The CACNews

News of the California Association of Criminalists • First Quarter 2012

The President's Desk

Who Should the CAC Be?

Recently, there have been frequent discussions at the board meetings over who exactly qualifies for membership in our association. As interest in our field has grown, we have received more applications from individuals who don't work in traditional areas of criminalistics. Our bylaws state that membership is "limited to persons who are

> ***... presently employed as laboratory scientists professionally engaged in one or more fields directly related to the forensic sciences"***

and

> ***"...have demonstrated ability to conduct work requiring college level education in appropriate physico-chemical or biological sciences."***

What should we do about an applicant who is a latent print examiner, a position which does not necessarily require a college science degree? The board decided in one case that the applicant should be approved, because the job at that laboratory could only be held by a person with a science degree and was considered by the management as a scientist position. In other cases, the application might be denied if the job did not seem to be that of a "laboratory scientist" as specified in the bylaws. At the Fall Seminar, one speaker offered the opinion that crime labs should be hiring scientists as latent print examiners, in order to put that discipline on a more scientific footing as recommended in the NAS report "*Strengthening Forensic Science: A Path Forward*." This has led to a debate: should the CAC begin shifting to an "open tent" encouraging membership from every field of forensics, or should we continue to focus on laboratory scientists? We expanded our affiliate member category from just students to include interns, laboratory technicians, and crime lab volunteers; should we consider expanding the field of those eligible for full membership?

We have more affiliate members now than ever before, and I must say this is only to the benefit of the association. If you attended the last seminar, you saw many excellent presentations by students at the UC Davis Forensic Science Graduate Program. I expect we will see many more at upcoming seminars hosted by the San Jose State University and Cal State LA programs. These students are going to determine the future of our profession, and it's important that we include them in the CAC as early as possible. With that in mind, I have been contemplating borrowing an idea from the NEAFS (with the encouragement of their president) and forming a committee specifically to deal with student issues. This committee could potentially have input on workshops, scholarships, internships, mentoring programs, public outreach, and more. If you are a student, instructor, or administrator please share your thoughts on the matter. What additional services can the CAC offer to our student members, and how can we better use the talents of those members to help the CAC?

* * *

In other news, AB 239, which would have reconvened the Crime Laboratory Review Task Force to recommend the composition of a statewide forensic science oversight body, was vetoed by Governor Brown. His veto message simply stated that he did not see a need for the task force to meet again, so this does not rule out future legislation on the subject of oversight. Our new Legislative Analysis committee will keep an eye on the legislature and let us know if there is any activity in this area. Finally, the Ethics committee and our webmasters have put together an ethics section on the association website. This includes some excellent summaries of regional, national, and international forensic science organization ethics codes. Also, be sure to participate in the Ethics Forum on the Member Services site. This gives you a chance to discuss the ethics scenarios presented in each issue of the CACNews with your fellow CAC members. Our profession continues to attract a high level of public interest, and this means that everything we do has the potential for both praise and criticism. You should be prepared to defend your work in both the courtroom and the court of public opinion. Our ethics committee is working hard to make sure you have the information necessary to conduct that work to the highest standard, please be sure to take advantage of this opportunity.

...should the CAC begin shifting to an "open tent" encouraging membership from every field of forensics, or should we continue to focus on laboratory scientists?

Kevin Andera
CAC President

FIRST QUARTER 2012

The CACNews

www.cacnews.org

On the cover...
The wall of fire! See more images from the ATF workshop on explosives—and the recent seminar—inside this issue.

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Please direct editorial correspondence and requests for reprints to the editorial secretary.

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

Submissions should be made in the form of Windows compatible files on CD or by e-mail. Alternatively, text files may be saved as plain ASCII files without formatting codes, e.g. bold, italic, etc. Graphics, sketches, photographs, etc. may also be placed into articles. Please contact the editorial secretary for details.

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

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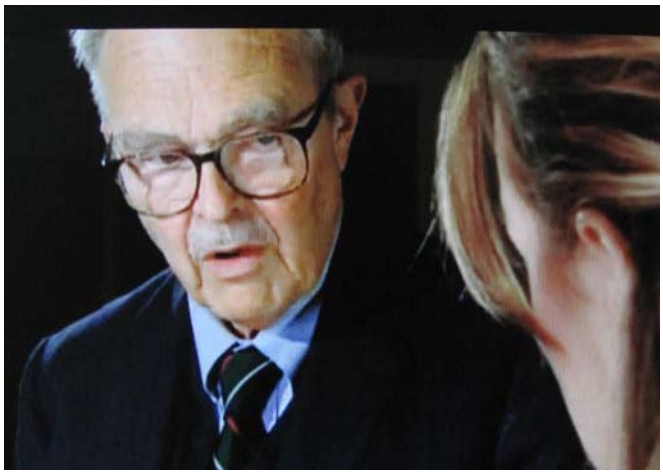
CAC*Bits*



St. Valentine's Day Massacre

On an episode of the PBS show *History Detectives*, CAC member Paul Dougherty uses a replica of Goddard's comparison microscope to examine shotgun cartridge casings fired from a weapon that could have been used in the St Valentine's Day Massacre of 1929. (Orig air July 2009)

Proud Day

Jennifer Mihalovich received the CAC's Anthony Longhetti Distinguished Member award at the Fall Seminar. She is joined here by her daughter Sabine and husband Robert. Jennifer's acceptance speech was accompanied by a slide show, "It Takes a Village," featuring dozens of historical CAC photos of colleagues, friends and mentors throughout her forensic career.

Bakersfield Meeting Already Shaping Up

Dr. Greg Hamkipian from Boise State University has agreed to be one of the featured speakers at CAC Spring 2012. He was the defense DNA expert in the Amanda Knox case. CSI actors and researchers David Berman and Jon Wellner are expected as well. This meeting will also feature at least three to four DNA workshops including a full day on DNA quantification sponsored by ABI, a day on body fluid identification (semen/sperm) offered by IFI, and a full day on DNA mixture interpretation using Cybergenetics; a trace evidence workshop by Wayne Moorehead; a shooting reconstruction workshop offered by Chris Coleman and Bruce Moran featuring Bakersfield PD SWAT; a leadership and team-building workshop offered by The Table Group; an alcohol correlation study workshop offered by Dan DeFraga and sponsored by Draeger, and a ethics workshop offered by Raymond Davis and Carolyn Gannett.

Forensic Dust Course

On March 19-23, 2012 an introduction to the analysis of dust traces for trace evidence analysts based on Skip Palenik's over 50 years of experience in studying dust in a forensic context will be offered. Beginning with the history of dust analysis and the work of Locard, Popp, Schneider, Heinrich, Frei-Sulzer and others, it will explore the techniques for collecting, separating, analyzing and interpreting dust evidence. Special emphasis will be placed on developing investigative leads such determining environment and/or occupation from the analytical results of a dust analysis. Students are encouraged to bring items of clothing, nasal swabs, earwax and/or fingernail clippings from interesting environments or occupations for study and at least one of these will be worked up as an example in class. Prospective students must have a taken the McCrone Research Institutes Applied Polarized Light Microscopy and the microchemical analysis course is strongly recommended as well.

Please visit www.mcri.org for more info on this and other forensic microscopy courses.

Looking for a Phone Number?

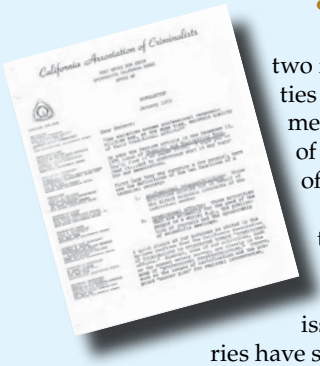
Remember that the current membership directory is available online, and that you can still print it out if you prefer. *www.cacnews.org*

More Awards

The Alfred A. Biasotti Most Outstanding Presentation Award was given to **Joseph Cavaleri**, who presented *"The Murder of LA County Police Captain Sparkes"* (Christina Gonzalez, James Carroll and Phillip R. Stirling, co-authors).

Dan Gregonis received a CAC Service Award for his work as representative to the American Board of Criminalistics.

Yesterday's News

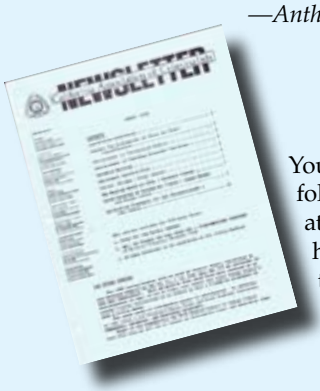


• 40 YEARS AGO IN THE *CACNEWS*...

First (and they may surprise a few people), here are the definitions of the two functions of a technical society: l. Professional responsibilities: those activities carried out on behalf of the direct economic interests of the individual member. 2. Traditional efforts: those activities that are primarily for the good of the people as a whole, e.g. the publication of journals and the sponsorship of scientific meetings.

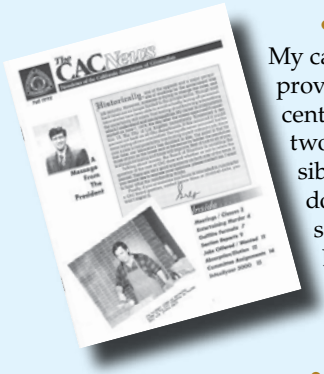
A quick glance at our purposes as stated in the Bylaws confirms that the California Association of Criminalists is orientated toward "traditional efforts." However some of our activities such as the annual salary survey are clearly in the area of "professional responsibility." Others, such as the issues of certification and the proposed "master plan" for regional laboratories have some element of self interest. . . . unless we can continue to walk the tightrope of co-existence, some future day we may each have to make a personal decision regarding the course of the association.

—Anthony longhetti, CAC President, Jan, 1972



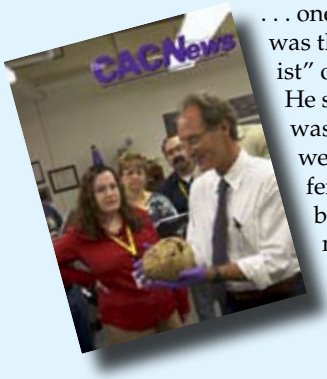
• 30 YEARS AGO IN THE *CACNEWS*...

You may be eligible for elevation to member if you meet one or more of the following requirements: 1. In one year, you have attended one seminar and at least four local meetings (section or study group) or; 2. In three years, you have attended three seminars and delivered one scientific paper or; 3. In three years, you have attended one seminar and actively served on at least one committee. *—Dorothy Northey, March 1982*



• 20 YEARS AGO IN THE *CACNEWS*...

My career in criminalistics started on July 7, 1978, the day after the voters approved Proposition 13. The City of Los Angeles immediately threatened a 10 per cent cut back on all city departments. If this occurred, it would mean laying off two criminalists. The layoffs never occurred, but for over a year a real possibility was finding myself without a job. Since that time, our laboratory has doubled in size. The point is that for those of you on the lower end of the seniority ladder the pendulum is always swinging and times will improve Best of luck to all of you. *—Greg Matheson, CAC President, Fall 1992*



• 10 YEARS AGO IN THE *CACNEWS*...

. . . one particularly striking observation made by Houck was that the new book would be soured for many readers because of a "generalist" overtone that permeated the writing.

He spent a few paragraphs demonstrating to his satisfaction that the specialist was here to stay, a fact he believes is both indisputable and inevitable. Readers were admonished to get over it and get on with the work. This struck us as fertile ground to cover during a pleasant afternoon's conversation. When the bartender's specialty arrived, we started with two questions: What do we mean by the term generalist? And what defines a specialist?

Norah Rudin & Keith Inman
"Proceedings of Lunch", First Quarter, 2002

Enjoy reading the rest of these articles and all the *CACNews* archives at www.cacnews.org

The Editor's Desk

Endings and Beginnings

A theme that has run through most, if not all, of the editorials I have written for the *CACNews* is my personal interest and dedication to the profession of criminalistics. I hope that for those of you who read my words in past issues have been able to take something away that has either inspired you or has caused you to examine how you serve the criminal justice community.

Recently I selected a date in early January 2012 for my retirement from the Los Angeles Police Department. I have been a criminalist with the LAPD for over 33 years and though I am not ready to leave forensic science, I am ready to leave behind the overhead and issues associated with working for a large metropolitan police department and being responsible for the activities of over 200 staff. Though it sounds like an easy choice, the decision wasn't anywhere near that simple.

One of the advantages of having worked in a crime laboratory like the one at the LAPD is there was never a shortage of opportunities to experience a wide range of forensic science challenges and to participate in many different technical disciplines. There were also a wide variety of people available to teach me both the right way and the wrong way to approach casework, supervision and management. I am honored to have had the opportunity to participate in the growth and development of an exceptional laboratory. The hardest part about choosing to leave the laboratory is all the extraordinary people I have met and had the opportunity to work with these many years. But, it is time, and if I have done my job right the laboratory will continue to grow, improve and be an even better place to work.

