert meeting attendees to the potential motive of suicide by cop phenomenon occurring in all officer involved shootings.

Firearm and Toolmark Identification—Meeting the *Daubert* Reliability Challenge; CAC Northern California Firearms Study Group CMS Survey; How Using Consecutive Matching Striae (CMS) Helps Meet the Main *Daubert* Requirement

John Murdock

Contra Costa County Forensic Services Division

This presentation is designed with forensic management in mind as an “executive summary” of the historical and current ability of the firearm and toolmark identification community to respond to *Daubert* challenges in general, and with emphasis on its response to the critical issue of scientific testability. The topics to be covered are as follows:

1. *Daubert* legal challenges including significance to the firearm and toolmark identification community and the impact on laboratory management overseeing this kind of casework;
2. Brief historical background of consecutive matching striae (CMS);
3. CAC Northern California Firearms Study Group CMS survey;
4. Common objections to the use of CMS in casework;
5. Benefits that management can expect from examiners adopting CMS in toolmark identification



ABC Update

At the beginning of 2008, the American Board of Criminalistics (ABC) implemented a new format for certification testing. Below is a summary of the eligibility requirements under the new format:

DIPLOMATE: Education—Applicant must possess a minimum of an earned baccalaureate degree, or equivalent, in a natural science or an appropriately related field from an accredited institution. At its discretion, the Board through its Credentials Committee may request documentation which certifies compliance with this requirement. Professional Experience and Training—Applicant must possess a minimum of two years full-time experience (including on-the-job training) and be actively working in Criminalistics. Qualifying activities may include casework, teaching at the post-secondary level, research, supervision, and management. Exam—Any of the below listed exams may be taken, and more than one may be taken. If taking one of the specialized ABC examinations, the experience should be in that particular field.

FELLOW: Fulfill all requirements for Diplomate status. Be able to document current successful participation in an approved annual proficiency testing program in either the designated specialty areas or in any area of forensic science for the Comprehensive Criminalistics Exam. Fellow status may be retained in more than one specialty area, with a separate proficiency test taken in each area.

AFFILIATE: Education—Applicant must possess a minimum of an earned baccalaureate degree, or equivalent, in a natural science or an appropriately related field from an accredited institution. (Exception: A student graduating at the end of the semester or trimester may sit for the examination if a letter from their professor is provided verifying their graduation status.) Affiliates are not certified. Affiliates are certification eligible. Certification only occurs after an Affiliate files an ABC Request For Promotion From Affiliate To Diplomate (form ABC 166) and the Registrar is notified of its approval by the Credentials Committee.

Available Exams: Drug Analysis, Fire Debris Analysis, Molecular Biology, Trace Analysis Hairs & Fibers, Trace Analysis Paints & Polymers, and Comprehensive Criminalistics.

The new format of each exam (except Comprehensive Crim.) includes 40% Core Forensic Knowledge and 60% Forensic Specialty Knowledge. The overall pass rate for the pilot exams was 60%, demonstrating that the exams have not been diluted by the new format.

Current Certificate Holders: Fellows will retain Fellow status, as long as they continue to participate in proficiency testing. Technical Specialists will automatically become Fellows. Current Diplomates can retain Diplomate status, or may request to be elevated to Fellow status (in General Criminalistics) if a practicing analyst and undergoing a yearly proficiency test, by submitting a letter to the Registrar requesting elevation to Fellow along with the Proficiency Testing Certification Form (ABC 708). There is a one time \$50 conversion fee to do this.

The yearly recertification form (ABC 600), has been updated to reflect the changes in certification and simplify filling it out. In order to facilitate review of the forms, additional documentation is being required of certificate holders. Individuals should include documentation of classes or seminars, such as a certificate of completion or payment receipt.

Ed Rhodes Scholarship: In memory of Edward Rhodes, a pioneer in forensic education and certification, the ABC offers a complimentary examination sitting for one (1) representative from each member organization per calendar year. Examinations can be taken at any offering during the year. Candidates should fill out the scholarship form (ABC 108) and submit it to the CAC Board of Directors for consideration. If the Scholarship is awarded, the Application Fee (\$50) is the responsibility of the candidate.

Application Fee paid by CAC: Several years ago, the CAC board of directors established a policy that the CAC would reimburse the application fee (currently \$50) for any CAC member taking a certification exam. The examination fee (currently \$200) is the responsibility of the candidate.

All forms and further information can be found on the ABC website: www.criminalistics.com

Physical Matching as a Duty of a Firearms Examiner

Jaco Swanepoel¹

Keywords: casting material, class characteristics, comparison microscope, hydraulic pump, individual characteristics, rubber shock absorbers

Abstract

Two objects or surfaces that have been in contact with each other for any period of time should (under most circumstances) leave their respective markings or traces upon one another. Through careful examination and comparison such markings and traces can be detected, possibly leading to the conclusion that the two objects or surfaces were in fact joined or in contact with each other. This case examination profiles a rare and unique dual-impression.

