

# The CACNews

News of the California Association of Criminalists • Second Quarter 2013



# *The President's Desk*

## **A Second Thanksgiving**

Normally November is the season for “giving thanks,” but in the world of a CAC president, I would like to celebrate a second “Thanksgiving” this spring. First and foremost, I want to thank my wife for understanding when I needed to spend some nights and weekends “on CAC stuff.” Additionally, as president I’ve been away from home while attending our semi-annual conferences. She unselfishly gave up some of “our time” so that I could fulfill my goals and duties as your president.

Next, I want to recognize our board of directors. Perhaps I shouldn’t admit this, but I actually enjoy our quarterly meetings! I’ve grown to anticipate and look forward to the board meetings. Each member is professional, pleasant and completes their work on time and without complaint. In short they’ve made my job a thousand times easier. As a bonus, I’ve enriched old friendships and made new ones thanks to my time on the board.

As I’ve stated in the past, and it’s worth repeating: much of the CAC’s work is done by our committees. I didn’t appreciate how much work is done behind the scenes until I took over as president. Seminar planning, endowment management, historical archiving of records, financial oversight, award tracking: these are but a few of the many tasks that just get done, without reminder, complaint or expectation of reward. I’m humbled and forever in debt to our committee chairs and members.

Finally, I need to thank you, the general membership for your trust in electing me to be your president. The CAC has a long, proud history of leadership within our profession. It has been surreal to be at our meetings, look at the crowd and see the faces our membership; a membership full of today’s forensic science’s leaders. Additionally it’s intimidating to look at the list of past CAC presidents and to try and fill those same shoes. I’ve tried my best to live up to our past and I hope you have been happy with my leadership.

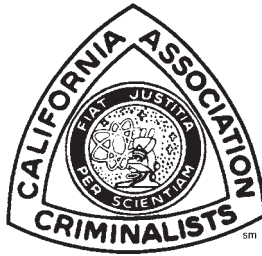


**Perhaps I shouldn’t  
admit this, but I  
actually enjoy our  
quarterly meetings!**



**Todd Weller**  
*CAC President*

SECOND QUARTER 2013



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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 August 15.



## On the cover...

Kristen Rogahn shares some photographic techniques for impression evidence.

## INSIDE

"The President's Desk" <i>President Todd Weller</i> .....	2
CACBits / Announcements / Classes.....	4
Editor's Desk: "CAC Board of Directors—Election Time" <i>Greg Matheson</i> .....	5
Book Review: The Torchered Mind <i>John DeHaan</i> .....	6
Feedback .....	7
<b>Cover Story:</b> Evaluating High Dynamic Range (HDR) Processing With Regard to the Presence of Individualizing Characteristics in Shoeprint Impressions <i>Kristin Rogahn</i> .....	8
Improvised Explosive Devices <i>John Jermain and Robert Born</i> .....	14
Ethical Dilemmas: "Semen Spatter Analysis" <i>Carolyn Gannett</i> .....	17
Proceedings of Lunch: "We're Probably Thinking..." <i>Norah Rudin and Keith Inman</i> .....	18
CAC BoD Candidate's Statements .....	20
<b>Featured: The Zambian Connection</b> <i>Laura Silva</i> .....	22





## Forensic African Travelogue

Oakland Criminalist Laura Silva (*l*) takes us on an adventure in Zambia. Laura presented her experiences at the AAFS meeting in Washington D.C. You can read all about it in this issue. *Photo by Greg Matheson.*

## Upcoming CAC Seminars

May 19-24, 2013, Cal State LA Dept. of Criminal Justice, Pasadena Hilton, contact: Katherine Roberts (krobert2@exchange.calstatela.edu, (323) 343-4625). Oct 21-26, 2013 DOJ

Central Valley, Hilton Modesto, contact: Chris Schneider, May 5-9, 2014, San Diego Sheriff, Westgate Hotel, contact Mike Grubb, chair, Fall 2014, Reno, Joint NWAFFS/CAC Renee Romero, chair, Spring 2015, Ventura County Sheriff, Renee Artman, chair. Visit seminar.cacnews.org.



Hertzberg-Davis Forensic Science Center

## Jerry Massetti Retires

This past January, CCI Program Manager Jerry Massetti retired following a thirty-plus year career with the Calif. DOJ system. More than fifty people attended his retirement party, wishing him the best of luck. During his career, Jerry moved from the Riverside lab to Fresno, finally landing in Sacramento at the Calif Criminalistics Institute.