I have written many times about the importance of being professionally involved and looking beyond your laboratory to improve yourself and the profession. It is through my involvement in the CAC, CACLD, AAFS, ABC and ASCLD that has given me the opportunity to meet many of the superstars of forensic science and learn from their successes and failures. My involvement in the profession and my experience gained from the LAPD is going to set the stage for my future contributions to the profession, which I hope are many. I don't like the term retirement because it sounds like an ending and I intend for my retirement from the LAPD to be a opportunity to be more involved in the profession of criminalistics, as well as enjoying more vacations and hanging with family and friends. Also, just because I am "retiring" doesn't mean someone else gets to bend your ears with their engrossing editorials – I still have about 16 months left in my current term as editorial secretary.

Over the last several months I have had many conversations with friends and colleagues about "retirement." I am very happy for those who are enjoying whatever phase of their profession in which they are currently experiencing. They are happy for me, but do not envy the position I am at in my career. On the converse, I feel sad for those who are counting the days until they retire. Even today, with my date looming, nobody will hear me count the days that are left because I have too many interesting and necessary things to do before someone else gets to sit in the seat I currently fill.

I recently attended the retirement party of one of our criminalists. Her advice to newer people was to "remember that when things are at their

...the reality is your job is going to be a roller coaster ride and it is important to savor the variety of experiences.

Greg Matheson
CAC Editorial Secretary

worse and the job is a drag, just wait, things will get better." She then followed that up with "when things are going great and the job is everything you hoped for, just wait, things will get worse." At first I was taken back by the pessimistic part of her advice, probably because I have been the cause of some of those times when things got worse. But the reality is your job is going to be a roller coaster ride and it is important to savor the variety of experiences. Learn from the highs and more importantly the lows, do your best, and enjoy the contribution you make to society. Don't waste away your time counting the days until your retirement —it will come soon enough. And, as I have said many times before, get involved and contribute to your profession—you will receive much more than you give.

A Decade of Lunch

Inside the 4th quarter issue of 2001 there appeared something a little different: *The Proceedings of Lunch*. It was a new kind of column, a bit edgy and pointed in it's tackling of topics usually heard at panel discussions. For nearly every quarter thereafter, Keith Inman and Norah Rudin have provided us with thought provoking articles that have touched on many of the significant issues faced by forensic scientists. Just look at the spectrum of topical issues in the titles below. I encourage readers to visit the *cacnews.org* website and enjoy these "lunches" again. (No indigestion, guaranteed.) Each and every title represents many hours of discussion, research and writing, so I say thank you, Keith and Norah, for your dedication to forensic science and the CAC, and for letting us eavesdrop on your philosophical forays. Sharing them as you have all these years has brought something special to the *CACNews*. —*G.M.*

To Err is Human…(and Inevitable)

Why Politics is Worse for Science than the Law

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The Experience Fallacy; How Low Can You Go? Should You Just say no?

'Tis the Season The NAS "One Year Later" Commemorative Edition

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The Forensic Disadvantage Suffered by Forensic Scientists

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Which Came First, the Blood or the Print?

Experts on Experts

Articulating Hypotheses – The Null Hypothesis and Beyond

Biological Evidence as Trace Evidence: The Forensic Science of DNA Typing

The Transfer of Evidence and Back Again

FEEDBACK

Merchants of Doubt Among Us

Recently I began reading a book, *Merchants of DOUBT*, by Naomi Oreskes and Erik M. Conway. No, what follows is not a book review. I only read the first few chapters and then rapidly skimmed through the rest. I find the game of "Ain't It Awful!" [*Games People Play: The Basic Handbook of Transactional Analysis*, Eric Berne (1996)] very quickly becomes tiresome.

However, as the authors railed on about the supposedly distinguished scientists who used their bully pulpits to deny or minimize such concerns as acid rain, the ozone hole, secondhand smoke, and global warming, it began to dawn on me that today the very same tactics are being employed by so-called scientists to discredit areas in forensic science.

The title of Chapter 1 is "Doubt is Our Product." It details how the tobacco industry used scientific uncertainty to claim

please turn to page 34

norah rudin & keith inman • the proceedings of lunch

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The Discomfort of Thought
—a discussion with John Butler

Several years ago, we began to keep a list of topics that we thought would either be worthwhile topics for a Proceedings (POL in our vernacular, for Proceedings of Lunch, capitalization optional), or just fun to talk or write about. Recently we added *discussion with John Butler* to the list. Although one of us (NR) has had sporadic conversations with John over the years, we've never actually had the opportunity to share a meal. Fortuitously, all three of us attended the recent CAC meeting in Sacramento (We don't think we provided Mr. Houde with any photo ops, but there were reliable witnesses), and were able to huddle around the salad and other lunch offerings to at least begin this session. John has indicated that he routinely reads the *CACNews*, including this column. And he expressed some fascination with the process of how these Proceedings actually come about. What better way to find out than to participate in one? We agreed to present him with a list of questions to stimulate the discussion, and then to schedule a phone conference so that we could actually dialogue. John had a question of his own: don't we have to be eating lunch, he wanted to know? Isn't that a requirement to participate? We made him affirm (We don't think he swears) that he would be consuming some food while he typed the answers to our emailed questions, thus preserving the namesake integrity of the column.

We note that John wears many hats, and one of them is as unofficial spokesperson, if not ambassador, for SWGDAM (the Scientific Working Group on DNA Analysis Methods, caps required). So we begin with a few questions about this group and its body of work, which naturally segues into other relevant topics.

What, we wonder, was the impetus for the SWGDAM 2010 Autosomal STR Interpretation Guidelines? What was wrong with the previous SWGDAM guidelines? Or what needed updating? John responds by saying that the Quality Assurance Standards (QAS) were, after a decade hiatus, revised in 2009. It was felt that the SWGDAM STR Interpretation Guidelines should also be updated to include more information and specifically to aid with mixture interpretation. The previous SWGDAM STR Interpretation Guidelines were released in 2000 and were very general. The 2010 guidelines expanded the text from 4 pages (1066 words) to 28 pages (9862 words) but followed the same general format. More information was needed on mixture interpretation and statistical approaches as the 2000 guidelines only had a few sentences on these topics without any real detail.

"For the greatest enemy of truth is very often not the lie – deliberate, contrived and dishonest – but the myth – persistent, persuasive, and unrealistic. Too often we hold fast to the clichés of our forebears. We subject all facts to a prefabricated set of interpretations. We enjoy the comfort of opinion without the discomfort of thought."

—John F. Kennedy

Having read and pored over these guidelines for almost 20 years now (the first TWGDAM guidelines were issued in the early 1990's), we wondered what went on behind the curtain; what sort of smoke-filled room and other prestidigitation is required to produce such a document?

At the NIJ Conference in June 2010, John introduced the SWGDAM Autosomal STR Interpretation Guidelines[1] to the forensic DNA analysts in attendance, wherein he described the process for creating SWGDAM guidelines:

[1] The slides are available on the NIST STRBase website at http://www.cstl.nist.gov/biotech/strbase/pub_pres/NIJ2010-SWGDAM-Guidelines.pdf.

- Recognized need or request for guidance on a particular topic received
- A committee is formed and individuals selected to participate (the committee selects a chairperson that directs the efforts)
- Committee works to produce a document
- Committee product provided to full SWGDAM for comment
- Committee revises document based on comments received
- Full SWGDAM group evaluates and discusses the document
- SWGDAM approves based on a membership vote
- Guidance document released to the public most recently through the FBI website *(Forensic Science Communications)*

John amplified during our conversation that, because most work is done only during semiannual meetings with some periodic phone conferences or WebEx meetings, it can take several years to complete this process, depending on the scope of the work. The most difficult part was getting everyone on the committee on the same page so that all used the same nomenclature to mean the same thing when discussing, as one example, thresholds.

One word that grabs our attention is "Guideline;" we frequently see confusion between guidelines and rules or standards. We asked John if he sees the 2010 SWGDAM guidelines as a general guideline or a strict set of rules? Or something else entirely? John believes that guidelines contain principles that, when followed, will lead to better laboratory protocols and individual analyst practice. Guidelines are not standards and should not be used as an audit checklist. In his mind, following properly written guidelines is good science and should make good sense. That being said, guidelines are, almost by definition, a work in progress, and thus will likely require further revision with time and additional experience.

Norah pursues that idea by noting that science is dynamic, while a set of guidelines is static. The moment guidelines are written, they are out of date. As examples, she cites the "ceiling principle" (which of course is neither) from NRC I; the NP calculation for database searches from NRC II; and the 2p "rule", which is really a shortcut, and of course not a rule or even a guideline. And so she presses John: how should labs and analysts proceed in the years in between SWGDAM guideline updates? Is there a way to use and appropriately justify new procedures and protocols?

John points out that any active scientific field is always going to progress and improve, but sagely acknowledges the practical dilemma; the challenge is in dealing with that change while trying to conduct casework. This situation is similar to purchasing a computer. You still have to use the computer for practical reasons long after better and faster computers are released. A key issue is that a set of guidelines is not going to be able to cover every possible scenario. Therefore, thinking will be required based on an understanding of correct principles conveyed by appropriate guidelines.

Keith now asks what is the proper use, then, of these guidelines? John begins by stating that following correct (accurate) guidelines is good science, but Keith quickly interjects with a story. Conversing once with Jan Bashinski, he (Keith) used that phrase "good science," and Jan cut him off with, "Everyone thinks they are doing good science; that phrase carries no meaning without definition." So Keith asks John, what do you mean when you use the phrase "good science," and further, in what way is following guidelines good science? Aren't some guidelines just matters of policy, not necessarily matters of science[2]? John, of course, has an answer. What he has in mind when using the phrase "good science" is that we should not convey meaning that is not directly supported by an analytical result, and that we convey meaning by providing data, rather than mere opinion. As an example, he stresses that we don't want to convey a false sense of the strength of a DNA result by failing to provide a statistic. Good science, in his view, uses data to communicate meaning to someone who is not a scientist, but who must nevertheless make a decision based on a scientific result that you, the analyst, have obtained. And the scientific means of doing that is via data, not opinion.

Norah, though, returns to the issue of thoughtfulness and understanding when it comes to the application of guidelines to casework. Why, she brazenly asks, do analysts follow guidelines without thought? Or, less accusingly, how do you think they follow them?

John responds with one of the most relevant quotes we have ever heard: While delivering the commencement address at Yale University in June 1962, President John F. Kennedy shared some valuable insights that John believes apply to DNA interpretation, particularly the interpretation of mixtures. President Kennedy said,

"For the greatest enemy of truth is very often not the lie – deliberate, contrived and dishonest – but the myth – persistent, persuasive, and unrealistic. Too often we hold fast to the clichés of our forebears. We subject all facts to a prefabricated set of interpretations. **We enjoy the comfort of opinion without the discomfort of thought.**"

Thinking, as discomforting as it may be, John insists, is required to perform mixture interpretation well. Analysts need to understand the principles that underlie mixture interpretation. In his training workshops, he typically focuses on principles, knowing (or at least hoping) that protocols and practice will improve if the basics are understood.

In contrast to his strong belief that interpretation requires thought, he regularly receives questions in which analysts solicit a "cookbook" response. What they often want is a simple recipe (protocol) that they should follow in order to ensure that they will, each and every time, bake the perfect cake (DNA interpretation and report conclusions).

So we put him on the spot a little; will he, we ask, provide an example where an analyst applied guidelines inappropriately, without thought or understanding? In his typical circumspect manner, John starts with a general example of a guideline that seems to be frequently misunderstood or misapplied:

SWGDAM Interpretation Guideline 4.6.2:

"It is not appropriate to calculate a composite statistic using multiple formulae for a multi-locus profile. For

[2] The establishment of an analytical threshold is an example of a guideline based more on policy than data. A 1998 article (Wallin et al., TWGDAM validation of the AmpFISTR blue PCR Amplification kit for forensic casework analysis. *J Forensic Sci* 1998;43(4):854–870.) suggests an analytical threshold of 150 RFU based on the desire of the authors to obtain a full DNA profile, and their data indicating that a specific amount of DNA coupled with a threshold of 150 RFU would achieve this goal. That paper clearly established, however, that DNA alleles could be detected far below that threshold. Subsequently, many laboratories adopted 150 RFUs as their threshold without regard to whether the goal of the analysis was a full profile or the detection of any and all real DNA alleles. A policy based on the arbitrary desire to report only full profiles should not be confused with or substituted for an empirically validated detection threshold designed to distinguish true signal from noise.

example, the **CPI** and **RMP** cannot be multiplied across loci in the statistical analysis of an individual DNA profile because they rely upon different fundamental assumptions about the number of contributors to the mixture."

