

The CACNews

News of the California Association of Criminalists • First Quarter 2018



The President's Desk

Forensic Nutrition

vincent
VILLENA



CAC President

With the past seminar hosted by the Orange County Crime Lab having the theme Epicurean Delights, the occasion truly provided the attendees with feasts for both the mind and the body.

The holidays are upon us. Thanksgiving involved committing the traditional and inevitable societal iniquities, sloth (unless you were charged with preparing the dinner) and gluttony (although, I typically have no need to use the holiday as an excuse to indulge in excessive eating). With the past seminar hosted by the Orange County Crime Lab having the theme *Epicurean Delights*, the occasion truly provided the attendees with feasts for both the mind and the body. As for the virtuous aspect of the Thanksgiving tradition, I thank the OC Crime Lab for a pleasurable and gratifying festivity. During the seminar, I also had the opportunity to thank not just one, but two, members of the organization who have provided significant contributions to the Association and to the field by awarding both of them with our prestigious Anthony Longhetti Distinguished Member Award. Although this is an award given only once a year in the past, having not given it the previous year, the Board made the decision to honor both very deserving nominees. The CAC has tremendously benefited by having Marianne Stam and Steven Myers as members of the Association and as practitioners and educators in forensic science.

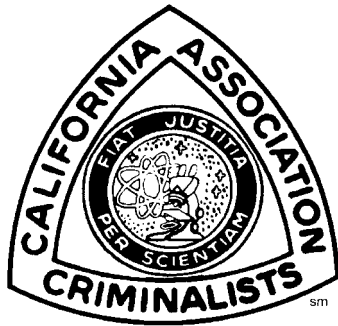
The holidays then continue with the gift-giving celebrations and the New Year. The latter is customarily affixed with the dreaded, and almost always unsuccessful, New Year's resolution. Weight loss is a battle I can never win. I love food too much. I am sure many share the same perspective. So, rather, I would suggest shifting focus to a professional resolution that would combine both gift-giving and commitment to growth. Since I am a big proponent of education and the future of our membership, this coming year, I challenge everyone to give the gift of knowledge by mentoring the novice or presenting at a seminar or a workshop. All the years or decades of accumulated information on the field will only be lost if not shared before retirement. For those who are considered neophytes in the field, I challenge you to pick up a journal (or the *CACNews*) at least once a month and read and absorb the information presented in the document. I suppose the latter can be applied to everyone. The field is forever evolving and it would be a benefit to everyone to stay abreast with the present, whether it is science, technology, or politics. On the last one, maybe focus on politics relating to the field of forensic science. Any additional areas of politics may only be depressing and demotivating. Our Legislative Analysis Committee has always been meticulous in providing us updates on current propositions or changes in the legislations. Even simply, stay informed on what goes on with our organization. I urge every member to log on to the Member Services on our website, review the Business and Board meetings, and submit any inquiry or input to the betterment of the Association.

Another matter I want to improve, as discussed at the previous Business Meeting, is the CAC's relationship with the Chartered Society of Forensic Sciences (CSFS), formerly the Forensic Science Society (FSS). I have been in correspondence with the CEO of the CSFS regarding how we can better improve the interactions between the two organizations. What better way to reinvigorate our relationship than the upcoming Joint Meeting in Spring 2019 in Oakland. 2019 is also the year CSFS will be celebrating their 60th Diamond Anniversary. I will be discussing more about the CSFS at the next business meeting.

For now, I end this peroration with encouragement and support in everyone's endeavor to lose weight in the upcoming New Year. If that ordeal seems a little out of reach, grab a book or your tablet instead, and eat a good hefty serving of forensic knowledge. Nutritional Fact: Calories 0.

Cheers,

A handwritten signature in black ink, appearing to read 'Vincent Villena', written over a horizontal line.



The CACNews

www.cacnews.org

FIRST QUARTER 2018

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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 September 1.



Flash Mob

The "Three Waiters" delight CAC members at the banquet of the Fall 2017 seminar in Newport Beach. More photos inside.

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CACBITS



Two Distinguished Members in 2017

The Anthony Longhetti Distinguished Member Award was presented to Marianne Stam and Steven Meyers at the fall CAC seminar banquet.

Besides the singing, there were several more awards presented at the banquet. *(left)* Adam Dutra receives the Al Biasotti Most Outstanding Presentation Award. *(right)* Robert Binz and Tara Heye pose with CAC President Vincent Villena (and their Service Awards). The Most Outstanding Poster Presentation was awarded to Mark LaVigne.



New Pub Comm Members Named

The CAC Publications Committee is growing with the addition of four new members. Joining the committee as Webmaster Trainees are Bonnie Cheng, Regina Davidson and Stephen Lu. In addition, Kathe “KC” Canlas will be serving as Social Media Specialist. Kathe (pronounced Kay-th) is seen here *(right)* proudly displaying her new CAC member’s certificate at the fall seminar.



Call for Papers—CAC Spring 2018

The organizers of the CAC spring seminar, to be held in Concord (San Francisco Bay Area—East), May 7-11, 2018, are requesting papers for presentation at the general and DNA sessions. Papers covering all topics and disciplines are welcome. Please submit abstracts for the general session to Eric Collins at ecoll@so.cccounty.us and abstracts for the DNA workshop to Tony Nguyen at tnguy@so.cccounty.us. Abstracts should include the submitter’s name, agency, and contact info.



DNA Study Group Chair Open

The Southern Region is looking for a new DNA Study Group Chair (or Co-Chairs)!

The DNA Study Group Chair is responsible for organizing topics and presentations for the DNA Study Group meeting. They are also responsible for taking attendance.

Interested individuals must be a Full member and currently working as a Forensic DNA Analyst in Southern California. This position is open to one or two people to be co-chairs. The study group meets between 2 and 3 times a year, at different crime labs throughout Southern California. Study groups last between 1 to 2 hours.

Please email the Southern Regional Director Jamie LaJoie@southregion@cacnews.org if you are interested.

2018 McCrone Microscopy Courses

Forensic Microscopy, Asbestos ID, Fungal Spore ID, PLM, SEM, FT-IR, Chemical Microscopy ... and more!

View McCrone Research Institute's 2018 microscopy course calendar or select the following links to see all courses by category and register online.

Asbestos, Fungal Spore, and Other Indoor Air Quality Courses

PLM, Forensic Microscopy, and Advanced Microscopy Courses

SEM, FT-IR, Raman, Sample Prep, and Other Micro-methods Courses

Visit www.mcri.org for full descriptions of all courses, secure online registration, hotel information, and more.

Since 1960, McCrone Research Institute in Chicago has offered intensive courses in microscopy that emphasize the proper use of the microscope and more specialized microscopy, focusing on a particular technique, material, or field of application. All courses are hands-on, featuring lectures, demonstrations, and laboratory practice.

McCrone Research Institute: 2820 S. Michigan Avenue, Chicago IL 60616-3230 Phone: 312-842-7100

We look forward to seeing you in Chicago!

Secrets Revealed

In each "goodie bag" received by attendees at the fall seminar was a curious disk. Under ordinary light it appeared unremarkable, but when viewed under UV the outline of the seminar's theme logo is revealed.



"Add To Cart"

Don't forget to visit the CAC Store for unique gift-giving ideas. www.cacnews.org

CAC LUGGAGE TAG



Click picture for larger view

CAC logo on one side, "California Association of Criminalists" on the other, and durable white tag on the inside. Who would mess with your luggage when you're sporting this luggage tag?? [| MORE INFORMATION](#)

Manufacturer's Description:

- 2.5" X 4.5"
- Inside features a Tyvek ID card sewn on inside
- Clear plastic loop to attached to your luggage
- 100% woven polyester fabric
- The outside features white printing on blue background

\$6

CAC LOGO CERAMIC MUG



Click picture for larger view

White, ceramic, 12-ounce mug featuring the CAC logo on one side and the famous chalk outline slogan "When Your Day Ends... Ours Begins."

No morning should begin without it!

\$3

BEACH TOWEL



Click picture for larger view

CAC Logo Beach Towel, Sized 35" x 60", 100% Cotton, IvoryTouch Screen Print (White) featuring the "California Association of Criminalists" and the famous chalk outline.

These are Navy Blue towels and the lettering/design is white.

\$3

TRAVEL MUG



Click picture for larger view

A great travel mug with the CAC Logo printed in Kelly Green ink.

Manufacturer's Description:

- 20 oz, double wall, polypropylene
- Threaded lid
- White gift box included
- Dishwasher and microwave safe
- Measures 8 1/4"H x 3 5/8"W.

\$6

AUGMENTED REALITY

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ROBINSON



CAC Editorial Secretary

Currently AR technology is not as advanced as what was demonstrated in the movie, however gesture-controlled interactions with virtual windows are already a reality.

For numerous reasons, many disciplines of forensic science have seen fewer, if any technological innovations. Progress seems almost embarrassingly slow in comparison to the advancements made in other scientific studies. In the time since I first made mention of CRISPR technology and this edition of *CACNews*, scientists have successfully used CRISPR technology to eliminate HIV from infected cells in living HIV-infected animal models.¹ Simply amazing! But, perhaps technological innovations would only be superfluous for some forensic science disciplines since the truth of the matter is reliably and sufficiently obtained through rudimentary means? If it isn't broke, right? Or is it that we continue with the same tried and true methods simply because they're just so, dependable and secure?

One technological advancement that may have better chances of early adaptation in forensics is augmented reality (AR). Current and familiar applications of AR are seen mostly in mobile devices as games or entertainment, such as Pokémon Go or as Snapchat filters. Augmented reality converts digital information into graphics and animations and overlays them in real physical environments. Basically, AR takes two-dimensional information and "augments" reality by allowing us to interact with it in our three-dimensional world. Augmented reality, unlike virtual reality, is an enhanced version of our real environment, not a simulated one. To illustrate the way AR works in theory, you can watch a scene from the science fiction film *Minority Report* [here](#).² Currently AR technology is not as advanced as what was demonstrated in the movie, however gesture-controlled interactions with virtual windows are already a reality. Holograms are a pending technology yet to be integrated with AR systems, however it is possible to share and view one's AR interface via live recording and live streaming. The major benefit of AR is that it enables one to keep important and readily accessible information within your field of view without having to view a computer screen. This potential can be widely adapted to many uses, including commercial and household.

Applications of augmented reality come in a variety of forms, from mobile device applications like SkyView® and IKEA Catalog to more immersive headsets like the Microsoft's HoloLens and Meta 2. SkyView® is one of my favorites. It enables you to use your phone to scan the sky, day or night, to identify celestial objects like constellations and planets. AR headsets, while not currently affordable for widespread household use, are being used in military and medical fields. Fighter pilots and ground soldiers use similar headsets called, Heads Up Display (HUD) and Head-Mounted Display (HMD), respectively. Both display critical information, such as altitude or enemy locations in their line of sight. Medical students can use AR to study anatomy and practice surgery and surgeons can combine MRI or X-ray overlays during surgery to enhance their sensory input and improve their perception, thereby possibly reducing risk.