Introduction

Edmond Locard's Exchange Principal is one of the cornerstones of forensic investigations and states that when two objects come in contact with each other they exchange trace materials, markings and possibly other significant evidence. In this specific case examiners are looking at markings that were cross transferred from one surface to another. It will also be important to examine the transferred markings in relation to their size, shape, position and orientation, as well as their individual significance.

Background

De Beers South Africa has a huge amount of machinery that they use for mining purposes, specifically diamond mining, particularly in the Kimberley area of South Africa. As the machinery gets older or breaks to a point of no repair, De Beers will leave the machinery parked in a lot on the property, a "Bone Yard" of sorts. The machinery still has a substantial monetary value and as a result the company does not want any of the machinery or parts thereof stolen.

However, from time to time parts and machinery do get stolen. The police will recover some of the stolen parts or machinery but may have trouble (as in this case) linking the stolen parts to the original machinery that it was stolen from.

Attending the crime scene was not an option in this case and the detectives ended up sending the stolen hydraulic pump and the base plate, which they recovered from the grader that the hydraulic pump was allegedly stolen from, to the Forensic Science Laboratory in Pretoria.

The hydraulic pump alone weighed about eighty kilograms (175 lb) and had a worth of roughly R50000. (\$8000US) The base plate, while not as heavy was still a cumbersome piece of metal to handle. (See photo 1)

Comparison Procedure

Examination of the base plate revealed that it was connected to the bottom of the hydraulic pump with three long bolts. Between the two plates were three rubber shock absorbers which consisted of three larger round rubber plates that fit between the base plate and the hydraulic pump, and the three smaller rubber plates that fit between the base plate and the grader.

These rubber shock absorbers and their specific orientation provided the examiner the first clue as to the orientation of the hydraulic pump and the way it fit onto the base plate; the rubber shock absorber marked A1 was installed incorrectly or upside down, while the other two rubber shock absorbers were installed correctly. Further examination of the bottom of the hydraulic pump and the impressions left by the rubber shock absorbers reflected this error. Immediately noticeable was the consistency in shape, size, position and orientation. (See photo 1)

Only the rubber shock absorbers made contact with the bottom of the hydraulic pump and therefore, this area of contact was closely examined. Further examination of the rubber shock absorbers revealed that the rubber shock absorbers also had a product part number on it. Examination of the bottom area of the hydraulic pump where it made contact with the rubber shock absorber also showed characteristics that were of individual importance.



Photo 1: The hydraulic pump and the base plate in the correct orientation. Note the correspondence in class characteristics; imprints of the size, shape and orientation of the three rubber shock absorbers.

¹Forensic Analytical Sciences, Hayward, CA.

While the particular part number marked on the rubber shock absorbers was not a unique feature, their specific orientation was very unique due to the fact that they were hand-fitted and as a result, the orientation was random in nature. The orientation of the rubber shock absorber marked B1 alone was not all that significant, but with consideration of B1's orientation in concert with the orientation of the rubber shock absorber marked C1 and the upside down rubber shock absorber, the resulting combined orientation issues/ relationships became of increasing significance. Of further importance to the examination/ comparison was the fact that the part number was shown on the rubber shock absorbers and their specific orientation, shape, size and position were consistently reflected/ impressed on the bottom of the hydraulic pump. (See photos 2 and 3)

As previously mentioned, the areas on the bottom of the hydraulic pump that made contact with the rubber shock absorbers also had very specific and significant characteristics. Examination of the hydraulic pump revealed that it had been painted with multiple layers. At least four layers of paint were counted; the base plate also reflected the many layers of paint. The multiple layers of paint combined with the haphazard way in which it was applied, consequently resulted in dried paint drips that in turn resulted in a very specific and unique pattern/ formation in the area marked C2 on the bottom of the hydraulic pump. (See photo 4)

Another area of interest was also found on the bottom of the hydraulic pump in the area marked C2, where several striations/ toolmarks were observed above and to the left of the dried paint pattern/ formation. (See photo 4)

Consistent with the Locard Principle of Exchange, the striated marks and the paint pattern/ formation were transferred to, and were reflected in the rubber shock absorber marked C1. (Please note that the shape, size, position and orientation have not changed, see photo 5)



Photo 2: Close-up of the rubber shock absorber and corresponding imprint marks on the base plate marked B1-B2. Note the class characteristics and in particular the orientation of the serial number.