He goes on to state that apparently many analysts simply follow a protocol written by their technical leader without understanding the validation studies upon which it (hopefully) relies. John further believes that analysts frequently fail to appreciate that guidelines based on single source or two-person mixtures don't apply to more complex mixtures with three or more contributors (more on this issue of complexity later). In particular, he notes that allele sharing can increase the height of STR peaks to a greater extent than might be predicted from the simpler samples, negating interpretation guidelines that depend on peak height ratios. One consequence of this might be a mis-estimation of the number of contributors. He emphasizes that treating loci within a profile differently, whether at the interpretation stage, or for calculating a statistic, is simply not supported by available data.

John then goes on to relate a question that he received, along with a portion of his response, as an example of failure to appreciate the scientific foundation for a guideline. The question asked:

In section 3.5.8 (Interpretation of Potential Stutter Peaks in a Mixed Sample), it is listed that 'If a peak is at or below this expectation, it is generally designated as a stutter peak. However, it should also be considered as a possible allelic peak, particularly if the peak height of the potential stutter peak(s) is consistent with (or greater than) the heights observed for any allelic peaks that are conclusively attributed (i.e., peaks in non-stutter positions) to the minor contributor(s).'

In your opinion, does this recommendation apply just to the statistical step of the analysis or does it mean that the stutter peak is to be considered a possible allele peak in the inclusion/exclusion phase of analysis? If we are doing unrestricted CPI, is it ok to estimate the number of contributors and delete a stutter peak if we are confident all contributors are already represented at a locus. Some are proposing that we delete the stutter peak at the inclusion/exclusion phase but then add it in when doing the CPI calculation. ***Is it ok to have that disconnect between your interpretation and statistical method?*** *Or if we have chosen to use CPI for our statistic should those rules apply to the interpretation of the sample (i.e. don't use assumptions of the number of contributors when determining alleles suitable for inclusion/exclusion.)*

In section 4.6.3, it is listed that 'When using CPE/CPI (with no assumptions of number of contributors) to calculate the probability that a randomly selected person would be excluded/included as a contributor to the mixture, loci with alleles below the stochastic threshold may not be used for statistical purposes to support an inclusion. In these instances, the potential for allelic dropout raises the possibility of contributors having genotypes not encompassed by the interpreted alleles'.

A portion of John's response included:

Your interpretation and statistical methods should have consistent assumptions and go together for each assumption being made (e.g., you may interpret a mixture under alternative sets of assumptions). Thus, in my opinion, you should be consistent with handling the stutter peaks. With use of unrestricted CPI and a peak at a stutter position below the stochastic threshold, the locus should be dropped from statistical consideration because it may be possible that allele dropout has occurred at that locus and a sister allele of the low level peak is missing. With the possibility of allele dropout at a locus, CPI is not an appropriate statistic at that locus.

John sees this exchange as an archetypal example of the failure to understand the very foundational knowledge upon which the guidelines were written. Keith adds that what the question illustrates is a lack of understanding of the limitations of the evidence, the test, or the interpretation. When analysts apply a statistical tool incorrectly, the disconnect can often be traced to a failure to understand and appreciate one or more of the aforementioned limitations. While CPI type calculations have been widely adopted due to their simplicity, many apply them to profiles for which they were never intended, thus pushing this simple tool far past where it should be used.

Keith continues on this theme by observing that understanding physical evidence analysis is much more about understanding limits rather than capabilities, both of the evidence and the test employed. Unless you have stressed your analytical system until it fails with known samples, you won't know when, with a real piece of physical evidence, you are standing on firm ground, when you are on thin ice, and when you are actually in the middle of a large body of water about to be permanently submerged. Norah provides an example; low template DNA methods and technology were developed without a concomitant development of interpretational schemata. She argues that we should not perform any type of analysis if we lack a theoretical framework for understanding the results that we get. John responds with two keen observations.

First, we should spend as much time developing our interpretation skills as we do our methodological skills. Technological progress (more sensitivity in detecting DNA, for example), can be a double–edged sword; without equivalent progress in interpretation skill, we are just as likely to cut ourselves as we are the target.

Second, John proposes the concept of a "complexity threshold," for which research theory and validation data establish the limits of our ability to interpret a result. He uses the stochastic threshold to illustrate his point; in most laboratories, this threshold is established by testing either single source or two-person mixtures. If we now attempt to apply that stochastic threshold to more complex data (three or more-person mixtures), we can easily be mislead because it does not take into account the additional layers of complexity. In other words, absent subsequent validation testing for three or more-person mixtures, we simply cannot support any conclusion drawn for results that are more complex than our validation data. We also discuss how this might be applied at the level of physical evidence. Should laboratories encourage or even accept gun and knife handle swabs, or other contact DNA samples, knowing that a high likelihood exists that they will struggle with interpreting the data?

As a member of the academic community, Keith wants to know whether more education might improve the situation? And if so, how? What kind of education would help? What do analysts need to know to use a set of guidelines thoughtfully and intelligently? He is quick to point out that it is not necessarily a matter of the degree conferred; many people know how to think, regardless of the piece of paper nailed to the wall in their office or study. And John's experience supports that notion.

A continuing frustration for John is that many analysts treat continuing education as a checklist; their agency sends them to a class, they sit there for 8 hours, with no feedback to determine whether or not they absorbed any of the material,

and everyone is content to check the accreditation requirement box for continuing education. He believes that some sort of assessment is required if such classes are truly meant to further the expertise of the analyst.

But Keith takes note of a large body of research on adult learners, especially work that emphasizes the need to produce life-long learners, defined as those who have learned how to teach themselves. Current work suggests that this is a matter of providing the appropriate challenge in the right atmosphere. The task of the profession is to engage forensic scientists as lifelong learners so that when given a new set of guidelines, they don't use them as a cookbook or as a checklist, but can successfully learn the concepts, theories, and experiments supporting the prose on the page in order to more competently analyze and interpret their evidence.

The training of a DNA analyst is the time when the attitude of learning and searching is best nurtured. Theoretical concepts such as experimental design would establish a foundation useful for reading literature on new technology and interpretation techniques, while further teaching and practice in the use of statistics should produce greater confidence when performing calculations on increasingly complex profiles. New analysts should also, as part of their training, familiarize themselves in detail with laboratory validation data. Why was a specific threshold selected—and based on what data? And what binder holds that data?

We collectively wonder what factors contribute to the seeming disinclination of forensic DNA analysts to continue deep learning. John provides an interesting laundry list of suggestions:

- Analysts are not engaged; they come to a class to be entertained rather than informed;
- Analysts want simple sound bites rather than in-depth explanations;
- Analysts believe that they are not allowed to fail, and yet they must be allowed to fail if they are to learn;
- Analysts are afraid of looking dumb in front of their peers; they would rather remain silent rather than ask a question that could clarify a concept for them;
- Some analysts are engaged and interested, but run into roadblocks back at the lab. "I can't implement this new technique because my Tech Lead won't let me;"
- A roadblock of fear also exists, including but not limited to:
  - Fear of an inability to defend one's thinking,
  - Fear of getting clobbered by a defense attorney who might question your approach,
  - Fear of not being able to easily check all the boxes on the audit checklist, and possibly jeopardizing grant funding, CODIS participation, and accreditation.

John laments that the forensic DNA culture is not one in which members are encouraged to think deeply about what they are doing; they skate across the surface to get the job done, actually welcoming the ability to easily apply preconceived guidelines that don't require much thought. The guidelines, and the laboratory protocols written from them, are combed for the exact situation presented by an instant case, so that original thinking is not required. Keith suggests that the only pressure felt by caseworkers is to get the report out; any other pressures are squeezed out or ignored. The message heard is that the analyst can't afford to think about a problem or an issue for a week; results are needed today.

John reiterates that guidelines cannot be written to cover every situation. He looks at it as a pair of glasses; you want the best glasses to clearly see the data. The better the analysts understand the guidelines, the more efficient they will be in the laboratory. They won't waste time spinning their wheels, discussing some issue without ever understanding it, and therefore taking forever to get the case out. He continues that you need the optimal prescription to see the world properly and clearly. With the correct prescription, you suddenly realize what you weren't seeing – the fuzzy blurs become pinpoints of light. If analysts understand the guidelines better, they will be ***more*** efficient in the laboratory, and not waste time endlessly discussing what to do with results from a piece of evidence, or searching in vain for a solution to their situation in the protocol. When genetic, statistical, and forensic principles are understood more completely and fully, the process becomes more efficient, rather than less efficient.

We think we've taken up enough of his time, so we thank John for providing thoughtful responses, and ask whether we can prepare this into a Proceedings. His response:

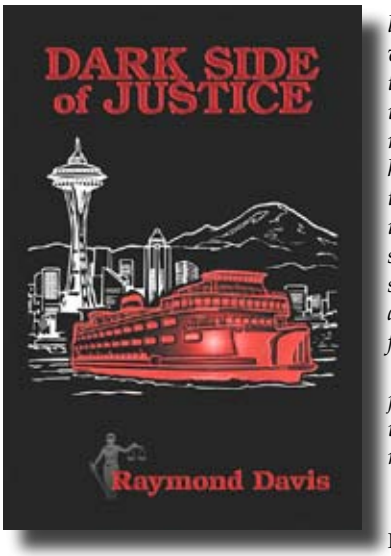
"As long as I'm not eaten for lunch."

We promise.

Announcing in 2012...

Dark Side of Justice, a new novel by CAC member Raymond J. Davis, is due out early next year.

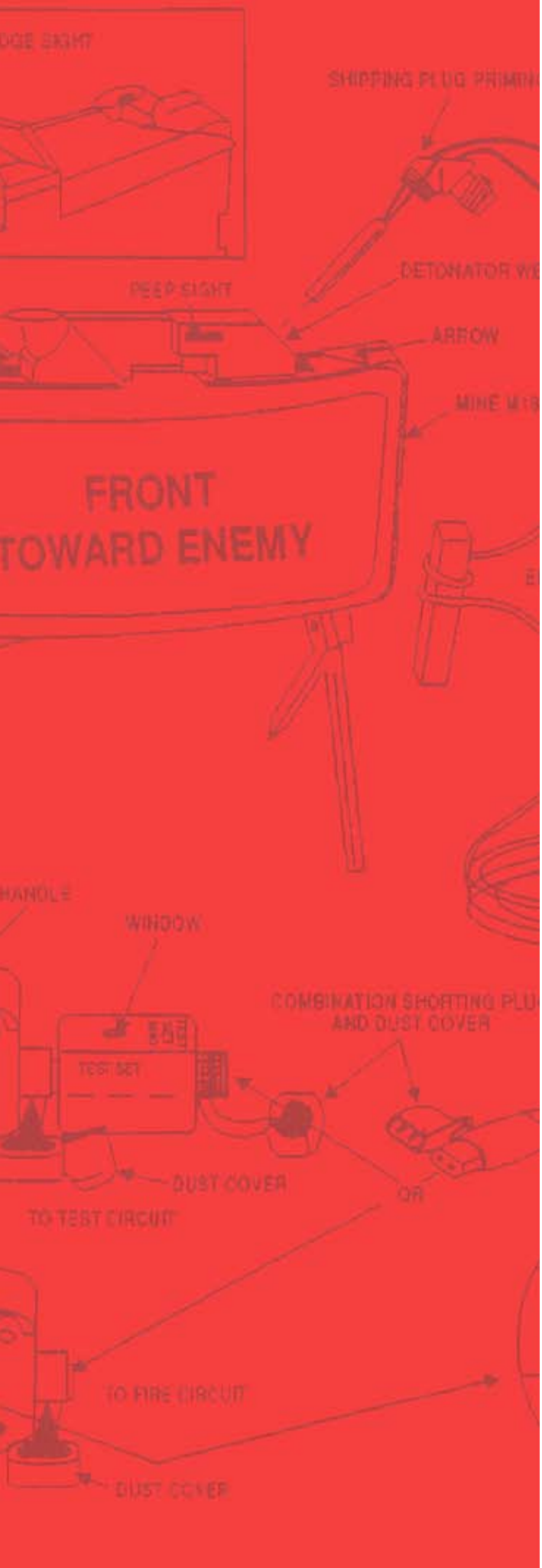
"Carl Bowman, a private forensic scientist in Seattle, Washington has been targeted by a secret cabal of cops investigating the Green River serial murder cases. They believe he has evidence implicating them for their failure to arrest the prime suspect, Gary Ridgway. Carl seeks safety in his ancestral homeland, Sweden, to wait out the threat and to take the opportunity to learn more about his heritage.



Carl's escape to safety lands him back into action when called upon to use his technical skills to solve an unexplained death at a European Conference only an hour's drive from his sanctuary. In the midst of the investigation, Carl receives startling news that will send him back to Seattle and a confrontation with law enforcement authorities.

Carl's odyssey to seek justice leads him instead to ultimately find the single most important thing in life."

RAYMOND J. DAVIS is a forensic scientist with over thirty years of experience in both private and government crime laboratories. He holds a degree in chemistry from CSU Sacramento. As the former editorial secretary of the CAC, he oversaw the publication of the quarterly journal, the *CACNews*. He also teaches law enforcement personnel in the techniques of effective courtroom communication.