One such medical integration of AR technology that I find particularly intriguing is advancements to telementoring. Telementoring is commonplace in the medical field. Typically, this is done either prior to performing a complex procedure or during through complicated videoconferencing equipment. For example, surgeons in remote areas or developing countries who may not have as much experience in a particular procedure may call a mentor for advice. Together the doctors can discuss and preparations can be made, but the actual procedure is still undertaken alone. If "live" telementoring is utilized, its only realistically achieved using cumbersome equipment including equipment for real-time video images, two-way audio communication, a robotic arm used to control the videoendoscope, and a telestrator.

However with the advent of AR technology, surgeons can now virtually sit in attendance and actively mentor while the surgery is underway using only a headset. This technology called Virtual Interactive Presence and Aug-

mented Reality (VIPAAR) was developed at the University of Alabama at Birmingham. VIPAAR utilizes Google Glass to superimpose a real-time projection of the mentor's hands into the surgeon's field of sight.³ In this application, it's easy to see how AR can be used to obtain and even share tacit knowledge.

With some imagination, this concept of "Virtual Interactive Presence" could have a multitude of applications. Specifically, in forensic science, I can imagine this technology being integrated in crime scene investigation and crime scene reconstruction. Imagine how convenient it would be at a crime scene to be able to summon the interactive "virtual" presence of a subject matter expert in the time it takes to place a phone call. They could instantly see what you're seeing in the scene, offer guidance, make annotations and indicate areas to search or collect. Better yet, imagine an advice call where the detective or officer could call you and with the aid of the AR headset, it's like you're there, actively instructing and calling out play-by-play the scene processing plan. This AR application may not be as far-fetched as you think, and perhaps it's even a little familiar? Back in 1999 there was a psychological thriller called *The Bone Collector* starring Denzel Washington as quadriplegic detective Lincoln Rhyme. Detective Rhyme is a

forensics expert who guides beat cop Amelia Donaghy, played by Angelina Jolie, through multiple homicide scenes. Amelia wears a headset, and serves as Lincoln's proxy, allowing him to interact with the scene and mentor her from his bed. His expertise combined with her instincts and aptitude for forensics, (and the fact that she's ambulatory), enables them to piece together evidence gathered from the serial cases, revealing the identity of the killer. So maybe, one day this kind of AR technology will become reality and we too, can instruct a street cop from the comfort of our beds. Not holding my breath, but a criminalist can dream! And if you're looking for something to watch this holiday season, there's always *The Bone Collector*, after all.

Mei

References:

1. <http://dx.doi.org/10.1016/j.yymthe.2017.03.012>
2. <https://youtu.be/PJqbivkm0Ms>
3. <https://youtu.be/aTOoBwfbqBe0>

FEEDBACK ◀.....▶

Old Abstract Appreciated

Just want to say I appreciate the 1997 abstract from Peter De Forest you included in the *CACNews* [4thQ2017]. This is as timely now, if not more so, than it was then. Unfortunately I don't think many people currently in the profession have an appreciation for what this is talking about. We've become so focused on ISO this and ASCLD that, that we've lost sight of being scientists that form a hypothesis based on our observa-

tion of the data (i.e. the evidence) in front of us and try and support or refute said hypothesis with an appropriately designed experiment. We've created a bunch of cookbook technicians with a 'if it's not in the protocols, it can't be done and I have to follow the protocol verbatim' mentality—the "thinkers" in the group are quickly squashed.

—Name withheld by request



Your CAC Board of Directors

(clockwise) Treasurer Helena Wong, President Vincent Villena, Editorial Secretary Meiling Robinson, Recording Secretary Gunther Scharnhorst, Immediate Past President Brooke Barloewen, President-Elect Mey Tann, Regional Director (South) Jamie Lajoie, Membership Secretary Megan Caulder, Regional Director (North) Cindy Anzalone.

Hertzberg-Davis Center Celebrates 10 Years



California State University, Los Angeles commemorated the 10th anniversary and honored the founders of the Hertzberg-Davis Forensic Science Center, home to the crime laboratories of the Los Angeles Police and Los Angeles County Sheriff's departments.

State Sen. Robert M. Hertzberg and former California Gov. Gray Davis (*below l-r*), who were instrumental in securing funds for the construction of the center, received California State University, Los Angeles Presidential Medallions, the university's highest honor bestowed upon individuals who have displayed outstanding leadership and extraordinary service to the community and Cal State LA.

The Hertzberg-Davis Forensic Science Center is the largest municipal-regional crime lab in the nation, and is second in size only to the FBI crime lab at Quantico. The state-of-the-art facility also houses the CSULA School of Criminal Justice and Criminalistics and the California Forensic Science Institute. *New York Times* best-selling author Michael Connelly has featured the center repeatedly in his Harry Bosch crime novels, and the facility has been used to shoot scenes for the *Bosch* TV series.



Photos courtesy LAPD / M. C. Sallaberry

ABSTRACTS

FROM THE

FALL 2017 CAC SEMINAR

STRmix and CODIS: Methods to Increase Efficiency and Maximize Cold Hits

Brian Burritt, San Diego Police Department

STRmix is a very effective tool for deconvoluting mixtures and it is the probabilistic genotyping software of choice for many crime laboratories. However, the output data from STRmix requires additional data manipulation in order to create profiles for entry into CODIS. This presentation will demonstrate the latest version of an Excel tool called COSTaR, which has allowed for a significant reduction of post-STRmix data manipulation time by the analysts at the San Diego Police Department. Additional Excel tools and search strategies that allow for a more efficient and effective CODIS operation will be also be described.

TrueAllele Database: Mixtures are Complicated, Matches are Simple

Mandi Van Buren, Brooke Ramirez; Kern Regional Crime Laboratory

As forensic DNA profiles from casework samples have become more complex, many laboratories have validated probabilistic genotyping systems to interpret mixtures and low level samples.

Probabilistic genotyping systems provide statistical weighting to different genotype combinations, using more of the available genotyping information, which enhances the ability to distinguish true contributors and non-contributors. Additionally, these systems have valuable database applications that can be utilized for investigative leads.

The TrueAllele® System has the ability to infer and match genotypes. These capabilities are used for both casework and investigative purposes. In casework, TrueAllele separates genotypes from DNA evidence data and then compares these single contributor genotypes with reference genotypes to calculate match statistics. For investigative purposes, TrueAllele stores and compares these genotypes on a database. A genotype database uses probability to preserve all of a DNA contributors identification information. The system compares database genotypes (both evidence and reference) with each other. This process can identify candidate matches ranked by an associated likelihood ratio (LR) match statistic, which quantifies the strength of the match. The database allows all DNA mixtures to be uploaded for investigative comparison, including many profiles that are ineligible for CODIS upload.

A TrueAllele Database (TADB) is a fast, customizable and automated screening mode that can be configured for flexible genotype comparison. A full 96-well plate of DNA evidence data can be uploaded and searched in a few short hours. The database compares the DNA profiles and returns candidate matches in order by (LR) match statistic. Comparing evidence to known references can identify likely suspects. Comparing genotypes between cases can link those cases through evidence or suspects. In addition to these investigative applications, genotype comparison within a case can help automate laboratory workflow. Comparison with staff

profiles helps detect DNA contamination and enhances quality assurance.

Upon implementation of the TrueAllele Database on June 25, 2017, the Kern Regional Crime Laboratory has successfully reported database hits to law enforcement agencies including evidence to subject hits and evidence to staff hits. In two scenarios, no CODIS eligible profiles were developed from the evidence. However, the TrueAllele Database was able to utilize the data from these complex mixtures and identify informative matches between cases. In a third scenario, a CODIS eligible profile was developed. However, the TrueAllele Database identified the profile as matching to a staff member of the submitting agency and prevented an erroneous profile from being uploaded into CODIS.

The match was reported notifying the agency of the contamination event.

This presentation will discuss the creation and implementation of the TrueAllele Database at the Kern Regional Crime Laboratory. Specific profile categories, batch uploads, database searching rules, and reporting processes will be reviewed and demonstrated through candidate match workflows. Case specific candidate matches and hits will be presented in further detail.

Tobias Hampshire, Ph.D., Laura Dodd, Global Product Manager LGC

A Rapid Serology Test Capable of Simultaneous Detection of Up to Six Bodily Fluids

S. Blackman, B. Stafford-Allen, M. Panasiuk, E. Hanson, T. Hampshire, L. Dodd, J. Ballantyne, S. Wells

Biological fluids provide vital evidence in a criminal investigation; identification of the type of biological fluid is important since the nature and source of the material can be critical to the investigation. Rapidly identifying biological material prior to submission to a laboratory may also provide a mechanism to ensure investigators are sending the most appropriate samples for DNA extraction and profiling. Current body fluid identification methods are lengthy, multistage, laboratory-based processes that do not permit the identification of all body fluids in one test, with most only offering a presumptive result. LGC have developed and validated the ParaDNA® Body Fluid Identification System to provide objective results for the identification of vaginal fluid, seminal fluid, sperm cells, saliva, blood and menstrual blood in a single test. The one-step, easy-to-use, rapid, confirmatory test can operate on existing ParaDNA Instruments (Screening and Field Portable) with no requirement for laboratory based extraction techniques. In approximately 90min, the accompanying ParaDNA Software provides automatic calls in a simple on screen display or PDF format report.

The presentation aims to summarise the developmental validation based on SWGDAM guidelines, and to demonstrate that with only apx. 5 min hands-on time the test can automatically determine the presence of specific body fluid mRNA markers in single-source or mixed samples on multiple substrate types. Results can either be used to support confirmation of source from previously obtained STR DNA profile results, or to improve screening success rates by making better informed evidential submissions. Some data from early access customers will also be presented.

A Review of Los Angeles County Sheriff's Oldest Cold Hit Cases

Amber Sage, Los Angeles County Sheriff's Department

The Los Angeles County Sheriff's Department Scientific Services Bureau has been uploading forensic unknown profiles to CODIS since 1994. In that time, we have entered more than 11,000 profiles. Since our first hit in 1997, we have had approximately 6000 Cold Hits, or matches to convicted offenders, and 2,200 case to case hits. A review was undertaken of the oldest Cold Hit cases worked by our laboratory. The criteria for the case review was one, it had a profile uploaded to CODIS, two, it hit on a convicted offender, and three, it was otherwise unsolved until the hit. Seven of the oldest cases that were reviewed will be presented. These cases were sexual assaults and/or homicides that span 1972 up to the early 1980s. The focus of the presentation will be the individual case circumstances as well as the unique obstacles that older evidence can present when DNA analysis is necessary. The initial laboratory work will be contrasted against the different techniques and technologies that were used in the CODIS era to obtain a profile suitable for upload. When possible, the outcome of the cases will be presented as well as any additional work that was done on the case after the Cold Hit.