Photo 3: Close-up of the rubber shock absorber and corresponding imprint marks on the base plate marked C1-C2. Note the class characteristics and in particular the orientation of the serial number.

To aid in comparison and the making of conclusions three different scientific comparative fields were employed pertaining to their respective opinions of class and individual characteristics; firearms, fingerprints and footwear impression evidence had the following criteria for class characteristics:

- Details common to others of the same source/ origin
- Measurable features of a specimen which indicate a restricted group or source, which is the result of design and determined before manufacture
- The more obvious distinguishable features

For the purposes of this examination/ comparison the following features that were observed on the bottom of the hydraulic pump and on the rubber shock absorbers were used as class characteristics:

- The shape of the base plate and the bottom of the hydraulic pump and the configuration in relationship to each other
- The shape, size, position and orientation of the rubber shock absorbers and their impression on the bottom of the hydraulic pump
- The shape, size, position and orientation of the characteristics on the bottom of the hydraulic pump and their impression on the rubber shock absorbers, specifically the rubber shock absorber marked C1

As mentioned previously in this article, strong arguments could already be made as to whether the hydraulic pump and the base plate were in fact joined at one time or another, such as the different layers of paint used, through examination and in establishing the different layers of paint, composition, color and order. Further strong arguments in regards to orientation, size, shape and position of the rubber shock absorbers and the specific way they were transferred

Physical Matching as a Duty of a Firearms Examiner, cont'd



Photo 4: Close-up of C2 (bottom of the base plate) note the dried paint pattern and the striated marks in the 6-9 o'clock position, these markings will be used for orientation and individual comparison



Photo 5: Close-up of C1 (rubber shock absorber). Note the imprint marks of the dried paint pattern and the imprints of the striated marks in the 9-12 o'clock position. These markings will be used for orientation and individual comparison

or impressed on the bottom of the hydraulic pump and visa versa with the markings/ characteristics on the bottom of the hydraulic pump.

The initial examination was conducted by simply placing the hydraulic pump and the base plate next to each other, while systematically moving back and forth comparing the different aspects. Illumination was also introduced at different angles of incidence and was employed to assist in giving a better perspective in the evaluation of markings or characteristics.

The comparison microscope was not utilized in this examination phase.

Considering the size, weight and cumbersome nature of the exhibits it was physically impossible to place either the base plate or the hydraulic pump under the comparison microscope. Photography and the use of different casting materials was the only way to facilitate the side by side comparisons in regards to the individual characteristics used in this examination/ comparison.

Referring back to the three scientific comparative fields employed earlier, the following criteria regarding individual characteristics were noted:

- Characteristics produced by random imperfections or irregularities on surfaces that are unique
- Characteristics that are the result of something randomly added to a surface making it unique
- Characteristics of such significance as to preclude the possibility of its occurrence by mere coincidence

For the purposes of this examination/ comparison the following features that were observed on the bottom of the hydraulic pump were considered to be individual characteristics:

- The dried flow pattern/ formation of paint in area marked C2
- The striated toolmarks in the area marked C2

The dried flow pattern/ formation had several characteristics that could be used for comparison purposes, but the pattern's uniqueness and randomness should first be noted. As with firearms manufacture, this type of pattern or formation could not be duplicated on a microscopic level, the painter or manufacture certainly had no desire or intention to create the pattern/ formation in the first place, making it random in nature. Secondly, they had absolutely no control as to the pattern's specific formation or configuration, thus making it unique.

Side by side comparison of the pattern on the rubber shock absorber and the forensic sil cast made of the actual pattern/ formation on the bottom of the hydraulic pump, revealed that the left border of the pattern/ formation had several individual characteristics that could be used for comparison purposes. Further examination of the pattern/ formation itself revealed several other areas that could also be used for comparison purposes. (See photo 6)

Even though the pattern/ formation were unique and random in nature, in this case as in most other cases, orientation is of the utmost importance. Note the orientation of the part number from the rubber shock absorber imbedded in the dried paint pattern/ formation. (See photo 6)



Photo 6: Close-up of the cast made of the dried paint pattern on the bottom of the base plate (C2). Note specifically the shape of the left edge of the dried paint pattern, the formation of the general pattern, and the orientation of the serial number.



Photo 6a: Close-up of the imprint of the dried paint pattern on the rubber shock absorber (C1) note specifically the shape of the left edge of the dried paint pattern, the formation of the general pattern, and the orientation of the serial number.



Photo 7: Close-up of a transparency of photo 6, overlaid on the photo of the rubber shock absorber C1. Note how the left edge and the general pattern physically match and how the serial number orientates.



Photo 8: Microscopical comparison of the striations separately cast on C1 and C2.