ATF
San Francisco Laboratory
Explosives Seminar

On October 25, 2011, an explosives seminar was hosted by the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) Lab in San Francisco for the California Association of Criminalists 2011 Fall Seminar. The seminar covered a lecture portion on various explosives and improvised explosive devices; a practical exercise involving three homemade explosive clandestine laboratories; and a bomb range demonstration involving an ATF Explosives Detection Canine and detonation of various types of explosives at the Yolo County Bomb Range in Davis.

by Kelly Beadle and John Jermain

Commercial Explosives:

An explosive is any chemical compound or mixture whose purpose is to function by rapidly releasing gases from a confined space accompanied by high temperature, violent shock, and a loud noise. Based on the characteristics of explosives, they can be divided into two categories: low explosives and high explosives. Low explosives are mixtures of chemicals which have a rate of combustion less than the speed of sound (3,300 feet/second). These types of explosives cannot support a detonation wave and therefore must be confined in order for an explosion to occur. Some types of commercial low explosives include black powder, black powder substitutes, smokeless powder, and pyrotechnics. High explosives are chemical compounds or mixtures that have a velocity of detonation (VOD) greater than the speed of sound and do not require confinement. Because of their different uses and characteristics, high explosives are subcategorized into primary high explosives, secondary high explosives, and blasting agents. Primary high explosives, such as lead styphnate (VOD = 17,000 feet/second) and mercury fulminate (VOD = 16,400 feet/second), are extremely sensitive to heat, shock, and friction that they are not commonly used as a bulk explosive. These types of explosives are utilized in blasting caps, which initiate insensitive secondary high explosives such as trinitrotoluene (VOD = 22,600 feet/second) and composition C-4 (VOD = 26,000 feet/second). Secondary explosives have a much greater detonation velocity than primary explosives, and given their relative insensitivity to heat, shock, and friction, they are used in bulk in many explosive charges. Blasting agents are mixtures that have a detonation velocity above the speed of sound (VOD range: 8,000 to 15,000 feet/second), but are insensitive to any type of heat, shock, or friction, including a blasting cap. As such, they require a higher detonation pressure to explode, which is usually supplied by a booster made up of a secondary explosive. Blasting agents tend to be used in extremely large quantities (hundreds of pounds) with ammonium nitrate and fuel oil (ANFO) being the most widely used explosive in the United States.

Homemade Explosives:

Homemade explosives are materials produced from common household chemicals that when mixed together become explosive. These mixtures contain an oxidizer and a fuel which are either mechanically mixed together or molecularly bonded during a chemical reaction. Information on the production of homemade explosives is readily available via the internet, underground journals (The Anarchists Cook Book or Poor Man's James Bond), or military field guides. Terrorist groups are also developing their own literature describing the manufacture of explosives. The Summer 2011 edition of Al Qaeda's Inspire magazine gives a step-by-step recipe for the production of triacetone triperoxide (TATP). However, this information can be incomplete or omit safety precautions for handling these sensitive types of materials.

Homemade explosives are generally grouped into three categories based on the main oxidizer present: chlorates/perchlorates, nitrates, and peroxides. Potassium chlorate (KClO3) and potassium perchlorate (KClO4) are common oxidizers in homemade mixtures. Potassium chlorate is the primary ingredient in match head composition and is also used in pyrotechnics. It is very unstable and mixtures with potassium chlorate are highly reactive and generally unsafe. Potassium perchlorate is also used in pyrotechnics, but is much more stable than chlorate mixtures. Explosives mixtures commonly seen with these oxidizers include fuels such as red phosphorus (Armstrong's Mixture), aluminum powder (flash powder mix), and Vaseline (Poor Man's C-4). A mixture of 2,000 pounds of potassium chlorate, aluminum, and sulfur was used to bomb a nightclub in Bali in 2002, which killed 202 people and injuring hundreds more.

Although black powder is a common commercial product, it can also be homemade. Potassium nitrate (KNO3), which is found in stump remover, is mixed with sulfur from plant food and charcoal. Effectiveness of the mixture depends on factors including the ratio of ingredients and particle size. Ammonium nitrate (NH4NO3) is a well known fertilizer that has been used in several terrorist bombs, and is especially prevalent in improvised explosives devices throughout Afghanistan today. Timothy McVeigh used approximately 5-7,000 pounds of ammonium nitrate and nitromethane (racing fuel) to bring down a large portion of the Alfred P. Murrah Federal Building in Oklahoma City, Oklahoma, in 1995. Ammonium nitrate can also be mixed with many other fuels to make explosive mixtures. Urea nitrate is an explosive molecule which can be easily made from urea (46-0-0 fertilizer) and nitric acid. One of the most notable uses of urea nitrate in American history was the first World Trade Center bombing in 1993, in which approximately 1,500 pounds of the explosive was used.

Peroxide explosives are the most sensitive of all homemade explosives. Although hydrogen peroxide in concentrated forms can be mixed with various organic fuels to form explosive mixtures, it is more commonly used in chemical reactions to make triacetone triperoxide (TATP) and hexamethylene triacetone diamine (HMTD). When hydrogen peroxide is mixed with either acetone or hexamine (fuel tablets), it forms a dangerous primary explosive. Both TATP and HMTD are highly sensitive to heat, shock and friction. The 2010 "Bomb Factory" in Escondido, California, in which George Jakubec had manufactured approximately 9 pounds of HMTD demonstrates the safety hazard of HMTD. It was discovered by a gardener stepping on a small amount in the back yard causing it to detonate. TATP was also recently used in the failed attempt by the Christmas Day/Underwear Bomber to initiate a high explosive, PETN.

Hypergolic mixtures and overpressure devices involving chemical mixtures that spontaneously ignite or release large amounts of gas products when mixed were also discussed at the seminar. Some hypergolic mixtures have been seen to initiate Molotov cocktails, but are not very prevalent. Overpressure devices, aka "bottle bombs," litter YouTube and are very common among juvenile offenders. These types of devices usually include some kind of pool or drain cleaner mixed with brake fluid or aluminum foil. The pressure builds up in the soda bottle until it bursts. These types of devices can cause chemical burns or other injuries.

Improvised Explosive Devices:

An improvised explosive device (IED) is a combination of components that are neither designed nor produced to be used in conjunction with each other and that, when assembled together, constitute a mechanism that has the capability of exploding and causing personal injuries and property damage. When constructing an explosive device, there are two essential components needed: the main explosive charge and the fuzing system. However, many devices employ ad-

ditional components such as a switch (safe to arm or fire), a power source, a container, and enhancements to the explosive device such as shrapnel.

The three basic types of switches that are associated with the fuzing system of a device are command, time, or victim operated. Command switches may involve the device being wired into a cell phone, radio transceiver, keyless car entry, or a pager. On January 29, 1998, Eric Rudolph killed Birmingham Police Officer Robert Sanderson by initiating a servo motor attached to the explosive device with a RC controller. Time switches may involve the device being initiated by a digital timer, watch, chemical delay or a pyrotechnic fuse. On December 11, 1994, Ramzi Yousef detonated a bomb on Philippine Airlines Flight 434 killing one passenger and injuring dozens more. The bomb had a four hour delay timer attached to fuzing system which he set just before he exited the plane on a stopover in Cebu before continuing on to Tokyo. A victim operated switch may also involve the device being initiated by passive infrared, tension pull or release, pressure release, or trembler, such as a mercury switch.

In order to start a detonation or deflagration of an explosive material, an IED must either have an electric or non-electric initiator. Electric initiators include blasting caps, exploding bridge wires (EBW), electric matches, or improvised igniters. Non-electric initiators mainly involve a burning fuse to initiate the explosive material. If an electrical initiation system is used in an explosive device, a power source must be utilized to provide a sufficient amount of electrical energy. In the case of Eric Rudolph, he varied the power source on each of his devices, using a 12 volt lantern battery for the Centennial Olympic Park bombing in Atlanta, D-cell batteries for the Sandy Springs Clinic bombing, and 6 volt lantern batteries for the bombing of the Otherside Lounge.

A container may or may not be utilized in the construction of an explosive device, although most bombers do use a container in one way or another. Containers can be used to conceal an IED, transporting or shipping the IED from one point to another, and as confinement for the explosives' main charge, especially for low explosives. But in the end, there are three factors that directly affect the construction of an IED: the ingenuity of the builder, the skill of the builder, and access to explosives. When commercial explosives cannot be readily obtained, the bomb builder relies on his skills and ingenuity to manufacture explosives in order to construct the explosive device.

Homemade Explosive Clandestine Laboratories:

In creating the setting for the homemade explosive practical exercise, three types of scenarios were utilized based on actual incidents that have occurred in the United States: The bombing of the World Trade Center on February 26, 1993, the bombing of the Alfred P. Murrah Federal Building in Oklahoma City on April 19, 1995, and an adolescent experimenting with explosives in his backyard. The precursor chemicals for the three scenarios were purchased from Target, HobbyTown USA, Home Depot, Orchard Supply Hardware, RadioShack, Rite Aid, Smart&Final, and a farm supply warehouse in Fairfield. Once the materials were chosen for each scenario, ATF Interns Mary Keehan and Jebel Iniguez constructed the homemade explosive clandestine labs.

The first scenario involved an international terrorist manufacturing urea nitrate and targeting a prominent landmark. This scenario was loosely based on the 1993 World Trade Center bombing in New York where Ramzi Yousef and five other terrorists detonated a 1,500 pound urea nitrate vehicle bomb in the parking garage under the North Tower. This scenario involved the manufacturing of urea nitrate by mixing urea fertilizer (46-0-0) with concentrated nitric acid. This main charge would be detonated by a homemade explosive booster comprising of ammonium nitrate and aluminum. The booster was made by misting metallic spray paint onto ammonium nitrate prills, which were obtained from commercially purchased cold packs. Finally the booster would be initiated by an improvised blasting cap containing triacetone triperoxide, a sensitive high explosive which is produced by mixing pool sanitizer (hydrogen peroxide), nail polish remover (acetone), and drain cleaner (sulfuric acid).

The "Tire Shot"

Demonstration of high-explosive detonated inside a rubber tire. Final frame shows the tire landing in the original launch site after being lofted over 100 ft.

The second scenario involved a domestic terrorist manufacturing an ammonium nitrate-based explosive device. This scenario was loosely based on the 1995 Federal Building bombing in Oklahoma City where Timothy McVeigh detonated a 7,000 pound vehicle bomb comprised of ammonium nitrate and nitromethane. This scenario involved the manufacturing of ammonium nitrate by mixing together equal portions of ammonium sulfate and calcium sulfate. The resulting solution was filtered and dried to allow the formation of ammonium nitrate crystals. Commercially purchased racing fuel (nitromethane) was added to the ammonium nitrate, which now represented the main charge of the explosive device. The main charge would be detonated by a homemade explosive booster containing potassium chlorate and Vaseline, commonly referred to as "Poorman's C-4". Finally the booster would be initiated by an improvised blasting cap containing hexamethylene triperoxide diamine, a sensitive high explosive which is produced by mixing hair care bleach (hydrogen peroxide), sour salt (citric acid), and fuel tablets (hexamine).

The final scenario involved an adolescent experimenting with homemade explosives and devices in his parent's backyard. This is the most common type of scenario law enforcement officials encounter in the United States, with approximately two-thirds of all explosive incidents involving juveniles. This scenario involved an adolescent manufacturing black powder and flash powder, and placing the homemade explosives into improvised devices. The homemade black powder was prepared by mixing stump remover (potassium nitrate), plant food (sulfur) and Kingsford charcoal. The black powder was place inside a pipe bomb device, which was initiated by three different types of homemade electric matches, fine mesh steel wool, pencil lead, or a resistor. Flash powder was also being manufactured by mixing potassium perchlorate, plant food (sulfur), and aluminum foil finely ground in a blender. The flash powder was placed inside cardboard tubes, sealed on both sides with plastic caps, and initiated with commercially purchased pyrotechnic fuse. Additional explosive devices included tennis balls and CO2 cartridge devices filled with match heads, and bottle bombs filled with toilet bowl cleaner (hydrochloric acid) and aluminum foil.

ATF Explosives Detection Canine:

ATF Certified Explosives Specialist Scott Dvorak and his explosive detection canine "Valdez" demonstrated the important role that dogs perform in finding explosives in the field. Valdez is a seven year old Labrador Retriever and has been working with Scott for the past five years. For the demonstration, Scott used a shell casing and parts from a fired handgun that would have utilized a double base smokeless powder. In order to detect the location of the firearm components, Valdez would have to detect the odors of nitrocellulose and nitroglycerin, the two main explosive components in double base smokeless powder. When he correctly detected the odor and identified the location of the firearm component, Valdez exhibited the desired behavior: sits and looks to Scott for his food reward.