Fusion 6C and PowerQuant- Trials and Tribulations

Gregory Hadinoto and Learden Matthies, LASD

The LASD Crime Lab Biology Section validated Promega's PowerPlex and Fusion 6C kits during 2015 and 2016. The laboratory adopted an external standard curve for the PowerPlex assay and will present the reasons why it was introduced and how quality is monitored in the absence of a standard curve on each run. Additionally, unusual quantitation results will be discussed and how those issues were resolved.

Issues such as spectral pull-up and other artifacts regarding the use of Fusion 6C on the 3500 will be discussed.

The section runs all casework in batches that are processed by Tecan liquid handler robots. We will discuss adaptations made to the robots and batch submission process in regards to the use of the new quantitation and amplification kits.

Selective Degradation Using the Erase™ Sperm Isolation Kit and PrepFiler® Purification

Melissa Moore, OC Crime Lab

This presentation discusses how selective degradation can be used to replace the standard differential extraction method to obtain a single source male DNA profile from post-coital vaginal swabs containing sperm. Differential extraction is traditionally used to separate and purify the sperm cell DNA from the epithelial cell DNA. Differential extraction is time consuming and requires intensive work by the analyst. With the high number of sexual assault cases and increasing backlog of sexual assault kits, it is necessary to implement a simpler method to separate sperm cell DNA from epithelial cell DNA.

After attending this presentation, attendees will understand the benefits of using selective degradation in place of the standard differential extraction method when processing sexual assault evidence. Attendees will learn how selective degradation can be used to replace the standard differential extraction method to obtain a single source male DNA profile, and how the process can be partially automated by integrat-

ing the Erase™ Sperm Isolation Kit (Paternity Testing Corporation, Columbia, MO) with the PrepFiler® DNA Extraction Kit (Thermo Fisher Scientific, Inc., Waltham, MA).

Selective degradation is accomplished by selectively destroying epithelial DNA using a nuclease, while sperm DNA remains intact because it is protected by the robust sperm cell. The Erase Sperm Isolation Kit provides crime laboratories with the components necessary to perform selective degradation on sexual assault evidence.

Once the epithelial cell DNA and sperm cell DNA are separated using selective degradation, the DNA sample must be purified. The Erase protocol states that the DNA sample can be purified using ethanol precipitation, size filtration, or Qiagen EZ1 DNA purification. This study determined that the Automated PrepFiler DNA Extraction Kit can also be used to purify DNA samples previously digested with the Erase Sperm Isolation Kit. Although the selective degradation portion of this method is performed manually, the DNA purification portion of this method can be performed automatically using the Tecan Freedom Evo 150. The DNA samples previously digested using the Erase protocol can be placed onto batches containing up to 76 casework samples and further processed using batching procedures.

What is Next with Next Generation Sequencing: Forensic Genomic Updates from Illumina

Melissa Kotkin, Illumina

Sequencing (NGS) by Synthesis (SBS) enables the entire human genome to be sequenced in one day. As a simpler yet highly effective alternative, forensic scientists can choose to perform targeted sequencing of PCR products. By sequencing a dense set of forensic loci, casework and database efforts are directed toward the genomic regions that best answer forensic questions, relieving privacy concerns and simplifying analysis. Because it does not depend on allele separation by size, the number of targets interrogated is not limited, allowing a more comprehensive result to be generated. We will describe the complete workflow, system, and data analysis tools, and present data from validation and collaborator studies including reproducibility, sensitivity, actual forensic samples, and concordance with standard capillary electrophoresis methods. Since the commercial release of the Forensic Genomics system, we have achieved several milestones. We will highlight key points of the developmental validation of a targeted amplicon panel for forensic genomics as well as the automation of library preparation.

Applied Biosystems Precision ID NGS System for Human Identification

Jill Muehling, Thermo Fisher Scientific

Next-generation sequencing (NGS) enables forensic scientists to gather more information from challenging and degraded samples than traditional capillary electrophoresis (CE) based methods. With NGS, larger multiplexes may be used. These multiplexes can be useful for developing investigative leads and in making identifications. The Applied Biosystems™ Precision ID NGS System for human identification consists of the Ion S5™ or S5XL™ System, the Ion Chef™ System, Converge™ Software, a selection of targeted Precision ID Panels which utilize Ion AmpliSeq™ technology for analyz-

ing STRs (allele number, repeat motif sequence comparison and SNPs in flanking regions), ancestry SNPs, identity SNPs, and mitochondrial DNA analysis for both the control region and whole genome. Data will be presented that describes how NGS analysis can impact forensic investigations now.

Testing the Utility of Merging Molecular Technologies to Help Combat Illegal, Unreported, and Unregulated Fishing Across the Pacific Region

Demeian A. Willette, Ph.D, Instructor-Biology Department, Loyola Marymount University

Recent multilateral agreements have set the framework for action on illegal, unreported, and unregulated (IUU) fishing, namely the aim to develop personnel expertise and tools in accurate and cost-effective monitoring, control, and surveillance (MCS) of fisheries. Conventional MCS tools are, however, limited in their effectiveness because they are extremely time-consuming and accurate assessment of landings requires expertise in fish identification. In contrast, emerging molecular genetic methods are creating new opportunities to address marine resource challenges, including the rapid, and accurate identification of fishery catches. For example, DNA barcoding is increasingly used to detect seafood mislabeling, and recently has been used to identify marine fish biodiversity from environmental DNA

(eDNA) in seawater samples. With publicly available databases of genetic information, rapid identification of fish landings is now possible. Building on the success of eDNA in enumerating fish biodiversity in open water environments, this study assesses the utility of eDNA as a monitoring tool in commercial marine fisheries.

Lessons Learned Regarding the Implementation of Probabilistic Genotyping in Casework

Melissa K. Strong, Criminalist, San Diego Police Department Crime Laboratory, Forensic Biology Section

Despite being online with probabilistic genotyping as an interpretational tool for about 2 years, we continue to closely evaluate the process for the purpose of improving it. Many things have changed or been incorporated over the last few years for various reasons. This presentation details those improvements and the thought process behind them. It covers topics from additional validation of higher order mixtures to refining inclusion and exclusion thresholds for reporting purposes. It also touches on some quality assurance considerations.

Using DNA Barcoding to Track Seafood Mislabeling in Los Angeles Restaurants

Demian A. Willette, Ph.D, Loyola Marymount University

Seafood mislabeling is common in both domestic and international markets. Previous studies on seafood fraud often report high rates of mislabeling (e.g. >70%), but these studies have been limited to a single sampling year, making it difficult to assess the impact of stricter governmental truth-in-labeling regulations. This study uses DNA barcoding to assess seafood mislabeling in Los Angeles over a four-year period. Sushi restaurants had a consistently high percentage of mis-

labeling (47%) from 2012 to 2015, yet mislabeling was not homogenous across species. Menu-listed halibut, red snapper, yellowfin tuna, and yellowtail had consistently high occurrences of mislabeling, whereas mislabeling of salmon and mackerel were typically low. All sampled sushi restaurants had at least one case of mislabeling.

Mislabeling of sushi-grade fish from high-end grocers was also identified in red snapper, yellowfin tuna, and yellowtail, but at a slightly lower frequency (42%) than sushi restaurants. Results show that despite increased regulatory measures and media attention, seafood mislabeling continues to be prevalent.

Criminalist's Ethics in the Era of Social Media

Greg Matheson and Jennifer Mihalovich, Ethics Committee

Social media like Facebook, Twitter, LinkedIn, YouTube, and Instagram have revolutionized the distribution and "life span" of information. The ability to instantly share our life and activities with potentially millions of people by providing truncated bits of data without taking the time for thoughtful editing has changed the way society interacts. Social media is a valuable tool but can also be dangerous.

All professions have some form of code of conduct to provide guidance for ethical behavior. Forensic science is no different; we have codes like the AAFS Code of Ethics and Conduct and the ABC Rules of Professional Conduct. Forensic science codes of ethical or professional conduct can be found in the many professional associations. As forensic science professionals, we strive to adhere to these codes and perform our work ethically, with honor and integrity. Unbeknownst to us, many of us have used social media without first evaluating the link between our ethics and social media outlets. Without recognizing and understanding the pitfalls, social media has made it more difficult to adhere to the codes of conduct. Actions that used to be a personal communication between two individuals have become public knowledge and available on line, forever.

Other professions, such as attorneys and health care professionals, are actively studying the impact of social media and providing their practitioners with additional ethical guidance. The federal government has prepared a guidance document for federal employees. Forensic scientists need to enter the conversation soon as too much time has already past and damage may have already happened. Examples of social media damage in the criminal justice system includes cases resulting in mistrials due to witnesses, jurors, and judges inappropriately commenting on cases through their social media accounts. Ethics Code sections will be examined and discussed to help identify pitfalls. In addition, other concerns such as Brady, reputation management, and employment impacts will be considered. Can postings on Face Book, YouTube or Instagram keep you from being hired by a government agency? Can defense attorneys or prosecutors use postings to show Brady violations? What impact can your on-line life have on your professional life?

Update on ASB FATM Consensus Body

Gregory Laskowski, Criminalistics Services International, LLC

The American Academy of Forensic Sciences created the Standards Board (ASB) as a response to the need for standardization from the forensic community. This was

in line with recommendations in the 2009 NAS report. It is now working in cooperation with the Forensics Science Board of the Organization of Scientific Areas (OSACS) to develop standards that meet American National Standards Institute (ANSI) guidelines. This presentation will update the status of the Firearms and Tool Marks consensus body with regard to its work setting standards with regard to the disciplines of firearms and toolmarks.

The Response to the Aurora Theatre Shooting

Lt. Stephen Redfearn, Aurora Police Department

Since the Columbine High School shooting in 1999 mass shootings have been a reality for law enforcement in the United States. Responding to and recovering from these horrific events requires a unique and multi-faceted approach. On July 20th 2012, a lone gunman opened fire inside a crowded movie theatre in Aurora, Colorado killing 12 people and wounding nearly 60 others. At the time this was the largest mass shooting in U.S. history. The initial police response was unprecedented and extraordinary. The investigation that followed was daunting and overwhelming.

This mass shooting was uniquely complicated due to the multiple components, ongoing crime scenes, and subsequent court proceedings. This presentation will detail the response, the investigation, the recovery, and the lessons learned.