Physical Matching, cont'd

A transparency was produced of the photograph of the forensic sil cast of the actual marks on the bottom of the hydraulic pump, and was superimposed on the marks found on the rubber shock absorber, to facilitate the comparison. (See photo 7)

Side by side comparison and superimposition demonstrated the consistency in shape, size, position and orientation as well as the individual characteristics of the paint pattern/formation. The striations observed on the left of the dried pattern/formation were compared using the comparison microscope. Whether the striations themselves were unique in nature was not determined for the purposes of this particular examination/ comparison. However, what was of importance was the spatial orientation of the impressions of the markings and these were compared to the actual markings to ensure that the marks seen on the rubber shock absorber were in fact a result of the carry over from the bottom of the hydraulic pump, thus establishing uniqueness.

Two microsil casts were made; one of the rubber shock absorber and another of the bottom of the hydraulic pump. The two microsil casts, however could not be physically placed and compared on the comparison microscope while applying both light sources from the same direction. The light sources had to be placed on opposite sides of the microscope tables, since an examiner cannot necessarily compare a cast of a negative impression with a cast of a positive impression. By simply switching the direction of one of the light sources the examiner can view both casts, either as a positive or a negative impression. (See photo 8)

Summary and Conclusions

Throughout this examination it was clearly demonstrated that class and individual characteristics cannot be separated from one another. This examination also demonstrated the importance of evaluation and the consideration of shape, size, position and orientation in the comparison process. There was a definite overlap of what can be construed as class and individual characteristics. This particular case was also a classic example of Locard's Exchange Principal, as the encountered markings from one surface carried over to another and consequently resulted in a dual-impression. While examination in this particular case to the point of individuality in certain characteristics may have been a bit of an over kill, it nonetheless demonstrated the answer to the basic question of whether the hydraulic pump and the base plate were in fact previously joined. The examination/ comparison could have been attacked from several different perspectives; however only one conclusion should have been reached:

There was an agreement of class characteristics and sufficient agreement of individual characteristics which were of such significance that it could be concluded that the hydraulic pump and the base plate were at one time connected to each other.

References:

- The Association of Firearms and Toolmark Examiners. n.d. Glossary (Fourth Edition) Retrieved from CD Rom
- Bodziak, William J., 1990, Footwear Impression Evidence. New York, Elsevier.
- Ashbaugh, David R., Cpl., Ridgeology. Royal Canadian Mounted Police.

Nichols: Background Noise

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What choices are we making? Are we focusing on the things that will have eternal consequences or are we focused on just the here and the now? If you have read this column with any semblance of regularity it will probably not surprise you that my wife and I are involved in ministry. In that ministry we have the opportunity to meet and share with many people. We have met some who are so concerned about the economy and what it means for them in the here and now that they are paralyzed by fear, so focused on the material aspect of their lives that the relational aspect has suffered tremendously. We have also met some who, despite circumstances that would cripple others, have stepped up and offered what little they have to others, recognizing that even in that little, they have much.

Here's a choice to consider for the new year, a choice that by itself will help to reduce the background noise of our lives—a choice of gratitude. I know I will be working hard on this myself. I know that in many ways I and my family have been so blessed that this heart of gratitude can become a heart of expectation. Rather than being thankful, we become expectant and when things do not develop as expected, it can turn into a heart of bitterness. Then our ego gets in the way and we find it a challenge to get back to where we need to be.

Let's tie this into some of the other things I have discussed. How do we choose gratitude for a best friend who passes away at such an early age leaving such a large family? Well, when he was here, he was a very good friend, one in whom I could rely and trust. While not perfect he did do his best to be a role model for his wife and children and his wife and children are a true reflection of his desire to be a man of integrity and honor. Does she miss him? You bet! But her heart of gratitude is as strong as ever. Yes, he died early, far too early some would say. At the same time, his investment in the lives of his family and friends will have eternal consequences and for that we can express gratitude daily.

How do we choose gratitude for 40 years of no contact between father and a son? Well, it could have been no contact until the day he died and there would have been no chance for any sort of reconciliation at all. Does a 15 minute phone call wipe out 40 years? Not by the world's standards. Then again, by choosing gratitude, that gap decreases pretty significantly because a small amount of gratitude can counter a tremendous amount of resentment and bitterness. That is, unless you like the way resentment and bitterness tastes as compared to gratitude. I mean ultimately, the choice is yours to make.

We have many things happening around us. Are we going to be defined by how we are impacted by the circumstances or are we going to define our circumstances by how we impact them? Simply put—how are you going to choose to respond to those things that are happening all about you? If we start with a heart of gratitude we will find ourselves impacting those circumstances rather than being a victim of them.

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

Ron

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