ATF created the Explosives Detection Canine Handler program in the early 1990s and has since trained and certified more than 700 canines for state, local and federal law enforcement agencies as well as the State Department. Currently ATF-trained canines are at work in more than 20 countries, including Afghanistan and Iraq. ATF's training methodology exposes canines to six basic explosive groups, including chemical compounds that are common to an estimated 19,000 explosives formulas enabling the dog to detect enough to elicit the response. Food is the primary reward, with verbal and physical praise the secondary reward. As soon as the dog responds correctly, verbal praise (secondary reward) is begun and creates a bridge until the food (primary reward) can be delivered. Eventually, the canine's behavior is modified to give a specific trained response (sitting and looking to the handler for the reward), which is the desired behavior. The dog remains in the final response position until the reward process is initiated. In the ATF program, the dogs are usually allowed to work until they are nine, sometimes ten years old. The reason for this is the program wants them to have a few years to just be a dog, especially having to work for their food everyday for so many years. Valdez has less than three years before retiring from ATF, after having such a distinguished career as an explosives detection canine. We wish him the best!!!

Calico Press

Live Explosives Demonstration:

ATF Explosives Enforcement Officer Mike Morgan presented the live explosives demonstration portion of the seminar. Before joining ATF in 1999, Mike was a Gunnery Sergeant in the United States Marine Corps' Explosive Ordnance Disposal (EOD) group for twelve years, where he specialized in Ground Ordnance and Improvised Explosive Devices. Assisting Mike on the explosives demonstration was ATF Certified Explosives Specialist Brian Parker, ATF Explosives Technical Programs Specialist Greg Smith, Sergeant Jason Winger of the Yolo County Bomb Squad and Sergeant Mark Harri of the Sacramento Police Department Bomb Squad.

The demonstration began by showing the explosive power of an electric blasting cap placed inside an empty paint can. Blasting caps contain a small amount of primary explosive which initiates a larger base charge in the blasting cap. A blasting cap is used to detonate less sensitive high explosives such as Composition C-4 and TNT.

The next explosive demonstration involved a low explosive burn display of approximately 3 pounds of black powder and smokeless powder. When ignited by an electric match, the smokeless powder burned slowly from particle to particle giving off a bright orange flame and no smoke. When the black powder was ignited, it was instantaneously consumed and gave off a large cloud of white smoke. What remained was a residue trail in the dirt showing two distinctive burn patterns, one more sooted than the other. Mike explained how a forensic chemist could analyze the residue and determine what the original explosive materials were. If black powder was used, post-combustion compounds such as potassium sulfate, potassium carbonate, and potassium sulfide would be present. If smokeless powder was used, chemical compounds such as nitrocellulose, dinitrotoluene, and nitroglycerin may be present.

The next group of blasts involved showing the overall performance of various high explosives. The explosive shots in this category ranged from a slow detonating explosive with a velocity of detonation (VOD) of 12,000 feet/second to Composition C-4 with a VOD of 26,000 feet/second. Some of the explosives detonated were Kine-Stick (a binary mixture of ammonium nitrate and nitromethane), DYNO®AP emulsion explosive, a cast booster containing a 50/50 mixture of PETN and TNT, and Composition C-4.

(above) Authors Kelly Beadle and John Jermain. (top right) Scott and "Valdez" demonstrate canine explosive detection.

Then 200 feet of PETN-based detonating cord was initiated with a blasting cap. The students were asked to determine which side was initiated with the blasting cap and in which direction (left or right) was the explosive shockwave traveling through the detonating cord. Given that detonating cord has a VOD of 22,000 feet/second or 4 miles per second, determining the direction the explosive shockwave is traveling is nearly impossible.

The final explosive shots exhibited were what ATF likes to call the "Hollywood Shots" and included the "Wall of Fire" and the "Tire Shot". For the "Wall of Fire", a length of detonating cord was horizontally stretched between two pieces of wood. Three gallon-sized jugs of gasoline were hung just below the stretched detonating cord. A small piece of detonating cord was placed into each of the gallon jugs and attached to the main explosive line. When the detonating cord was initiated with a blasting cap, the explosive in the detonating cord (PETN) instantly ignited, which also ignited the gasoline giving the "Wall of Fire" effect. [*See this issue's cover].*

The "Tire Shot" consists of a rubber car tire lying on the ground with a cast booster explosive placed inside. When the cast booster is detonated, the blast pressure launches the tire approximately 100 feet into the air. The goal of the bomb tech is to place the cast booster into the tire in such a matter that the tire will land is exactly the same spot where it was originally.

Conclusion:

The seminar provided introductory information regarding commercial explosives, homemade explosives, and improvised explosives devices. Expert training on the study and handling of explosive materials takes years to complete. This course was intended to provide general knowledge on the available types of explosives. For additional questions or comments regarding this material, please feel free to contact Forensic Chemist Kelly Beadle at (925) 280-3608 or Kelly.Beadle@atf.gov. Forensic Chemist John Jermain may be contacted at (925) 280-3607 or John.Jermain@atf.gov.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EDUCATION & Training

"A Bridge to the Future of Forensic Science"

The hosts for the CAC Spring 2011

seminar were U.C. Davis and the California Criminalistics Institute, so it was fitting that the program was filled with presentations from students and teachers in the forensic science programs up and down the state. Your tireless seminar crew included Nancy Kniskern, Gemma Marlia, Gillian Currie, Ashley Chu, Traci Carlson, David Fevig, Jennifer Madrid, Neda Koshkebari and Isaac Eaquinto, and hosts Cecilia von Beroldingen and Fred Tulleners. All of whom made a comfortable space to enjoy technical presentations while meeting old friends and making many new ones.

If it's been a while since you've attended a CAC seminar, make plans to join us for the next one!

The 2010-11 CAC Board of Directors (top). The meeting opened with remarks by Larry Wallace and Eva Steinberger (above), Fred and Cecilia. (left) Vendor sponsors each gave a welcome and invitation to their tables (below).

2011 Fall Seminar

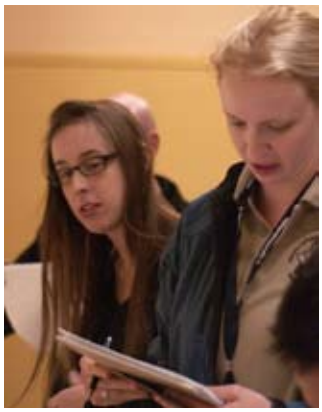












Among the five workshops offered were "ATF Explosives" *(top and middle)*, "Non-Human DNA" *(above, r)*, and "Gas Chromatography" *(below)*.

Zambian Police Officials Visit the CAC Seminar

Mr. Tresphord Kasale, Chief for the Victim Support Unit and Mr. Katongo Chipompo, Forensic Scientist and Assistant Commissioner of Police, both from The Zambian National Police Service, attended the Fall DNA Workshop and CAC conference. *(Shown above with CAC Treasurer Laura Silva.)*

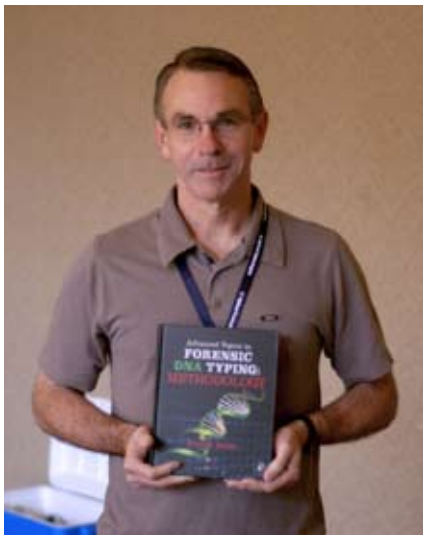
The officials spent three weeks in the US as part of a program to enable healthcare, forensic, and police professionals from the Republic of Zambia to engage in practical training programs in the United States. Funded by the Georgian Foundation (http://georgianfoundation.org) through the Zambian Center for Child Protection program, the overall goal of the program is to create and overhaul the current medical, investigative, laboratory and judicial systems related to sexual abuse of children in the country. Child sexual abuse cases are rife in Zambia. Thousands of children are known to be sexually abused annually. Combined with very HIV prevalence and low prosecution rates due to lack of evidence, there is a tremendous improvement opportunity in areas of police and advocacy support, medical and DNA evidence processing.

The training program focuses on procedures for collecting, transferring, storing and maintaining a tight chain for sexual assault evidence. The program is also supporting the development and accreditation of the first forensic DNA laboratory in Zambia with the help of volunteers and cooperating partners. Key to this goal is to provide the Zambian officials an opportunity to visit US forensic science laboratories to observe how they function. The attendance at the Fall CAC conference was a cornerstone of the visit and allowed them invaluable opportunities to meet people in our forensic science community. With the help of professionals in the US and abroad, they are very excited to move this vision forward to a reality. For more information about the program or ways you can be involved, please contact the organization's forensic training coordinator, Laura Silva (lauradlud@gmail.com) or visit the website georgianfoundation.org.

—Laura Silva

East Meets West

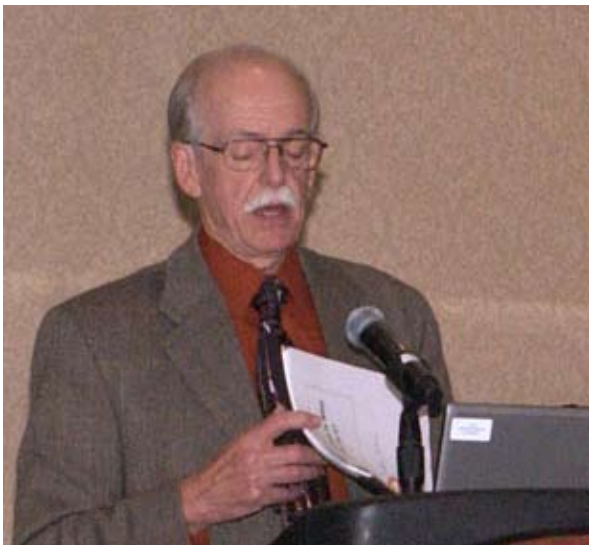
Northeastern Association of Forensic Scientists President Peter Diaczuk *(l)* enjoys some CAC hospitality (and a CAC T-shirt) with President Kevin Andera. Police officer/novelist Robin Burcell signs copies for her fans *(bottom)*.



"Ghost" Presentation Worked Well

In what may have been a CAC seminar first, a live presentation was given by an off-site speaker. Using "Go-To-Meeting" software, Jason Nawyn gave his paper on synthetic cannabinoids from his location in the southeastern US. "We're finding it's very powerful in bringing in new speakers," said moderator Jerry Massetti *(seated, above)*. The connection was bidirectional and allowed the speaker to answer questions from the audience. (There was no vaporous image, just a disembodied voice.)

2011 Fall Seminar



Wine chemistry (along with consumable samples) was the fare for the banquet speaker, Dr. James Brown *(top)*. New members are welcomed to the CAC by Adam Dutra *(below)*.

Ethical Dilemmas

Discussion Corner with Carolyn Gannett

Share your thoughts and dilemmas at
www.ethicsforum.cacnews.org

Different Conclusions; ASCLD/LAB's Guiding Principles

The Scenario: *You work for a public lab for which you've completed an analysis. The defense team hired an outside expert to review your work, and that expert disagrees with one of your primary conclusions. He contacts you a couple months before trial and says he would like to discuss the matter. What should you do?*

Discussion: This scenario is directly addressed by seven associations* in their ethics documents, as follows:

AFTE, CAC, NWAFS: *...every effort be made by both examiners to resolve their conflict before the case goes to trial.*

MAAFS, MAFS: *If there is a conflict of results, every effort should be made to resolve this prior to trial.*

SWAFS: *It is considered proper for a forensic scientist to evaluate evidence previously examined by another. Any discrepancies noted should be discussed prior to the case going to court.*

IABPA: *Members who are aware that another expert has arrived at a different conclusion or opinion from their own should, if possible, give due consideration to potential sources of that difference. When possible, members should attempt resolution of the difference.*

A related ethical concept is the recognition that honest differences of opinion occur:

ANZFSS, SMANZFL: *There should be a preparedness to concede that other opinions, being contrary to or at variance with one's own can be honestly held.*

IABPA: *Members should realize that there can be legitimate differences of opinion.*

Prior to arranging a discussion with the other expert, it would be prudent to inform the attorney of your decision.

Note that ASCLD/LAB's *Guiding Principles of Professional Responsibility for Crime Laboratories and Forensic Scientists* does not address this scenario. It also lacks two principles found in several other associations' documents: *fairness* and *confidentiality* (based on a survey of three dozen forensic science ethics documents—see www.cacnews.org > "Ethics" tab > "Summary of Code Principles").

In spite of these shortcomings, some associations are using ASCLD/LAB's document as a springboard for their own ethics codes. IAI, SOFT, and SWFS have recently adopted such documents. A decision to do so could be influenced by the fine print at the end of ASCLD/LAB's document:

The draft of this document was distributed to thirty (30) forensic science organizations and several legal commentators for comment. The comments received were considered and many suggestions incorporated into the final version.