The Lindbergh Kidnapping Case

Lucien C. Haag, Forensic Science Services

A compelling argument can be made that the cornerstone of toolmark identification and physical match comparisons was laid by Arthur Koehler in the Lindbergh kidnapping case.

The March 1, 1932 kidnapping of the only son of Charles Lindbergh, the 'Lone Eagle' and America's foremost hero of the day, truly became the crime of the last century- a crime that went unsolved for nearly 2½ years until the arrest of Richard Bruno Hauptmann on September 18, 1934.

At the request of the American Academy of Forensic Sciences in 1982, this presenter examined the retained physical evidence and the trial exhibits archived in West Trenton, NJ.

This evidence and the trial testimony of expert and lay witnesses led to the conviction and subsequent execution of Hauptmann on April 3, 1936. The most compelling and persuasive evidence was that of wood expert Arthur Koehler after his detailed study of toolmarks in wood and the physical matching of growth ring patterns in certain portions of wood from the abandoned kidnap ladder with a severed board in the attic of Hauptmann's home.

But just as with the assassination of President Kennedy, numerous conspiracy claims and subsequent doubts regarding the guilt of Hauptmann resulted in multiple books supporting these subjects. In 1981 a lawsuit was filed by Hauptmann's widow accusing the prosecutor, David Wilentz and the State of New Jersey of a wrongful conviction and execution of her husband.

This presentation will cover the crime and crime scenes, the investigation, the arrest of Hauptmann, the evidence, the remarkable work of Arthur Koehler, the trial and the aftermath.

Contemporary Frangible Ammunition: A New Challenge for the Firearms Examiner and GSR Analyst

Lucien C. Haag, Forensic Science Services

A number of companies have made and marketed so-called frangible ammunition in both rifle and handgun calibers. Some of the handgun entries also contain heavy metal-free primers. The bullets in these cartridges come in one of two forms: powdered copper dispersed in a polymer such as Nylon or a sintered mixture of powdered copper and tin. These bullets also weigh less than their traditional counterparts which results in elevated muzzle velocities, but reduced exterior ballistic performance. At close range, both forms produce a conical distribution and deposition of minute copper particles around the bullet holes which can be used for range-of-fire determinations. A new reagent for copper will be included in this presentation. In all instances, "frangible" is a relative term in that these bullets only break up upon impact with certain hard targets such as steel deflection plates in indoor shooting ranges. Otherwise, these bullets behave much like full metal-jacketed bullets. With rare exception, traditional firearms identification techniques fail due to the lack of striae in the rifling engravings in these bullets.

Transformational Forensics

Ron Nichols, Nichols Forensic Science Consulting

Transformational forensics is a commitment on the part of forensic science laboratories to collaborate with clients and stakeholders to identify needed change, creating a vision to guide that change so that our communities can become safer places for all to have an opportunity to reach their potential. For decades, forensic laboratories have become increasingly segregated from clients and stakeholders, confined in smaller organizational boxes. However, it is this segregation that inhibits a meaningful and strategic response to the violent crime plaguing our communities.

Forensic science laboratories have the opportunity to provide more than a reactionary response to crime that has already been committed.

Leveraging expertise and technology in the right way can elevate the forensic science laboratory to be part of a proactive response to a violent crime problem thereby potentially reducing the level of violence in the streets. Significant strides have been made across the United States with respect to strategic crime gun intelligence.

Cities have experienced unprecedented improvements in the development of crime gun intelligence with investigators routinely obtaining critical information within 24 to 72 hours of an incident taking place, all without sacrificing the integrity of the evidence. And with links between cities from coast-to-coast, it vital that forensic laboratories also work as strategic partners to better deal with the firearm-related violence beyond their own jurisdictional boundaries.

This presentation will focus on the philosophical shift that forensic laboratories and law enforcement agencies have made within the United States to develop a cohesive, regional strategy that is helping to reduce firearm-related violence in the United States. Various strategies will be discussed that begin at the crime scene and end with the identification and apprehension of the responsible parties.

It is believed that will minimal costs, existing resources can be reallocated to demonstrate success on a smaller scale, encouraging funding for a more comprehensive enforcement network.

Correlation Performance of the EVOFINDER 3D Ballistic System

Thomas Matsudaira and Rachel Bauer (Intern), Orange County Crime Laboratory

The Orange County Crime Laboratory has been using the EVOFINDER 3D ballistic database system for nearly four years. In that time, we have been able to scan hundreds of bullets and cartridge cases into the system. In some instances, a sister bullet or cartridge case was also scanned. Correlation against these sister bullets or cartridge cases enabled us to effectively evaluate the performance of the EVOFINDER system against a crime database.

My Experiences as a Forensic Science Consultant for Television Crime Dramas

Gregory Laskowski, Criminalistics Services International, LLC

For the past 17 years, I have served as forensic science consultant to such television shows as CSI:, CSI Miami, Bones, Rissoli and Isles, Law and Order, Rosewood, the Blacklist, and others. Through the use of personal stories and video clips from some of these shows, this presentation will show both the real and farcical aspects television crime dramas.

East Area Rapist / Original Night Stalker

Paige Kneeland, Sacramento County Sheriff's Department

In June of 1976 an unknown suspect sexually assaulted a resident of Sacramento County. The Sacramento County Sheriff's Department was unaware this would be the first in a series which would span ten years, fourteen law enforcement agencies, and include countless residential burglaries, forty-five sexual assault victims and twelve homicide victims.

The geographic area of the suspect's numerous attacks in Sacramento County led to his moniker, the "East Area Rapist". Two years after his first assault there, he began striking communities in the East Bay Area. In December of 1979 he moved south, killing a couple in their Santa Barbara home. At that time, the crime's connection to the East Area Rapist was unknown. Law Enforcement agencies tracked his continued killings separately from the Northern California crimes, and the suspect became known as the "Original Night Stalker" as he committed eight more homicides between 1980 - 1986.

Over the years, investigators began to theorize there was a link between the northern assaults and the southern homicides. In 2001, DNA linked the "East Area Rapist" cases to the "Original Night Stalker" murders, confirming that theory. But the suspect's identity remains unknown and the case remains unsolved after forty years.

This presentation will cover a brief summary of the crimes, as well as subsequent investigation. Recent efforts have included collaboration with multiple jurisdictions (local, state and federal) as well as some creative methods in an attempt to solve this series.

Implementing 3-D Virtual Comparison Microscopy into Forensic Firearm/Toolmark Examinations

Heather Seubert, FBI

Following this presentation, attendees will be aware of the validation method used to evaluate 3d instruments for virtual comparison microscopy, the method used to incorporate these technologies into traditional forensic firearms/toolmarks examinations, and the capabilities of using 3d technology for training, examination verification, and blind verification/testing.

This presentation will affect the forensic science community by demonstrating the effectiveness of 3d technologies for integration into forensic firearms/toolmarks examinations. The topics will include how the FBI Laboratory Firearms/Toolmarks Unit (FTU) has been tasked with evaluating 3d technologies for validation and incorporation into casework.

The Firearms/Toolmarks Unit has been conducting a validation study for the incorporation of various 3d platforms into operational casework as another tool to assist in the examination of ammunition components. It is anticipated that having these technologies available will enable efficiency for cases with high number of submitted components, provide additional training aids and also provide larger scale views of information captured for the examiner's examination and review. A portion of the validation study was to determine if a qualified firearms/toolmark examiners could successfully determine, using virtual comparison microscopy, the correct answers to previously distributed proficiency tests and consecutively manufactured test sets. The FBI Laboratory has a repository of Collaborative Testing Services® (CTS), Inc. firearms proficiency tests previously distributed to evaluate the FTU for quality assurance. Ten of these proficiency tests were selected with test distributions spanning from 2003 to 2012. Some of the test participants had previously taken these proficiency tests using traditional optical comparison microscopy. All proficiency test samples, including the three knowns submitted for evaluation were given random identifiers for virtual microscopic comparison.

Additionally, three test sets were assembled using consecutively manufactured slides from the FBI Laboratory Consecutively Manufactured Slides and Barrel Collection (CMS-BC), which is used for training and research. Consecutively manufactured Ruger®, SR9 slides were selected using Winchester® ammunition to create test samples.

Each consecutively manufactured test set consisted of ten cartridge cases with randomly assigned identifiers for virtual comparison. The participants contributing to this study ranged in years of experience and included qualified examiners and examiner trainees.

The Cadre® Forensic TopMatch- GelSight instrument uses the Bidirectional Reflectance Distribution Function (BRDF) to acquire 3d surface images and was acquired by the FBI Laboratory in 2014. The system's software allows for side-by-side evaluation of surface topographies and matching algorithm search capabilities for topography similarities. For this virtual comparison microscopy evaluation study, test participants did not have access to the matching algorithm to assist in reaching a conclusion. Test participants were given operating instructions on GelSight prior to conducting test examinations. Results were recorded by the individual test participant on an answer key and they were encouraged to provide feedback on the virtual comparison microscopy analysis. The outcome

of the results of this study will be discussed, along with the incorporation into the Firearms/Toolmarks Unit's standard operating procedures and implementation into casework as an alternative to traditional comparison microscopy.

Internet Safety: How to Protect Your Child On-Line

Sandra Longnecker, Orange County Sheriff's Department/Orange County Child Exploitation Task Force

In this presentation you will learn about how to protect children, in an easy fashion. It is easier than you think! I will show you local and current case examples my team has worked in Orange County and briefly explain how the suspects were able to exploit their victims.

Many of you will look at the title of this presentation and think, Oh, no....this is going to be a depressing class, but in actuality, you will leave this class with a better understanding how Cyberpredators find and exploit our children, and I will also throw in some funny personal stories about my own children that I believe many of you will be able to relate to. I will also discuss Cyberbullying and how law enforcement can help on cases such as these.

What Jurors Want in an Expert Witness

Suzie Price, Orange County District Attorney's Office

This teaching block will focus on what jurors are looking for when they evaluate expert witness testimony. The course offers an overview of the jury instructions the jurors receive regarding how to evaluate expert witness testimony. The session will also include a discussion on effective communication styles, methods of simplifying expert testimony so that is understood by the audience and building credibility by focusing on current tasks and responsibilities as crime lab personnel.

Studying Marijuana Impacts: A Toxicologists Perspective

Jennifer Harmon, Vanessa Hancock, Shelli Perez, OC Crime Lab.

Since the early 2010's the Orange County Crime Laboratory has evaluated workflows, testimony expertise, and policy as it relates to impairment from and legalization of marijuana. The laboratory has taken a proactive stance in understanding legislation impacts, growth of expert testimony, and the impact the drug can have on operating a motor vehicle. The presentation will share a toxicologist's perspective on the impact of the drug and its legalization on a forensic laboratory. Topics will include the legalization legislation, Proposition 64, studies on collecting baseline data in deceased drivers, crash risk, and the applicability of a legislated per se. Additionally, a study on drug prevalence in nearly 1500 blood samples of arrested drivers above the legal blood alcohol per se will be presented and published work on whether Drug Recognition Expert (DRE) evaluations and Standardized Field Sobriety Tests (SFSTs) can correlate known impairment to a specific blood THC concentration.