I've asked my ethics students (over 350 to date) what they think the fine print means, and the typical reply has been: the document is well vetted by the forensic science community. Yet, when I ask the same students whether they remember being offered a chance to review the draft, the overwhelming response is, "No." In fact, I can count on one hand the number of students who have said they remember seeing the draft. And that's about all they remember about it. Based on the students' responses, the document appears not to be well vetted at all, in spite of the wording in the fine print.

The fine print contains misleading language. The draft was *not* distributed to the membership of thirty (30—in case you can't read the word "thirty") organizations. It was sent to *one individual* in each of 30 organizations. And, it appears that those individuals typically did not distribute it to their membership for review. Ironically, "Avoid misleading language" is one of the ethical concepts found in many forensic science ethics documents, including ASCLD/LAB's (the following emphasis in bold is my own):

ASCLD/LAB 18: *Opinions are to be stated so as to be clear in their meaning.* ***Wording should not be such that inferences may be drawn which are not valid****, or that slant the opinion to a particular direction.*

Another common ethical principle in forensic science ethics documents is: *be forthcoming.* It's in ASCLD/LAB's document, too (emphasis in bold is my own):

ASCLD/LAB 14: *Present* ***accurate and complete data*** *in reports, testimony,* ***publications*** *and oral presentations.*

It could be argued that to be in compliance with its own ethics document, ASCLD/LAB would need to be forthcoming about the misleading language in the fine print of its publication. If ASCLD/LAB were to do this, I would hope that its act of being forthcoming to the forensic science community would be effective, unlike its attempt to notify the same community of its draft publication's availability for comment.

ASLCD/LAB's ethics document is not a bad one. But, it is by no means the best the forensic science community can produce, as evidenced by its lack of two principles commonly found in other such documents. Given that associations are already starting to use ASCLD/LAB's document as a template, ASCLD/LAB might best serve the forensic science community by finally having its document well vetted by the forensic science community as soon as possible.

***Acronyms:** AFTE—Assoc. of Firearm and Tool Mark Examiners; ANZFSS—Australian and New Zealand For. Science Soc.; ASCLD/LAB—Am. Soc. of Crime Lab. Directors / Laboratory Accreditation Board; CAC—California Assoc. of Criminalists; IABPA—Int'l Assoc. of Bloodstain Pattern Analysts; IAI—Int'l Assoc. for Identification; MAAFS—Mid-Atlantic Assoc. of Forensic Scientists; MAFS—Midwestern Assoc. of For. Scientists; NWAFS—Northwest Assoc. of Forensic Scientists; SMANZFL—Senior Managers of Australian and New Zealand Forensic Science Labs; SOFT—Society of For. Toxicologists, Inc.; SWAFS—Southwestern Assoc. of Forensic Scientists; SWFS—Soc. for Wildlife Forensic Science

ABSTRACTS Fall Seminar 2011

Brady v. Maryland (1963) 373 U.S. 83

Michael Chamberlain, Deputy Attorney General, California Department of Justice

Brady v. Maryland (1963) 373 U.S. 83, continues to require disclosure to the defense of all material, exculpatory information possessed by the prosecution and its investigating agencies. As an investigating agency, the crime laboratory that worked on the case has an obligation to make the prosecutor aware of all potential Brady material in its files -- which could include both casework files and personnel files. If Brady material is missed, it could jeopardize the criminal conviction. Michael Chamberlain will discuss Brady and its legal progeny. The talk will examine what information actually falls under Brady, when, how, and where crime-laboratory staff should look for it, and what to do with information that may implicate Brady.

Proteomic Analysis of Hair Evidence

Robert Rice, Ph.D., Environmental Toxicology Dept, UC Davis*

The possibility merits exploration that proteomic analysis of human hair recovered at crime scenes can provide probative information, increasing its value as evidence. Analysis of the protein composition of hair is now greatly improved thanks to recent advances in mass spectrometry coupled with protein database searching. Hair proteins solubilized under strongly denaturing conditions, primarily keratins and keratin-associated proteins, are amenable to standard biochemical analysis. Identities of the insoluble proteins, however, intractable due to their isopeptide cross-links mediated by transglutaminase activity, have been mysterious until their recent elucidation by shotgun proteomics. Variation in hair structure evidently exists. For example, individuals suffering from a deficiency in transglutaminase activity exhibit defects in hair shaft and nail plate structure (as well as scaly skin). With proper technique, more than 100 proteins can now be routinely identified from human and mouse hair shaft. Nail plate is amenable to similar analysis. While quantitation of absolute protein amounts by this method is difficult, relative amounts in parallel samples can be compared. Using this approach with inbred mice has revealed that different strains are distinguishable by the patterns of proteins in their pelage fur. Since inbred mouse strains resemble individual humans as samplings of populations, we hypothesize on this basis that proteomic analysis has the potential to distinguish ethnic origins and perhaps even individuals among human hair donors.

Creation and Accomplishments of a Forensic Internship Program

Wayne Moorehead, forensicTRACE, Rancho Santa Margarita*

Over the past 26 years, the OC Crime Lab has accepted a number of interns to help accomplish projects typically outside the ability of the working forensic scientist to complete. Pressure to reduce a backlog of cases, court testimony, training, and other issues often inhibit the scientist from initiating or completing a project.

After selection, interns are provided adequate training for their projects. As projects successfully progress, interns are permitted to job-shadow in each laboratory section, attend an autopsy, listen to forensic scientists provide testimony, observe forensic specialists perform routine crime scene investigations, read criminalistics journals and texts, attend local professional meetings, and be mentored by a forensic scientist. Some of the projects are presentation- or publication-worthy and the intern may be included as an author, while other projects simply provide better resources to the laboratory. The ratio of the amount of time the intern spends completing a project compared to the time the forensic scientist spends training and evaluating his or her work can be 3:1 to 35:1. No longer is heard "I don't have time for an intern" but "When does our section get an intern, I have a project."

Employing a SWOT Analysis in Preparation for Interviewing

Raymond Davis, Courtskills, Eagle, Idaho*

A SWOT analysis is a business model that has applications for interviewing. The acronym stands for Strengths, Weaknesses, Opportunities, and Threats. Successful businesses routinely use this model to increase sales, and improve customer service and customer retention. The analysis is often conducted with a business professional providing objective feedback on the company.

I have interviewed about 100 candidates during my career with five different Bay Area crime labs. These laboratories have all used uniform interviewing methodologies seeking the best candidates for their respective laboratory. One quality I have found lacking in the majority of the applicants was a failure to adequately communicate their strengths and weaknesses and how to position themselves among the other applicants. Utilizing a SWOT analysis can provide a helpful guide in preparing for and conducting an interview.

I will present a SWOT analysis of a typical resume and show how it can be used effectively in preparing for an interview.

Variability Among Pathologists Examinations in Suspected Rape-Homicide Cases

Gillian Currie, UC Davis*

There is much debate regarding the frequency of rape-homicides occurring in the United States each year, with reported figures ranging from as low as 0.1% of homicides with a rape component to as high as 17%. California statistics showed that rape was identified as a circumstance of homicide in only 0.1% of cases. Several factors may contribute to the discrepancies in these statistics, including varying definitions and documentation techniques, a lack of standardized protocols, and operational differences in the three death investigation systems in California. This study collected information on the investigation and autopsy practices of female homicide victims (18 and older) in California to compare methods and techniques used to establish if rape was a component. The purpose of this information was to help determine whether some rape-homicide cases are overlooked due to differences in procedure, to determine if there was variability across pathologists' examinations of suspected rape-homicide cases and, if so, the nature of that variability.

Information was collected via survey that was distributed to forensic pathologists across California via email and regular mail. Responses were collected and analyzed using an online survey tool (SurveyMonkey). Of 29 surveys distrib-

uted, 19 responses were completed and valid for use in the study, giving a 68% return rate.

Results showed a range of variability in pathologists' examinations of suspected rape-homicide cases with a number of inconsistencies. The actual number of sexual assault work-ups performed per total cases per year was 1.2%, which is significantly higher than the 0.1% of homicides with a rape component reported by the state. The subjective nature of the decision to perform a sexual assault examination was made apparent, especially in the criteria reported for determining when to employ a rape kit and when swabs of visible stains were collected. Fifty-three percent of offices also reported relying on law enforcement or on criminalists to supply an alternate light source. Potential bias in these results is possible due to the relatively low response rate. Overall, this study illustrated a lack of standardization of practices in the California coroner system, which could be a contributing factor in the low number of female homicides with a rape component reported in the state.

Forensic Science Leadership and Management Training at UC Davis

Fred Tulleners, Forensic Science Graduate Program and Gene Crumley, Business & Technology, UC Davis Extension*

The University of California at Davis and its UCD Medical Center in Sacramento have more than 220 different and diverse laboratories that conduct research and various types of technical analysis. Several years ago, the UCD Office of Research realized that there was a significant need to educate the professional scientist who would become a laboratory supervisor or manger. While these new supervisors/managers had excellent technical skills they had little or no concept of the management and leadership skills needed for a functional laboratory. Nor did they have the skill set to interact with subordinate staff in order to formulate unit goals and objectives. Because of this, UC Davis devoted considerable effort to develope an in-depth three-week laboratory management and leadership course that was presented as a series of one week classes over the period of a year. If one looks at the various forensic science crime laboratories in a state, they have the same management needs and lack of relevant available training. In fact, because most are part of a local agency, they have very little, if any, recourse to advanced management and leadership training because the local city or county governments do not have the laboratory expertise or resources to fund such training.

The UC Davis Graduate Forensic Science Program proposed a curriculum to the National Institute of Justice to build on the expertise of the UC Davis Laboratory Management and Leadership curriculum, incorporate most of its key elements, instructors, and focus on the needs of the modern crime laboratory. Subsequently, NIJ funded this proposal for fiscal years 2011 and 2012. The curriculum is called "Forensic Science Crime Laboratory Leadership and Management Certificate Program" and is presented in three one-week classes, each year, for a two-year period. Upon completion of all three classes, the recipient obtains a certificate and 14 units of continuing education. The curriculum would be reviewed and approved by a committee of senior forensic science crime laboratory managers. We will utilize instructors from UC Davis and the major labs in the forensic science community. These instructors will have expertise in business, research lab operations, analytical lab operations, medical laboratory operations, staff and professional development, and leadership techniques.

Forensic Entomology

Robert Kimsey, Professor, UC Davis, Davis

Arthropods, their biology, succession, development and population biology in matters of criminal prosecution. Emphasis on understanding the nature of entomological evidence, how to recognize it and how to collect and preserve it for further analysis.

Molecular Technique for the Interpretation of Bloodstain Patterns

Donald Johnson, Cheryl Andersen, Katherine Scriven, Amberly Klein, and Cindy Carroll, California State University, Los Angeles*

The body of a homicide victim is oftentimes removed from the primary scene by the perpetrator and disposed of elsewhere. The location of the murder then becomes an important fact to establish in the investigation. Knowing where the murder took place can assist investigators in identifying suspects. Murders often result in significant bloodshed, which can allow investigators to establish the location of the murder based on bloodstain pattern interpretation. However, the circumstances of other homicide cases are such that little blood is shed or even discovered due to the nature of the injuries or the act of cleaning by the perpetrator. Additionally, the suspected murder scene is often a place where the victim is known to have a history of physical activities—sometimes the suspected murder scene is the victim's residence. These circumstances can complicate investigations, because if small amounts victim's blood are found at the victim's residence or at a place where the victim visits, then the question becomes whether the bloodstains are related to the homicide or the result of some prior accidental injury. Unfortunately, current forensic methods used to correlate bloodstains with injuries are greatly limited when dealing with trace amounts of blood or bloodstains that have uninformative patterns. We hypothesized that trace quantities of wound-track cells are present in evidentiary bloodstains. The detection of these cells requires a method that is sensitive and specific. Sensitivity and specificity are properties of current forensic DNA typing methods; therefore, this research investigated a molecular approach to correlate bloodstains with injuries.

We here report on the development of a PCR-based technique to detect trace amounts of wound cells in bloodstains. In this proof-of-concept study, we used the laboratory rat as a model to investigate the use of tissue-specific micro-Ribonucleic Acid (miRNA) markers to distinguish bloodstains originating from different wounds. Specifically, we examined the miRNA species, Rn_miR-124a_1, as a marker for rat brain tissue. The basic procedure for the miRNA assay consisted of the following steps: 1) extraction of total miRNA from simulated head wound bloodstains using a rat blood-brain mixtures using QIAGEN's miRNeasy mini kit; 2) synthesis of cDNA from miRNA with QIAGEN miScript Reverse Transcriptase Mix; 3) amplification of the target miR124a-1 with Taq polymerase and oligonucleotide primers from QIAGEN miScript Universal Primer, and miScript Primer Assay; and 4) identification of the miR124a-1 cDNA using the QuantiTect SYBR Green PCR Master mix fluorescence detection with the Rotor-Gene Q Real-Time PCR Detection System.

Preliminary studies included the optimization of the detection assay and the evaluation of the specificity of the marker. We additionally examined a procedure for the collection of bloodstains for use by this assay, and the stabil-

ity of the marker under different environmental conditions. Proof-of-principle was achieved by the ability to distinguish bloodstains produced by a gunshot wound to the head versus bloodstains produced by a gunshot wound to the chest with use of the assay.

Collecting Volatile Data

Timothy Lott, The Search Group

Historically, when dealing with crime scenes, law enforcement personnel have gathered potential digital evidence with the mind set: shut it down, tag it, bag it, and take it to the forensic analyst. However this mindset does not take into account the vast amount of volatile data that can be permanently deleted by using this procedure.

Random Access Memory (RAM) is memory that is stored inside a computer and is available as long as the computer stays on. Computers utilize RAM to help them run more efficiently. The computer uses RAM as a form of a digital clipboard constantly swapping the information in and out to assist in running programs. The more RAM a computer, has the better it operates. Most computers today come with a minimum of 2GB of RAM. This is enough to store approximately 200 images.

The information that can be contained in the computer's RAM may include evidence of a virus, chat logs, portions of email, image files, video files, passwords and networking information. All of this data may be pertinent to the case.

Familial Searching – Recent Cases

Gary Sims, Criminalist Manager, California Department of Justice, Jan Bashinski DNA Lab, Richmond

The California Department of Justice initiated its familial search program in 2008. As of early September 2011, the DNA Data Bank at the Jan Bashinski DNA Laboratory had conducted 28 familial searches. From these 28 searches, there have been two familial "hits" to convicted offenders that, coupled with additional investigation, led to direct matches between a relative and the crime scene evidence profile. This presentation will discuss the DOJ familial search policy and procedures, with special reference to how these activities played out in the two successful hits.

Using Selective Degradation to Improve Differential Extraction Quality and Throughput

Michelle Beckwith, PTC Laboratories, Columbia, Missouri

Sexual assault evidentiary samples often result in sperm fraction DNA mixtures. The mixture profiles are difficult to deal with statistically and they can make courtroom explanations much more complicated than testifying to a single-source profile. National Institute of Justice-funded research has facilitated the development of a new differential extraction method, and ultimately, a kit that can be used to greatly improve the results obtained during differential extraction.

The Erase Sperm Isolation Kit eliminates mixtures in nearly all samples by using a technique called selective degradation. After separation of the epithelial and sperm cells by a preferential lysis, most of the aqueous layer is removed for epithelial fraction DNA analysis. The remaining epithelial DNA in the sperm fraction is destroyed using a nuclease. Only DNA from intact sperm cells remains.

Even when there are relatively few sperm cells and overwhelming quantities of epithelial DNA, this method produces a single-source male profile. When the standard differential extraction method is only able to obtain trace profiles of the male along with a predominately epithelial profile, using the Erase method will often result in a full male profile with no, or negligible, epithelial contamination.

This method requires little hands-on time for individual tube preparation and is very adaptable to automation with basic liquid handling robots.

When Your Cold Case Turns Hot, Hot, Hot!

Pamela Hofsass, Inspector, San Francisco Police Department*

Cold Case investigations are not your average cup of Joe. Once the DNA Hit report arrives in the mail or by phone, the wheels of justice begin to turn or not. Each case presents its own challenges and obstacles to overcome. Spend some time on the Internet, and you can find all kinds of resources to assist in the positive resolution of your case – think the President's DNA Initiative or the Denver DA's Cold Case Project.

This presentation aims to provide a unique perspective from a detective who has worked the field (CSI), the bench (DNA Unit) and the desk (Sex Crimes Cold Case Unit and Homicide). Three DNA cold cases will be presented and reviewed. Some of the shoulda, coulda, woulda slides will be included for good measure as well as the successful outcomes of these types of cases.

Ignorance is Bliss! Or is it? The Legislative Bill Analysis Process and Forensic Science

Torrey Johnson, Program Manager, California Criminalistics Institute, Sacramento

Forensic science requires the application of science to matters of law. The forensic scientist is subjected to sometimes conflicting demands of science, the criminal justice system and the legislative branch of government. We can only respond to many of these challenges, but in the area of legislation, we can and, perhaps, should be proactive. Because poorly conceived or poorly worded legislation can have long term technical and fiscal effects, the California Department of Justice has a formalized legislation review and analysis program. This program will be discussed, with special attention to problems in the analysis of pending legislation. Several specific examples of legislation, both current and historical, particularly in the areas related to firearm examination, will be used to illustrate the types of issues involved and the results of enacting flawed legislation.

Shooting Incident Dynamics: The Forensic Elements

Alexander Jason, Certified Senior Crime Scene Analyst, Pinole

A central element in any analysis of a shooting incident is the realization that all shootings involve time and motion: From visual perceptions, decision processes, neural transmissions, to muscle movement during the "squeeze" of the trigger, bullet travel, and gross defensive or offensive movements of the shooter and person being shot. Along with this understanding, the analysis and reconstruction of shooting incidents often requires consideration of several forensic and human performance components including wound ballistics, psycho-neurological factors, bullet flight dynamics, terminal ballistics, gunshot residue characteristics, firearms operation, and other associated areas of knowledge such as blood-spatter interpretation. The integration of the data from these ar-

eas can be extremely useful in any forensic examination of a shooting incident – particularly when multiple shots are involved.

A case review by the author of actual shooting incidents has established that in many shooting incident analyses, the movements of shooters – and particularly – the person(s) being shot are inappropriately ignored. Research on the actual movements of participants in shooting incidents was performed and the results demonstrate that a consideration of body movements during the incident can provide significant data directly useful in the analysis, reconstruction of shooting incidents and in the legal determination (adjudication) of the incident.

Cartridge Case Signature Identification Using Topography Measurements and Correlations; Unification of Microscopic and Mathematical Comparisons

Alan Zheng, Robert Thompson, James Yen, National Institute of Standards and Technology, Gaithersburg, Maryland*

A comparison microscope employing the standard optical-comparison method and confocal microscopy with subsequent cross correlation mathematical analysis were used to correctly identify cases fired from a set of 10 consecutively made pistol slides. A Nipkow disc confocal microscope was used to gather the 3D topography data from the breech face area of each case.

A total of 1,600 correlations was performed in a 40x40 matrix. Using statistical analysis from the known match and known non-match correlations, a baseline cross-correlation function was established to identify matches. The mathematical identifications were based on the breech face impression without the firing-pin aperture shear marks. Fifteen unknown cases were compared to test-fired cases sets from the consecutively manufactured slides. In addition, five "persistence cases" were also compared to the slides.

Bullet Signature Identification Using Topography Measurements and Correlations; the Unification of Microscopic and Mathematical Comparisons

Alan Zheng, Robert Thompson, Wei Chu, John Song, National Institute of Standards and Technology, Gaithersburg, Maryland*

Current firearm identification is based on image comparisons using optical-comparison microscopes. The ability to produce an accurate identification depends on image quality, which is largely affected by lighting conditions. A 2D and 3D Topography Measurement and Correlation System was developed at NIST for certification of NIST Standard Reference Material (SRM) 2460/2461 Bullets and Cartridge Cases. Based on this system, a prototype system for signature measurement and correlation of fired bullets has been recently developed at NIST for bullet identifications. The 3D topography data of the land-engraved areas (LEAs) of fired bullets are captured by a commercial confocal microscope. The LEAs were processed by the "edge detection" method to determine the "striation density" by which the surface area with low striation density on the LEA could be masked out from correlation. The modified 3D micro-topography data on the remaining "valid correlation areas" are compressed into a 2D profile that represents the 2D ballistics signature of the LEA. A correlation program using two methods has been developed for matching the paired profile signatures: the Consecutive Matching Striae method, used by many firearms examiners, and the cross correlation function maximum method developed by National Institute of Science and Technology based on analysis methods in surface metrology.

Fast Fourier Transform (FFT) As A Means of Isolating Prominent Stria

Stephan Shaffer, Forensic Science Graduate Student, UC Davis*

In this research, we examine the Fast Fourier Transform as implemented in Microsoft® Excel® as a means of filtering and smoothing bullet-profile data to locate key primary peaks in the profile. We then continue analysis of the peaks by measuring peak locations and peak spacing ratios. This is part of a broader research effort to develop a fast, efficient, database system for storing, searching, and retrieving bullet-profile data from a large number of samples.

After a search of the literature and on-line resources, we selected an FFT analysis template available through an on-line public domain software site as a starting point for our testing. The spreadsheet was selected because it contained a convenient template for conducting forward and backward FFT analyses and because it readily accepted data in a form convenient to our needs. The spreadsheet was then edited and enhanced to meet our specific needs, including the development of multiple versions to accommodate different lengths of input data.

FFT filter parameters were tested to determine optimal settings. An FFT-domain high frequency of 0.020 was found to be optimal for removing form and waviness from the data. A low frequency of 0.060 was found to be optimal for removing fine detail and noise. Using these parameters, the FFT filter yields approximately 37 prominent peaks/mm from a source file that originally contained approximately 330 peaks/mm. The selected parameters and the resultant peak density approximate the level of detail seen using established bullet-comparison microscopy protocols.

We validated the FFT-filter process by comparing the filtered spectrum to the original source data to ensure that it contained all of the prominent peaks or groups of peaks while introducing no extraneous peaks. We found accurate and reproducible results but did identify possible anomalous data at the extreme ends of the filtered profile. Correcting this is the subject of an on-going effort.

Following isolation of key peak locations, we developed an application to determine the length of the gap between adjacent peaks. We took each successive six-peak group and determined the relative spacing of the first, second, fourth, and fifth peak intervals to the third interval, yielding a five digit string of numeric values that represent that six-peak sequence.

Doing this for each six-group peak sequence, we develop a series of five-digit codes that represent the entire measured profile.

In conclusion, we found that Microsoft® Excel® combined with our spreadsheet template are suitable for further use in single-line profile analysis of fired bullets. Further, we found that it is possible to develop a relatively short series of number sequences to represent all of the peak locations in a profile. This numeric sequence is suitable for inclusion in a database of bullet-profile characteristics. Further research is in progress to determine if such a database may be suitable for search and retrieval among a very large number of entries.

Fourier and Curvature Corrections in Confocal Microscopy

Ashley Chu, Forensic Science, UC Davis*

Confocal microscopy combined with Mountainsmap software has been used to produce profiles of the National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 2460 standard bullet. Data files from a Zeiss CSM 700 confocal microscope were exported to Mountainsmap. Line profiles were then extracted from the data files using Mountainsmap. Raw data collected from various objectives were compared, and we found that 20X (NA 0.6) and 50X (NA 0.8 and 0.95) objectives provided good quality data that compare favorably in character to NIST's published profile for SRM 2460. We also collected good quality data using a 50X objective while rotating the bullet at one-degree increments through a range of 0 to 10 degrees. When rotating bullets, we found that features in the raw profile data quickly became unrecognizable. However, when the same data were compared following leveling and FFT processing in Mountainsmap to flatten and smooth the data, we found good correlation between files. We conclude that confocal microscopy and Mountainsmap software can produce good quality raw data that compares well with published data for the NIST SRM 2460. We further conclude that FFT is a suitable means for revealing consistent profile detail which is independent of rotational position within limits of at least ± 10 degrees.

Quantitative Comparison of Blood Spatter Patterns Resulting from Bullet and Blunt Force Impacts

Sonja Siu and Jennifer Saifi*, UC Davis*

Due to the lack of set quantitative boundaries distinguishing different bloodstain patterns, the analysis of bloodstain patterns can be rather subjective. Results are being based on qualitative classifications rather than quantitative, causing them to be controversial. This project aims to determine whether quantitative boundaries between medium- and high-velocity impact spatters can be established along with what those boundaries are. A high-speed video camera will be used to capture and calculate various impact velocities using different blunt weapons and caliber bullets, while the distance to the vertical target surface will be varied. The generated patterns will be analyzed to produce a collection of statistical data, looking at size and spatial distribution, which will allow for the determination of a quantitative classification for medium- and high-velocity impact-spatter patterns. The overall mean drop size of the pattern should decrease and the spatial distribution of the drops should become less sparse as the impact velocity increases. For future studies, we will conduct a double-blind survey with the patterns generated in the experiments, assessed by trained analysts and students, to obtain error rates in the identification of medium- versus high-velocity impact spatter patterns.

Reconstruction of an Unusual Officer-Involved Shooting: A Multidisciplinary Approach

Eric Collins, Contra Costa County Office of the Sheriff, Martinez*

In late 2005, an officer-involved shooting occurred outside a bar in the city of Vallejo. The initial shooting investigation indicated that the suspect's gun, a Raven Arms .25 Auto semiautomatic pistol, had been shot out of his hand and disabled by one of the officers during the incident. The subsequent reconstruction of this event proved daunting due to the unusual and complex nature of the incident, as well as issues raised by the defense's firearms expert. Ultimately, this case study reinforces the importance of trace evidence and the application of the scientific method in shooting reconstruction cases, while highlighting the significance, or lack thereof, of the absence of blood on bullets that have passed through human tissue.