HAM Sandwich – How Alcohol Metabolizes

Valera Horton, Orange County Crime Laboratory

Controlled drinking studies play an integral role in the understanding of ethanol metabolism in the human body. The laboratory routinely assists with controlled drinking

studies as training for Forensic Alcohol Analysts and to aid students participating in Standardized Field Sobriety Test (SFST) and Drug Recognition Expert (DRE) courses.

The objective of each drinking study was to monitor and evaluate a subject's breath alcohol concentration (BrAC), as well as their performance on SFSTs. The Intoximeters Alcosensor VXL instruments were used to measure each subject's BrAC throughout the day. Over the course of a two year period, 12 drinking studies have been conducted by the Orange County Crime Lab, including a total of 90 volunteer drinkers (42 males, 48 females). Some individuals have participated in multiple drinking studies, providing insight on variation that can be seen within individuals across different drinking episodes. BrAC curves have been plotted for all participants and approximate rho values (percent body water) and elimination rates have been calculated.

Optimizing the Use of High Definition 3D Imaging for Bullet and Cartridge Case Comparisons

Andrew Boyle, Ultra Electronics-Forensic Technology

The introduction of High Definition 3D imaging gives the IBIS (Integrated Ballistics Identification System) user a multitude of ways of comparing and exploring the microscopic details found on fired bullet and cartridge case exhibits. Participants of this workshop will see several tips and tricks that have been developed specifically to optimize the users time and experience with IBIS-TRAX HD3D in order to get the most out of the available features. IBIS-TRAX HD3D is the technology used on the ATF's NIBIN Program with nearly 200 installations throughout the US which, includes 21 installations in the State of California. The interactive format will be open for QA to cover any topics of relevance to the attendees.

Recent Developments in the Law and Policy of Forensic Science and Expert Witness Testimony

Mike Chamberlain, California Department of Justice

This presentation will update attendees on recent developments in the law and policy of forensic science and expert witness testimony.

The CAC Board of Directors *sine qua non**



*Nothing without you!

How to do a CAC Seminar: *in 7 easy steps*



1

Check in, get your goodie bag and meal tickets.

Be greeted with smiles...



2

Reconnect with friends and colleagues you haven't seen since you worked in *that* lab...



3

Get coffee...add one pastry...



4

Meet the vendors.



5

Find a seat and stretch...



6

Watch fascinating presentations...

7

Have fun!



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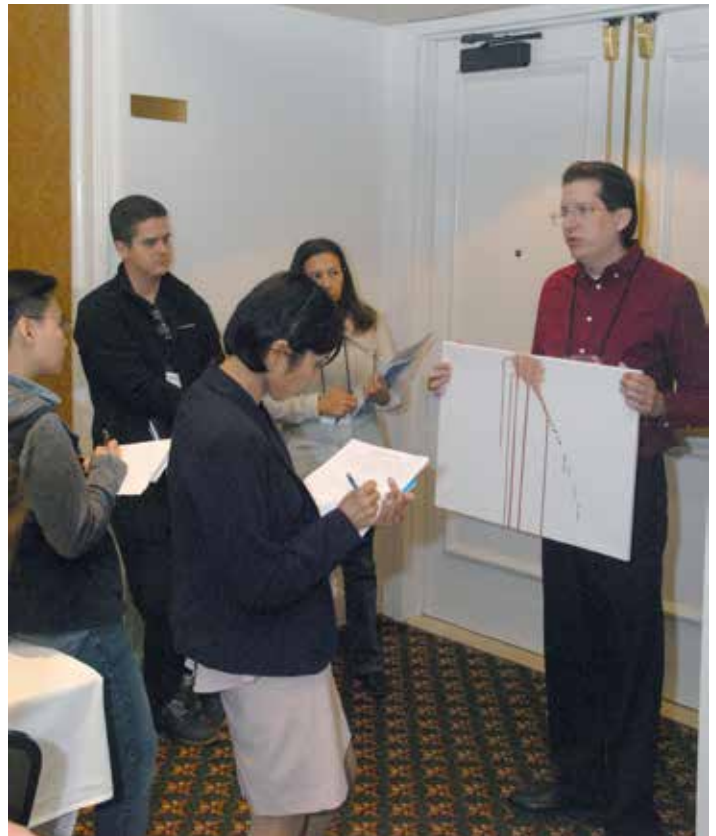
A very tasty recipe indeed was served by Orange County Crime Lab to nourish the minds and bodies of attendees at the Fall 2017 CAC Seminar.

Workshops, presentations, awards and, at the banquet, a three-person “flash mob” were among the perfect ingredients.



Spatter Class

(l-r) Kelly Kaye, Than-Nhan Do and Shelli Perez study bloodstain patterns during Kevin Andera's workshop at the Fall 2017 seminar in Newport Beach.



WORKSHOPS



Greg Seachrist photo.

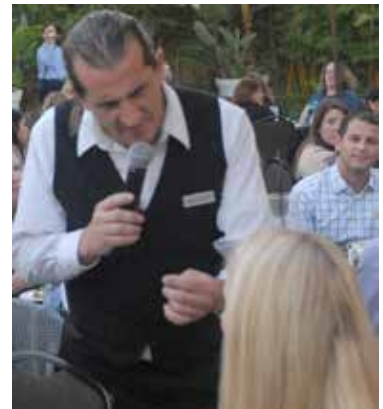








The appetizer for our sumptuous banquet turned out to be "The Three Waiters" who serenaded us with selections from operas in French, Italian and English.





The Role of Science in Criminalistics—Are We Going the Wrong Way?

John D. DeHaan, Ph.D., F-ABC, FCSFS, FIFireE, IAAI-CFI

I am a criminalist. That is all I have ever been professionally. More specifically, I am a generalist in trace evidence. Since 4th grade, I wanted to be a scientist - answering questions, solving mysteries of how things went together, worked, or failed. That was not a common ambition among my peers, so that meant being something of an outsider. Today, I'd be labeled a science nerd or geek. Beyond getting a job as a criminalist, I have had no career plan, sought no promotions, just lucky enough to have opportunities present themselves at the right time. As a college sophomore, I got a position as an undergraduate research assistant in the High Energy Physics Program that UICC had at Argonne National Labs. Other than space programs, this was the pinnacle of Big Science in the 60's. After a couple of years, however, I realized that the actual work of the physicists was complex mathematical data analysis and the results were of interest to a very small group of people and were not bettering the world. As a child of the 60's, I wanted to make the world a better, safer place. In casting about for an alternate, on a whim I took a Criminal Justice course: Introduction to Criminal Law. Amid all the aspiring lawyers and police, I was an outsider. My classmates said "you're a scientist; you need to stay around for the next class in here—Criminalistics". This being 1968, who ever heard that term? Well, I stayed, and met Joe Nicol, who changed the course of my life. Joe had just retired as the head of the state crime lab at Joliet, had a BS in chemistry and MS in physics, and had started his career as a police chemist at the Chicago PD lab in 1946. He did crime scenes and lab analysis. He knew the value of trace evidence, microscopy, and instrumental analysis. Here was a way to do real science and make the world a better place! I was IN! Joe was a founding member of the American Academy of Forensic Sciences (and insisted that I join as soon as I was qualified). He took several of his students to the AAFS meeting in Chicago in 1969 and introduced me to many of the legends of forensic science - Jim Osterburg, Bill Eckert, Lloyd Shupe, Alexander Gettler, Milton Helpert, and many more.

It was too late, however, for me to change majors, but that turned out to be an advantage in the future, because my deep background in physics gave me operational knowledge in optics, spectroscopy, IR and UV, x-ray analysis, even material science. The late 60's marked a major shift to forensic analyses by instrumental means, rather than wet chemistry or microscopy alone. When I looked for a job, I found there were only three crime labs in Illinois - the State lab in Joliet, Chicago PD, and the private crime lab in Highland Park. None of them was hiring. Luckily, our program hosted a lecturer on sabbatical from California - Duayne Dillon. He gave me a list of the 14 public labs then operating in California. I selected the Bay Area (I had family in Southern California and had not



John DeHaan (r) receives the Rasbash Medal for contributions to fire science from Martin Shipp, president of the Institute of Fire Engineers (UK). Author's photo.

been impressed with the environment there). I was hired in Dec 1969 at the Alameda County Crime Lab. Once there, Bob Cooper wasted no time in telling me that I was on "double" probation because I was the first criminalist he hired that was not a Cal graduate. He could not be certain of the quality of the criminalistics education I had received from such a foreign source! I was an outsider there, too!

I quickly learned that we civilian criminalists were treated with caution (if not respect) by the uniformed personnel. We were not in the chain of command and they could not be certain of our "loyalty" to the members of the thin blue line. We would come to our own conclusions and opinions based on our examinations. Although he was sometimes a harsh supervisor, Bob would allow no interference or influence from police or prosecutive agencies. We were expected to evaluate the case, apply the best science and follow the science to our conclusions. When I went to DoJ in 1974, the same policy was expressed. When I was with ATF from 1983-87, it was the same cautious acceptance by the agents of the independence of the white coats. As long as you were willing to pick up a shovel at fire scenes with the rest of the National Response Team members, you were OK. That shovel experience came in very handy during my years of fire research and investigations.

Scientific knowledge has long been a source of conflict and challenge to authority, whether that authority was governmental, religious doctrine, or beliefs of the citizens. Scientific opinions ranged from the heavens, life on earth, or how human bodies work and have evolved over the millennia. Thomas Kuhn in his remarkable book: *The Structure of Scientific Revolutions* (1961) described this process as what has now been termed "punctuated equilibrium." Much of western concepts of life and the universe were built on the philosophy of Aristotle (~ 384BC - 322BC). He encouraged systematic enquiries and logical inferences to create an explanation of the universe as it could be observed at that time, but without testing or experimentation.

Ptolemy (ca 100-170AD) created a model of the universe based on his observations and inferences that placed the earth at the center of all creation. Because this "geocentric" model fit

Delivered May 10, 2017 at the San Francisco meeting.

well with the majority of religious beliefs that humans and earth were the specific creation of one God, it was accepted as truth.

Governments and educational centers were controlled by religious authorities who “set” those theories and rejected all challenges to them. One exception was Alhazen (Ibn-al-Haytham) (~950-1000AD) from Mesopotamia (today Iraq). He advanced what we recognize today as the scientific method (supported by data from systematic experimentation). Arabic science was apparently supported if not encouraged by Muslim clerics (after all, Arabic scientists did invent/discover distillation of alcohols to everyone’s pleasure!). In the Western World it wasn’t until Nicolaus Copernicus (Germany/Poland, 1473-1543) that scientific thought really challenged the party line with the conclusion that ours was a heliocentric universe, demoting Earth from center stage to a planet circling the sun. Ironically, Copernicus was a cleric and educated in the church, so this was doubly challenging. His opinions seemed to be marginalized, at least for a while. He was forbidden by the Church from teaching these concepts for many years. Since the church controlled education and written media, few contemporaries learned of his opinions.

Galileo Galilei (1564-1642, Italy) advanced the concepts of explaining the universe using experiments and demonstrations of how gravity worked, which further challenged even the heliocentric universe. This led to strenuous conflict with the church, which convicted him of heresy in 1633. He spent his remaining years under house arrest because he refused to yield his scientific truths to the “authorized” explanations.

Rene Descartes (1596-1650, France) advanced many analyses with math and geometry. Pope Alexander VII prohibited publication and circulation of these heretical concepts to protect the party beliefs. At about the same time, Francis Bacon (1561-1624, England) was encouraging the adoption of conclusions based on scientific methods and experimentation to challenge antiquated systems of thought for the betterment of all. Surprisingly, he was a trained lawyer and was Lord Chancellor and a member of Queen Elizabeth I’s Privy Council. Even that elevated position did not ensure acceptance – the royal administration rejected all such concepts outright.

Isaac Newton (1642-1727, England) advanced the knowledge of light, optics, motion, gravity (inventing calculus to support the analysis) and proved the mechanisms by which planets circled other heavenly bodies. This, like with his fellow scientists, put him into conflict with the Church (which still adhered to the geocentric model of Aristotle and Ptolemy). He ended his days reforming the Royal Mint and its coinage and helping prosecute counterfeiters (who faced execution if convicted).

Charles Darwin (1809-1882, England) was a naturalist, geologist, and biologist with medical training (a true Generalist!). He combined his knowledge of fossils and wildlife and the vast data from his 5-year voyage on the Beagle to create, over a 20 year period, a defensible system for the variations and evolution of the animal and plant kingdoms. His conclusions were in direct conflict with the beliefs of conservative clergymen and fundamentalists who refused to accept man’s evolution from the apes. They insisted on the accuracy of Biblical sources that established that man was created above (and separate from) all other species. This conflict still exists in many quarters today.

It was only a matter of time before science came to be recognized as a source of knowledge that could be of help to the triers of fact seeking the truth in criminal cases. Hans Gross

(1847-1915, Austria) was trained as a lawyer (Graz and Vienna, 1869) and was quickly appointed to be a magistrate and a professor of criminal law. His main interest in many of his cases was the psychology of the criminal, motives, and improving interviews and interrogations to get the most reliable information. He is credited with inventing the term Criminalistics from the title of his historic landmark text - *Handbuch für Untersuchungsrichter als System Der Kriminalistik*, in 1883. (Handbook for Examining Magistrates). He insisted that judges and magistrates need to consider physical evidence, particularly trace evidence, in their cases but that they should seek out qualified experts in biology, medicine, geology, botany, and chemistry to aid them. It is said that Gross’ book was an inspiration to Arthur Conan Doyle in the creation of Sherlock Holmes. Others show that Doyle attended lectures at Edinburgh given by a remarkable forensic pathologist, Dr. Joseph Bell. Bell had an uncanny skill in estimating what professions his “clients” pursued from the calluses, stains and trace evidence on the body.

While some insist that Holmes was a purely fictional character, many of us ascribe our interest in criminalistics to exposure to Watson’s accounts of Holmes cases while in high school. If you are among the deprived, please avoid the current TV and movie depictions that involve over-the-top interpretations and find the brilliant series from the 1990’s with Jeremy Brett as Holmes for accurate rendition of the original canon!

It is certain, however, that Gross inspired many of the European pioneers to take up their microscopes in pursuit of facts needed in criminal cases. I strongly suggest if you have not read them, to find and read *The Century of the Detective and Crime and Science* by Jurgen Thorwald (published in English ca 1966-67). [1] You will gain tremendous respect for the contributions of trace evidence specialists (and other pioneers in serology and biology) to our field.

A few of the pioneers in trace evidence:

Max Frei-Sulzer:(1913-1983, Zurich Switz). Microscopist who invented the tape lift method

George Popp: (1861- ? , Frankfurt, Germany). Chemist, serologist, trace evidence

Edmund Locard: (1877-1966), France: Locard Exchange Principle for trace evidence

R.A. Reiss: (1875-1929, Lausanne, Switzerland). Forensic photography and trace evidence Founded the Institute for Police Science

John Glaister: (1892-1971, Egypt and Glasgow). Published an encyclopedic work on Hairs of Mammals and Humans, 1931.

James Osterburg (1917-2012). Police chemist. Wrote the landmark text: *Introduction to Criminalistics*, 1949) that included trace evidence and instrumental analysis

This line extends, of course, to our own E.O. Heinrich and Paul Kirk, and even our contemporaries like Skip Palenik and Faye Springer.

As criminalists, we work within an adversarial system of justice, so we are bound to be in conflict with someone else’s opinions and conclusions. It has become fashionable for lawyers to attack all of the forensic sciences, in particular criminalistics, as a way of discrediting our results and opinions. They often argue that we are biased, because we testify so much for the prosecution. It should be pointed out, that when we work in a public sector (police or prosecutor) laboratory, our negative results are not seen in court because there is no case to pursue. I do not know of a case in 47 years in which

a prosecution went forward when my tests said the guy didn't do it. In my private consultancy practice, every potential client got the same warning: You are going to get my opinion – good, bad, or indifferent to your case. I never had a public sector representative: police, fire, prosecutor or public defender (or for that matter a private defense attorney) ever hesitate at that condition. It is true that many civil insurance lawyers found help elsewhere with that warning. I never had one supervisor suggest that I should change my opinion and find an answer better suited to the agency's needs, if I had followed the best science available and tested all of the alternative hypotheses. Better we had a "maybe" or an "undetermined" than a positive for the wrong reasons. I was always open to requests and suggestions of the submitting agent, however, and I nearly always had one or two phone conversations with the submitter if there was any question about the analysis or its interpretation. The suggestion that I just do the analysis requested or the comparison or reconstruction without any input or information from the investigator would prompt and immediate conference. My supervisors (former bench criminalists themselves) recognized the problems that could arise from just checking the boxes. Bob Cooper was a harsh supervisor but he always insisted that every criminalistics case be accompanied by a police report – whether it was a scene report, incident report or a full investigative report. If not, it did not get done. The suggestion that I would provide a result as a "black box" robot without knowing the context of the submission – the where, what, and how of the scene - would be energetically rejected. How do I know if the examination or comparison I am asked to do is valid under the circumstances? I learned from some scene exams that what I considered relevant was not always what the crime scene officer or detective would select. I dare say there have been many more erroneous interpretations of physical evidence when this "black box" policy was in effect.

I have described myself as a "trace evidence guy" throughout my career. What is trace evidence? We used to jokingly describe it as everything that doesn't bleed, shoot, or get you high. This covers a lot of ground - from the residues of an ignitable liquid in fire debris, to residues of explosive material on a target (or on a tool), to hairs and fibers associating an individual with a place, thing, event, or other person. Did bits of plastic or paint on clothing come from that vehicle? Did that chunk of concrete in the burglary match the pieces left in the suspect's car? Was this counterfeit currency actually laundered to age it? What was this burned, blown up, or crushed thing and did it play a role in the crime? What are these residues on the walls of this hallway where a guy was gunned down, and how can they help reconstruct the shooting (given that the gun was not recovered)? How was the victim shot and how was he searched and moved? What does the damage to the body tell us about the scene or the incident? These are the questions for the "trace guy". There really can be no manual or SOP to cover all the questions that can arise in a thorough investigation of many crimes. To refuse an analysis of critical evidence when the resources to properly analyze them and the skills and knowledge base of the examiner are adequate is a disservice to the profession and to the criminal justice system. I dare say I have turned in a lot more negative associations or exclusions than positives over the decades. Those are the ones that the attorneys may never see. If a criminalist correctly applies the scientific method –

evaluating the problem, collecting data, formulating suitable hypotheticals, conducts the valid tests, and interprets the results (including the "negatives") fairly and accurately - that is a guarantee of accuracy for the forensic process. If we apply good science and interpret the results fairly, we will have defensible answers. To preclude certain tests because we do not have a certification in hand for that particular examination is wrong. My independent approach to apply the best science to one-off forensic problems drove several of my lab managers to distraction. I am sure I was referred to as, "That independent SOB back in the trace lab" on more than one occasion. Needless to say, most of my changes of employment were the results of conflict with management

When we in the profession first considered certification, we thought it was a good idea to offer some sort of a guarantee to ourselves, administrators, and our users that the analyst had suitable understanding of the process, application, and interpretation according to shared knowledge. We developed extensive training courses at all levels. I am very proud of the courses that were put together at CCI, and the CAC has offered a lot of first-rate courses over the years. We practicing criminalists developed certification exams for general criminalistics as well as specialties. All that improved the accuracy and reliability of forensic analyses. That wasn't enough, however. How do we establish that the laboratories are run correctly? This is where things went crazy. Over the years we have applied more and more stringent measures to accredit labs according to mystifyingly complex protocols. An entire industry has grown up on accrediting and certifying, and documenting it all. Accreditation has been achieved at great cost and staff time only to have the next inspector require more. Many lab instituted policies that forbade the use of any analysis technique that was not part of the library of approved protocols (or SOPs) for the accreditation. This is wrong and bad science. Sheila Willis, Director of the Irish National Forensic Science Lab (ISO 17025 and 17020 accredited) put it succinctly:

"However, there are potential flaws with the use of accreditation system. The standard operating procedures (SOPs) that are formulated for the system can become too rigid. Individuals become too reliant on the value of SOPs and ignore judgement. This is particularly problematic in an environment where the samples for analysis are not uniform. Tasks can be carried out to comply with the system, rather than consider the underlying reason for the examinations or questions to be addressed. The greatest danger is that personal responsibility is abdicated to the system. ... With time, documentation becomes overly complicated. It needs to be periodically reviewed from a first-principle standpoint. There is also the risk that staffs rely on their memory or perception of what is in the documentation. Phrases like "we can't do that because of accreditation" need to be constantly challenged. The system allows for a deviation from SOPs when necessary so long as the reasons are documented. This aspect is not always used when appropriate. Instead there is a rigid adherence to protocols. This occurs when the use of judgement and a different approach is needed." [2]

In other words, apply good science. Collect all the data, test all the hypotheses, evaluate and report it fairly. All, seemingly, to no avail. The notorious NAS review concluded that much, if not all, of forensic science was bogus, built on insufficient science. The term "junk science" became the rallying cry. Why? Maybe because too many of the private lawyers' clients were being found guilty? Were mistakes made? Were some found guilty that were not? Was there some bad science involved? Yes, no doubt. We are familiar with the ever-grow-

ing number of wrongful convictions being found today. Many of these were a result of dramatically improved DNA determinations (revealing that the serological methods of decades gone by were good but could not accomplish the numerical precision of DNA). I have been a part of a number of post-conviction appeals and Innocence Project cases (on both the prosecution and defense sides). I was a member of the Texas State Fire Marshal's Scientific Advisory Panel that reviewed a number of convictions for arson (and often murder). Some of those were based on erroneous lab determinations (that were not revealed by sufficient preparation or suitable cross-examination by opposing counsel). Some were the result of prosecutorial misconduct, misrepresenting the scientific findings. Some were juries simply not understanding what any of it meant. Some were due to judges wholly unprepared to evaluate the validity of the science that was being offered. The New York Innocence Project attorneys concluded that jail house informants, eyewitness errors, and poor police or prosecutorial procedures were responsible for the greatest bulk of wrongful convictions, not lab errors.