Synthetic Cannabinoids and Bath Salts (by remote)

Jason Nawyn, U.S. Army Laboratory, Forest Park, Georgia

Over the past few years, police agencies have recorded a spike in uses of new, supposedly legal ways for drug-users to get high. From the synthetic cannabinoids of the "Spice" craze to the bath salts containing Mephedrone and MDPV, users are devising new ways to get high while skirting some common drug laws. This discussion will focus mainly on the synthetic cannabinoids and their history, chemistry, legal issues, common objections, and then it will delve into what new compounds may be seen next.

FT-IR ATR Determination and Non-destructive Analysis of Sodium Gamma-Hydroxybutyric Acid (NaGHB) Impregnated in Denim Fabric

Phillip Brooke, UC Davis*

Forensic laboratories are often tasked with analyzing samples that are suspected of containing a chemical residue. One reason for analyzing this type of sample is to prove or disprove the presence of a substance. The information collected from this type of analysis may be the only evidence available from a legal standpoint. Forensic drug chemistry is one area of study that routinely analyzes residues of controlled substances. Residues of controlled substances can be present on many different substrates including textile fabric, drug paraphernalia, glassware and any other surface capable of adsorbing small amounts of organic material. In this study, FT-IR ATR spectroscopy was tested as a non-destructive preliminary screen for analyzing a suspected chemical residue. That is, the method was tested to see if it may serve as an initial guide in making appropriate decisions for further sampling and chemical analysis. A variation of this idea was investigated by focusing on a particular controlled substance and a single type of textile fabric. More specifically, solutions containing sodium gamma-hydroxybutyric acid (NaGHB) were applied to samples of denim fabric and allowed to dry. FT-IR ATR spectroscopy was used to analyze the NaGHB residue in order to determine whether this method may aid in the sampling of material and selection of analytical techniques for the remainder of the identification process. By monitoring the carboxyl salt stretching band, residues of NaGHB could be detected at nominal concentrations relevant to a forensic setting. The forensic context of analyzing a NaGHB residue and the uniqueness of the spectra are discussed.

Synthesis and Intermediate/By-Product Analysis of Bromo-Dragonfly, a Dihydrobenzofuran Analogue of Phenethylamine Hallucinogens

Brittany Huntington, UC Davis*

In 1998 and 2001, two articles were published by the Nichols lab (Purdue University) providing the synthesis for (R)-(-)-1-(8- Bromobenzo[1,2-b;4,5-b´]difuran-4-yl)-2-aminopropane hydrochloride (bromo-dragonfly). Since that time,

bromo-dragonfly has become a hot topic in the drug community, with both users and analysts alike. Fairly pure samples of bromo-dragonfly have been found worldwide, with the one documented sample within the United States

being found in Oregon. These samples have investigators wondering when the first clandestine lab will be found, or if it already has been, but overlooked beause of a lack of a standard to which it can be compared. No library previously existed for the intermediates, byproducts, and wastes accrued in this synthesis. This research investigates the full synthesis of bromo-dragonfly following the method published in 2001, while also looking at other possible routes and modifications. A library was created at the Sacramento County District Attorney's Laboratory of Forensic Services, compiling EIGCMS data for each step. The synthesis is difficult and time-consuming, requiring sophisticated equipment and knowledge, as well as liters of solvent and many toxic, atmosphere-sensitive reagents. The synthesis of bromo-dragonfly is far out of the capabilities of the typical clandestine chemist and lab; investigators should be looking at established chemistry labs to be producing samples of the caliber that have been found thus far.

Qualitative analysis of Sodium Gamma-Hyroxybutyric Acid (GHB) residue from plastic and glass containers using FT-IR ATR

Esmeraldo Gorecho, UC Davis*

In this work, Fourier transform-infrared attenuated total reflectance (FT-IR ATR) spectroscopy was used to detect and qualitatively analyze gamma-hydroxybutyrate (GHB) residue from plastic and glass cups.Varying amounts of the sodium salt of GHB mixed with water in plastic and glass cups were used. The residues from the cups were collected using cotton swabs and analyzed using FT-IR ATR. The study provides insight on the criteria for an analyst to determine the presence of GHB in a cup using the FT-IR ATR technique as a presumptive test by using a 1550 cm-1 asymmetric carboxylate band as an indicator for NaGHB. The FT-IR ATR method used was also able to detect GHB in a model whiskey drink and discriminate from NaGHB from GBL residue. The FT-IR ATR technique offers several advantages of avoiding sample preparation, shortening analysis time, and being a non-destructive method compared to traditional techniques used for GHB analysis.

To PEBT or Not to PEBT That is the Question

David Koenitzer, Bureau of Forensic Services, California Department of Justice, Sacramento

The California Department of Justice Bureau of Forensic Services (BFS) needed to find a replacement for its aging breath alcohol system, known as "Evidential Portable Alcohol System" (EPAS). BFS embarked on a three-year project with a grant from the California Office of Traffic Safety to develop, test, validate, and implement a replacement for the EPAS devices. This presentation will recount the many technical and administrative potholes, ruts, and stones along the branching pathway that led to our new system of Portable Evidential Breath Test instruments, as well as our current architecture for data acquisition, storage, and retrieval. Validation studies performed on the new Draeger 7510 instrument will also be discussed.

What You Don't Know About Cal/OSHA Training Requirements

Mark Cameron, CIH, California Criminalistics Institute, Sacramento

Cal/OSHA and other regulatory agencies have myriad training requirements for the workplace, including the crime lab and crime scenes. Injury and illness prevention plans, evacuation, bloodborne pathogens, and clandestine drug lab response are more commonly known areas. But less known areas, such as confined space entry, chemical spill teams, radiation machine, lasers, and many other areas require documented training as well. The lesser known training requirements by Cal/OSHA, Cal/EPA, the Department of Transportation, and other agencies will be presented. Types of acceptable training and where to obtain it will also be discussed.

Implementation Strategies for Becoming a Paperless Laboratory

Barry Miller, Solano County District Attorney, Bureau of Forensic Services, Fairfield

As the trend continues for laboratories to move to a more "green" paperless system, the implementation challenges can appear overwhelming. In this session we will discuss the layout of two "paperless" laboratory systems. The first implementation facet deals strictly with an electronic case record via a Laboratory Information Management System (LIMS) and integrated repository for images and file upload with data from images stored either directly in a SQL Server database or an existing server file structure with electronic pointers stored in the database. The second discussion includes branching to network integration of instruments, general laboratory documentation and records including security, accreditation standards, batch data, document control processes and electronic signatures and data entry.

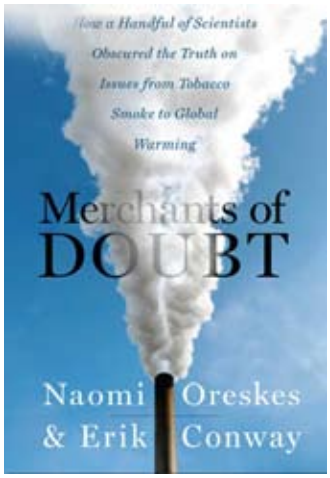
Lastly, we will discuss novel implementations of Laboratory Information Management Systems and electronic tablet integration through network infrastructure while attempting to maintain Department of Justice requirements for two factor authentication for portable devices.

SWGDRUG Update - Fall 2011

Jerry Massetti, Chemistry Program Manager, California Criminalistics Institute, Sacramento

The Scientific Working Group for the Analysis of Seized Drugs (SWGDRUG) continues its efforts to recommend minimum standards for the forensic examination of seized drugs and to seek international acceptance of those standards. SWGDRUG would like to inform CAC members that its website has been updated to reflect recent progress. The latest version of SWGDRUG Recommendations (Version 6.0) is available and includes new recommendations for analysis of clandestine laboratory samples (Part IIIC). "Examples of Measurement Uncertainty for Weight Determinations," the latest revision to its third supplemental document (SD-3), was approved in July 2011 and is posted. A mass spectral library of drugs and drug-related compounds has been compiled. Current projects include: development of Internet-based training resources, development of examples of measurement uncertainty for purity determinations, and development of reporting examples. SWGDRUG requests feedback to assess the value and utility of SWGDRUG recommendations. A future survey is in preparation. Prior survey results are summarized.

that there was no scientifically validated connection between lung cancer and smoking. On page 34 the authors state: *"Doubt-mongering also works because we think science is about facts – cold, hard, definite facts. If someone tells us that things are uncertain, we think that means that the science is muddled. This is a mistake. There are always uncertainties in any live science, because science is a process of discovery. Scientists do not sit still once a question is answered; they immediately formulate the next one. If you ask them what they are doing, they won't tell you about the work they finished last week or last year, and certainly not what they did in the last decade. They will tell you about the new and uncertain things they are working on now. Yes, we know that smoking causes cancer, but we still don't fully understand the mechanism by which that happens. Yes, we know smokers die early, but if a particular smoker dies early, we may not be able to say with certainty how much smoking contributed to that early death. And so on.*



"Doubt is critical to science – in the version we call curiosity or healthy skepticism, it drives science forward – but it also makes science vulnerable to misrepresentation, because it is easy to take uncertainties out of context and create the impression that everything is unresolved. This was the tobacco industry's key insight: that you could use normal scientific uncertainty to undermine the status of actual scientific knowledge. As in jujitsu, you could use science against itself. "Doubt is our product," ran the infamous memo written by one tobacco industry executive in 1969, "since it is the best means of competing with the 'body of fact' that exists in the minds of the general public."129 The industry defended its primary product - tobacco – by manufacturing something else: doubt about its harm. "No proof became a mantra that they would use again in the 1990s when attention turned to secondhand smoke. It also became the mantra of nearly every campaign in the last quarter century to fight facts.

"For tobacco is not the end of our story. It is just the beginning. In the years to come various groups and individuals began to challenge scientific evidence that threatened their commercial interests or ideological beliefs."

Many in the legal community and even a few forensic fellow travelers (some regularly contribute to *CACNews*) have also found the *doubt is our product* to be a very effective and profitable strategy. Validity of identifications based on fingerprints? Oh but there is *doubt*. Bullet comparisons? –*doubt*. Cartridge case comparisons (firing pin impressions, breech face markings, extractor and ejector marks)? – *doubt*. Tool marks, questioned documents, footwear impressions, fracture matches, bite marks – all *doubt*. Oh, and a beautiful Hollywood starlet is shot and killed while trying to exit a mansion and the gun is not hers and the shot clips off a portion of one of her fingernails as though she had a hand up in a "No! Don't shoot me." gesture, and the bullet impacts her teeth as it goes into her brain and kills her. Homicide or suicide? – *doubt*.

In the book, the named distinguished scientists who testified for the tobacco industry and other special interest groups did so towards the end of their scientific careers and the ensuing "gifts" and "honorariums" greatly eased their declining years. Am I the only one who sees parallels with what is happening today in forensic science?

I'll close with a quote from the last page of the book. "- S. J. Green, director of research for British American Tobacco, who decided, finally, that what his industry had done was wrong, not just morally, but intellectually:

"A demand for scientific proof is always a formula for inaction and delay, and usually the first reaction of the guilty. The proper basis for such a decision is, of course, quite simply that which is reasonable in the circumstances."

Chap. 1. 129. Smoking and Health Proposal, 1969, BN: 680561778, Legacy Tobacco Library

Epilogue. 12. S.Green, Smoking Associated Disease and Causality, n.d., BN: 1192.02 Legacy Tobacco Documents Library.

—Bob Blackledge

Photo Brings Back Memories

Lou Maucieri's recent article in the *CACNews* (4th Quarter 2011) brought back vivid memories. I began my career with DOJ in 1972, one year after Lou's remarkable case. I had just completed the Forensic Alcohol Supervisors Course being held at the Sacramento Lab. I was assigned to work in the San Rafael Lab along with my partner Bill Corazza. We thought we'd hit the lottery working in Marin County. Much to our disappointment, the lab was an empty space in the sheriff's office filled with cobwebs. We would have to wait approximately two months while contractors designed and built a lab for us. In the meantime, we met with dozens of law enforcement agencies in our five county area to solicit work. It felt as if we were operating a business instead of a laboratory.

On the day I arrived at the Marin County Civic Center (location of the San Rafael Laboratory), I noticed bullet holes on the building's façade from that horrible shoot out. It gave me pause. What most people don't know is that Judge Haley wouldn't allow his bailiff to be armed. A decision that would have tragic consequences. I can't imagine how the bailiff felt when he saw guns being drawn in the courtroom. I doubt that there would have been an armed escape had the defendants known that the bailiff was armed. The prosecutor in that case was credited with saving the lives of several people held captive in the getaway van. He was severely wounded crippling him for life but continued his career as a superior court judge for Marin County. Unfortunately for Judge Haley, the shotgun taped around his neck, lost his life that day.

—Raymond Davis

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