Why are we flagellating ourselves to satisfy a group that only resents our scientific conclusions because they frustrate or derail their causes – whether that is to avoid justice or cost them money? Science-based decisions are always contrary to *some* party's self-interest. All forms of criminalistics improve the finding of justice, when they are properly studied, tested, conducted, and presented.

Sure, there have been misleading or erroneous methods. Neutron activation analysis (NAA) was a rising star in the 1960's because of its tremendous sensitivity to trace elements. It was used for linking soils, paints, and metallic traces (like GSR). It was then extended to hair analysis in criminal cases. There was data that suggested the trace elemental content of human hair varied greatly across a population and therefore offered a potential to link hairs with a single individual. While it was very sensitive, it required several hairs and long exposures to gamma radiation for multi-element accuracy. The technique was destructive (literally frying the hairs inside the sample holder). When more sensitive techniques were applied, it was found the elemental content varied from hair to hair on a single scalp and along the length of individual hairs. By 1972, there was a consensus that biological tissues like hair had too many variables to be characterized by NAA. Atomic absorption spectroscopy enjoyed a vogue for GSR analysis (looking for barium, antimony, and lead from primer mixtures on hand swabs). When different primer formulations were introduced that did not contain all three elements and environmental sources were found that could mimic the remaining elemental content, AAS was phased out in favor of SEM/EDX (that could record the morphology of particles as well as their elemental content). Sometimes the technique is too sensitive, and we ascribed evidential value to trace quantities that were environmental background. This was true for fire debris analysis. As analysts tried to match the sensitivity of the canine accelerant detection canines (a few ppb) with laboratory GC/MS, they discovered a complicated world where ignitable liquid residues were found at ppb levels in all kinds of "innocent" consumer goods – from copy paper, to clothing, to shoes. There is an on-going struggle trying to convince canine handlers that multiple alerts in a room or in unburned materials may well be a "false" alert. A similar issue arose some years ago in the detection of traces of explosives on hands, where the spot or TLC test used was not specific for

NG and there were consumer products at the time that could generate chemical traces that gave similar results. The significance of trace transfer evidence (such as hairs or fibers) depended on population surveys – how often do these materials occur in the "normal" course of events. At the time, the HOCRE in the UK could conduct such surveys, but few agencies in the US could duplicate them. Sadly, CRE was one of the first "research" agencies disbanded by the Thatcher government when it declared research was a waste of resources.

Despite all our professional efforts to establish reliable tests (through ASTM, SWGDRUG, SWGFEX and the others) today we face a governmental juggernaut that threatens all scientific independence in forensic science. Science can be defined as the systematic enterprise of gathering knowledge about the world and organizing and condensing that knowledge into testable laws and theories. Note that these are NOT beliefs that people (and governments) hold that are considered to be valid without testing. What happens when science is subjugated to authority for its own purposes? The Nazis developed armed rockets. North Korea and Iran hold a nuclear weapon threat against the rest of the world. Even the U.S. had the Manhattan Project (to win World War II). It was successful but Robert Oppenheimer and Einstein argued against its use as representative of the Goddess of Death (and strongly opposed the development of the hydrogen bomb just to have a bigger bomb than anyone else). What will happen if forensic science is hand-cuffed and muzzled against government misinformation in court proceedings?

Today, our scientific testimony is often challenged by opposing lawyers by means of a *Daubert* challenge. This was first pursued as an improvement on the *Frye* test (1923) for evaluation of novel scientific techniques (originally used in the first use of polygraph testing). The *Frye* test was for the judge to see what other qualified experts in the relevant scientific discipline had to say about the technique. This was often in the form of a review of peer-reviewed publications. In the *Daubert* case, the judge was asked to decide whether the statistical analysis of illness occurrences was reliable and applicable to the birth defect lawsuit in front of him. [3] In an extension of the principle (*G.E. v. Joiner*), the decision was whether the test results based on injections of transformer oil inducing tumors in rats was applicable to a human (*Joiner*) getting sprayed with transformer oil in his job. [4] That decision named the judge to be The Gatekeeper to keep out unreliable scientific testimony, not only in "novel" cases but in all science-based cases. That clearly is a tall order since most judges were lawyers first and had had little if any scientific training. The defense bar quickly realized that they could get an extra cut at the scientific evidence by way of a *Daubert* challenge (in Federal courts and about 35 states). Some judges will turn to a panel of independent scientific experts to advise them. Others just wing it based on their common sense. My recent review of appeals court decisions (just on the simple issue of admitting canine accelerant detection testimony) showed a wide range of court decisions, with the judges in *Daubert* courts making awful decisions much more often than those in *Frye* courts. Judges will sometimes turn to a paid "*Daubert* expert" who is often not a lawyer or a scientist but a professor of logic or ethics, to tell the judge about bias on the part of the expert. This is clearly not helping the judge establish the reliability or validity of scientific testimony. Criminalists, then, have to be much more thorough in explaining

the science behind their analyses and what testing was done to eliminate or control the (assumed) built-in bias of our employment for the law enforcement entity. The full range of our testing of alternate hypotheses may have to be described in some cases.

My own specialty of fire investigation has seen tremendous change and improvement over the 40 years or so of my involvement. As a fire debris analyst, I was often challenged by the investigator as to the reason for a “negative” result. There was nothing wrong with my equipment and the technique met the current standards for sensitivity. When I questioned the submitter as to why that sample had been taken, I often discovered reasoning that I thought faulty. When we started setting and observing “training” fires (where we knew the starting conditions), we discovered that fire development and fire patterns were often different from what investigators were expecting. There were fire engineers and fire scientists at NBS (now NIST) and Berkeley, Harvard, and other places, but their knowledge was not shared with scene investigators. Nearly all scene investigators (for police or fire) had been trained by their predecessors, usually only by looking at burned out scenes. The existing text books were written by insurance or police investigators with minimal scientific training. Public scene examiners were making decisions with serious consequences: Was it a deliberately set fire (demanding arrest and prosecution) or accidental (with possible civil lawsuits worth millions of dollars). Paul Kirk’s book: *Fire Investigation*, was based on scientific knowledge and live-fire testing, but it was not released until 1969. [5] By complete accident I was one of the first public-sector forensic scientists to try to bridge the gap between investigators and science/engineering knowledge. That made me a real outsider (sometimes to both professions). Why is the crime lab guy helping set up and run our training burns and what is DeHaan going to do with this data? It was all those observations and data from hundred of live fire tests in real buildings that supported the somewhat revolutionary opinions published in *Kirk’s Fire Investigation* over the years. [6]

Fire investigation was one of the first forensic disciplines to be called “junk science.” It was not. There was no science at all, just a collection of misobservations and fables. It was a long struggle to convince practicing fire investigators that they were often mistaken in their conclusions. (I was called a “defense whore” several times for my alternative explanations for phenomena that were not the result of “flammable liquid” devices, contrary to the prosecution’s opinions.) When the *Daubert* rationale was first applied to the testimony of “scientific experts”, the IAAI prepared an amicus brief explaining that fire investigation was not science but was a technical application, so *Daubert* didn’t apply to them. When *Daubert* rulings were extended to all “technical experts” they were really stymied. Paul Kirk’s book was the first book on fire investigation actually written by a scientist, but it did not draw great attention. The second edition (1983, by me), got some attention but was often dismissed as the ranting of a “lab rat.” Later editions were based more and more on the hundreds of live fire tests I was able to conduct or observe and were more widely read and accepted by investigators. Recent editions have been listed as the source reference for all certification exams. The whole concept of scientific fire investigation got a tremendous boost when the NFPA released *NFPA 921: A Guide to Fire and Explosion Investigation* (in 1992). It was authored by a multi-disciplinary technical committee of scientists, engineers and ex-

perienced investigators. I was a member of that committee from 1991-1999. The most recent editions of the NFPA professional standards for fire investigators (NFPA 1033) list some sixteen areas of science and engineering that are considered necessary for competence. I like to think that I was something of a catalyst to bring fire investigation and science together for a reliable method.

Today’s science-based fire investigators do a much better job (if they are given the tools and time). The adherents of the “old ways” who rejected the cautions of scientific knowledge are finding themselves excluded more and more by more critical courts and knowledgeable cross-examiners.

It is troubling today to see scientifically-supported conclusions being denied and denigrated because their acceptance means lost profits or political strength. We are seeing the current political powers dismantling and limiting the sources of scientific data, and preventing their publication or dissemination. This is aided by the repeated use of revised data, alternative facts, and fake news (circulated and repeated via digital media without review or analysis). This harkens to the theme of George Orwell’s famous 1949 book, *1984*. There, the main character is employed by the supreme authority (Big Brother) to rewrite news stories to favor the power and support “group think.” When he is tempted to stray from the behavioral norm, he is jailed and tortured until he admits that the truth or the correct answer is not what he knows, but what he is told is the correct answer by the “group think” that prevails. Even the rallies of hate and ridicule in the movie sound frighteningly like the chants of recent political events, and the current anti-science campaign echoes the efforts to replace data with fake news in *1984*.

I am proud of what I did as a criminalist over 47 years. I think I helped keep the justice system on track (and sometimes *find* the right track). I am proud of what I helped to improve in forensic science by the research I conducted, taught, and published (sometimes at the great frustration of my supervisors). I am also proud of the progress all of criminalistics has made over the same half century. Our techniques are more sensitive and more rigorous today (dare I say more accurate). Equally important, we have a better understanding of the control data, background, and limitations of what we do. Have I made mistakes? Possibly—hopefully no serious ones (although some of my professional opponents would claim there were many). Has forensic science made mistakes?

We work however, within an adversary system, entitled to call on the services of other experts to contradict the government’s experts. We are fortunate here in California to have a well-prepared, energetic, and ethically-driven “defense” expert community. As a prosecution expert, I was surprised (and gratified) to find out years afterward that many of my local cases had been reviewed and accepted by my colleagues here. It was to their credit that errors were caught and, in a few cases, revealed the misguided individuals who dry-labbed tests or misrepresented their findings to “help out” the police. With the retirement of a number of them, the availability of qualified opposition criminalists for the defense bar is sadly limited. In my specialty, forensic reviews require knowledge of scene investigation, origin and cause determination, physical evidence analysis and often fire reconstruction. Most of the qualified fire and explosion experts worked for public agencies and refuse to take on criminal defense cases, because

they will be seen to be traitors to the thin blue line. For some years, I was one of two or three fire and explosion experts on the “approved” list for the Los Angeles County Public Defender. When I was conflicted out and asked to find a substitute, I found it was very hard to find a qualified investigator to even review a public defender case.

In our adversarial system, it should be the responsibility of the opposing attorney to question and challenge the expert and reveal the flaws, errors, and weaknesses of the testifying criminalist. That will require their seeking out of qualified, unbiased outside consultants. (Yes, sadly there are some who will tailor their opinion and the data to support what the client wants to hear). That so much “erroneous” scientific testimony was allowed in is really the failing of the attorneys (on both sides) as much as that of the ill-prepared or errant criminalist.

Conclusions and Opinions!

1. For lab managers, criminalists, and educators: Do NOT abandon trace evidence. It is the foundational application of science to investigations that provides context and sequence that other forms of evidence cannot. Trace evidence can exclude as well as associate – people, places, and events.

2. Do not abandon useful forensic techniques such as glass fracture patterns or physical matches because there is no ASTM technique to validate it and no training protocol in place. The sound basic approach is to evaluate the evidence AND its context, select (or develop if necessary) the most valid science, apply good science and fairly evaluate the data that results, including negatives and exclusions. This may mean reining in the current accreditation process or simply doing a better job of implementing the science.

3. Do not accept the technician or “black box” approach to analysis of any non-drug evidence. If it’s good science it will include controls for bias and pre-judgment. Insist on having the scene or incident reports and access to the investigator to make sure you are answering the right questions for the right reasons.

4. Certification (and the training necessary to achieve it) is a good thing as long as the testing is valid. It is not available, realistic, or practical for many types of “one-off” analyses that we might be expected to do and cases demand. Make sure your organizational rules do not prevent you from performing needed tests when there is no “certification” available. For those in administrative roles, you must make sure your “rules” do not exclude good science when it is needed in one-off cases. There is nothing in ASCLD or ISO 17020/17025 accreditation that demands that.

5. Be active in CAC and read everything published in *CACNews*, *Journal of Forensic Sciences*, *Science & Justice* and other relevant forensic journals. Many are available on line today without membership requirements.

6. Keep track of what OSAC and its peripherals are doing and let your voice be heard. Some of the OSAC groups have been taken over by “special interest” groups who want to limit participation to a select few.

7. Be aware of the quality of the scientific education your new employees and colleagues have. Some of today’s bachelor’s graduates have really minimal knowledge of what happens in the real world. To them, if it isn’t on a computer, it isn’t of interest. The real world of evidence cannot be experienced through a computer screen. They may not know how to develop and conduct real world tests and have little curiosity on

how to accomplish that. An overwhelming sense of curiosity about the what, why, and how of all manner of things should be the first requirement of any criminalist candidate!

8. Beware of chief management appointees that are not scientists but are general purpose bureaucrats or academics. They will not understand the principles of independent assessment, data collection and hypothesis testing, all of which require time and flexibility, as well as specialist knowledge.

9. If you haven’t read Kuhn’s *The Structure of Scientific Revolutions*, every scientist should! If you have never read Thorwald’s *Century of the Detective* and *Crime and Science*, do it!

May all your “calls” be just as well as technically correct. I wish you well!

- [1] Thorwald, Jurgen, *Century of the Detective* (1965) and *Crime and Science* (1967). Harcourt, Brace, and Co. NY
- [2] Willis, Sheila, “Accreditation – Straight belt or life jacket?” *Science & Justice*, 54 (2014), 505-507. <http://dx.doi.org/10.1016/scijus.2014.06.001>
- [3] *Daubert v Merrell Dow Pharmaceuticals*, 509 U.S.579; 113 S. Ct. 2786, (1993)
- [4] *General Electric v Joiner*, 522 U.S.136, 188 S. Ct. 512 (1997)
- [5] Kirk, Paul L. *Fire Investigation*, John Wiley & Sons, NY, 1969
- [6] DeHaan, John D., *Kirk’s Fire Investigation*, Second Edition, John Wiley & Sons, 1983, Third Edition (1991), Fourth Edition (1997), Fifth Edition (2002), Sixth Edition (2007), Seventh Edition (2012), Pearson, NJ



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Calling all Arenophiles

by Bob Blackledge

Are you familiar with Laser Stimulated Fluorescence (LSF)? I just recently became aware of its existence. So far, its reported use has only been in paleontology. It would seem that as far as fossils, it can reveal details that are not seen with regular photomicroscopy. Could LSF have use in locating and characterizing certain types of trace evidence in criminal cases? Could LSF show differences in fluorescence in sand or soil samples, depending on the age or the source of diatoms and forams (salt water/fresh water/brackish water)?

The equipment needed for LSF is simple, inexpensive, and not bulky. When you are in the field (crime scene), could you save time by screening samples with LSF? As far as human bone fragments and teeth, could LSF help you find them, and then show you the best locations for attempting to recover DNA? Below are a few references to LSF:

Laser-Stimulated Fluorescence in Paleontology

<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0125923>

Images for laser stimulated fluorescence

<https://www.google.com/search?q=laser+stimulated+fluorescence&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjwLZ3rg77WAhUU8YMKHZKIB-WEQsAQITg&biw=960&bih=450>

<http://www.palaeocast.com/laser-stimulated-fluorescence/>

[Numerous photographic examples of fossils shot in ordinary light then in LSF. Also a ~ 38 min. Audio interview of the discoverers of LSF]

A YouTube video (just less than 16 min.) about LSF that is well worth your time is:

Laser Simulated Fluorescence in Paleontology | Dr Michael

Pittman | TEDxLingnanUniversity

<https://www.youtube.com/watch?v=X7zuaMLc6Fw>

This may be our best idea of what a dinosaur really looked like

<http://www.nationalgeographic.com.au/animals/this-may-be-our-best-idea-of-what-a-dinosaur-really-looked-like.aspx>

Basal paravian functional anatomy illuminated by high-detail body outline

<https://www.nature.com/articles/ncomms14576>

Jurassic Spark

[https://www4.hku.hk/pubunit/Bulletin/2017_Sep\(19.1\).pdf](https://www4.hku.hk/pubunit/Bulletin/2017_Sep(19.1).pdf)

Soil (including sand) is an important type of trace evidence. Many materials that are only weakly fluorescent under a black light will exhibit ten times or more fluorescence when illuminated by LSF with the optimum laser wavelength. Could LSF assist in the forensic comparison of questioned soil samples with known soil samples?

Some other possible forensic applications you could try with LSF: When a bullet impacts bone, it is not uncommon to find tiny bone fragments in the recovered slug. Bone and the mineral apatite are chemically quite similar. Would LSF be able to distinguish between bone and apatite particles visible on a recovered slug? If so, this would be good since it would not then be necessary to remove the particles from the recovered slug. [Examination methods that don't alter or

destroy the physical evidence are preferable.] You could add fragments of bone, teeth, forams, and diatoms to see if LSF would make their detection in a sand/soil sample easier.

Page 11 of the 2nd Quarter 2017 issue of the *CAC News* had a brief item with the title, 'Human Habitat Profiling.' The essential idea was that detection and identification of microscopic particles on just about anything could provide clues. I wondered if LSF might prove advantageous in human habitat profiling? Doing a Google search and entering the terms 'Laser Stimulated Fluorescence' and 'forensic science', I discovered that an effort at human habitat profiling assisted by LSF had already been tried in the examination of physical evidence from a very famous case. Unless you are well into your fifties, you won't recall this case but may have stumbled across it in your reading. On November 24, 1971 a Boeing 727 aircraft was hijacked. Because the media got it wrong, to this day the hijacker is known as "D. B. Cooper." The fictitious name he entered at check-in was actually, Dan Cooper. If you don't know the details you can look them up, but the only piece of physical evidence they could connect to the hijacker was a clip-on tie that he had been wearing but removed and left at his seat before he put on a parachute and exited the rear ramp of the plane. The tie has been examined by LSF, and confirmed he was a heavy smoker, but not much beyond that. See: 'Imaging and Identification of Tie Particles' at <https://citizensleuths.com/uv-imaging-of-tie.html>

Broken glass particles are another form of trace evidence. Window glass is made by a process where the molten glass spreads out over a bed of molten tin. Because of this, one side of the glass will have traces of tin. One can easily distinguish the float side due to the trace amounts of tin. The tin surface side (float side) will fluoresce under short wave UV. However, when dealing with numerous tiny broken glass fragments the fluorescence isn't strong enough for one to be able to pick out those fragments that originated from the surface of the float side. Due to the greatly increased fluorescence with LSF that may now be possible. Also, a number of years ago Pilkington in the UK introduced a new type of exterior window glass whose exterior side had self-cleaning properties. That side, although clear, was rich in titanium dioxide. Could LSF distinguish this glass from ordinary window glass? Today's smartphones are expensive. They likely will be a target of muggers. There are a number of manufacturers of glass smartphone screens and cases. The glass is very thin and is under great compression. When it breaks it shatters into numerous small fragments, and some could be transferred to a mugger's clothing. Could LSF help locate these glass fragments and also distinguish this glass from ordinary window glass or bottle glass? Could LSF distinguish between different manufacturers or different models?

If at all successful, I'm sure the results could be published in a forensic science journal, and also in any journals or websites for sand collection hobbyists (arenophiles—ha ha, I made you either look up the word in the title, or read all the way down to here). And you could give either an oral presentation or present a poster at a forensic science-related conference. The one I would recommend would be Inter/Micro 2018 (or 2019) in Chicago. <https://www.mcri.org/v/101/InterMicro>

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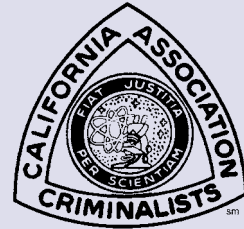


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