(below) Jerry in 1979 as a newly-minted Crim-I with DOJ Riverside. (left) a slightly more recent photo.



## Low-Template DNA Statistics Program Released

Lab Retriever, based on the algorithms of David Balding and John Buckleton, programming and graphical user interface by Ken Cheng and Luke Inman-Semerau, made it's debut Monday, February 18, 2013, at the AAFS meeting in Washington D.C. The workshop was attended by 90 analysts from around the world, and consisted of an introduction to the problem of low template DNA samples, the problems engendered by such samples, and the solution proposed in the form of Lab Retriever software. This beta release of the software is now available on scieg.org <<http://scieg.org/>> as well as github.com <<http://github.com/>>, and all at the workshop were directed to these sites for download and testing. Both sites are publicly available.

It was profoundly clear that a solution is desired by the profession; it was obvious that analysts around the country were hungry to understand how to interpret and provide an accurate statistical weight for these samples. We reviewed different approaches and currently proposed solutions (e.g. prior deconvolution, empirically derived estimates of P(DO), and modeled estimates of P(DO)), and emphasized that continuing research is required to understand the accuracy of, and differences between, the various approaches and tools.

We want to acknowledge and thank our collaborators for the relentless and untiring work that they expended in making this day possible. And we are excited to continue this work.

—Norah Rudin, Keith Inman & Kirk Lohmueller

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- Digital Imaging and Photomicrography
- Forensic Dust Analysis
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- Microscopy of Extraneous and Foreign Matter in Food
- Microscopy of Food
- Sample Preparation & Manipulation for Microanalysis
- Asbestos Fiber Counting [NIOSH 582]
- Hair and Fiber Microscopy
- Indoor Air Quality: Fungal Spore Identification
- Microchemical Methods
- Microscope Cleaning, Maintenance and Adjustment
- Practical Infrared Microspectroscopy -- FTIR

# The Editor's Desk

## CAC Board of Directors— Election Time

Every spring at the May CAC Seminar the membership elects officers to the CAC Board of Directors. Each year a new president-elect is selected, in addition, half of the remaining board positions are filled. This year, the offices of editorial secretary, regional director (south) and treasurer are up for election. Next year, in addition to president-elect, the offices of regional director (north), membership secretary and recording secretary will be elected.

In this spring's election, the only candidate new to the board of directors will be the president-elect. Meghan Mannion Gray graciously agreed to move from regional director (north) to fill the mid term vacancy of treasurer. She will be running this spring to fill the position for at least one full term. Alice Hilker was appointed to fill the regional director (north) position vacated by Meghan. Unfortunately, your CAC Treasurer, Laura Silva, needed to step down for personal reasons. Meghan has done a great job of stepping into the position, but Laura has been and will be missed. So, though new to the office of treasurer, Meghan is not new to the board. Mey Tann will be running for her second full term as regional director (south) and I will be running for my third term as editorial secretary.

It is great that our association has people interested and dedicated enough to continue on the board for multiple terms. It helps with continuity and allows people the opportunity to learn and become proficient at their jobs before moving off. Unfortunately, when you go past a second or third term, you block the way for new people to enjoy the experience of running the CAC with new energy and new ideas.

The CAC needs a combination of personality types to be board members. Some who strive to run the association as its president and others who are satisfied by completing the many tasks needed to maintain such an active and important organization. In this spot, I originally wrote about the importance of completing a non-president board position before running for president elect, but I deleted it when I thought back on all the great presidents we have had whose first term on the board was as president-elect. I have been extremely impressed with the quality of service our current President, Todd Weller, has brought to our association and have faith our next President Eric Halsing will be equally up to the task, neither of whom had previous board experience. That said, I would recommend if you desire to make your mark on the CAC as one of its future president's, take the time to run for a different board position first.

If you have made it this far into my editorial, you are either very dedicated to knowing everything our association puts forward, you are a friend of mine and want to be able to respond accurately when I quiz you about my latest offering, or you have an interest in the *CACNews* and would some day like to participate in its production. I have thoroughly enjoyed my last four years as your editorial secretary and don't doubt the next two years will be just as enjoyable and fulfilling. I feel like I could continue in this role for as long as I am able to read and write. However, room needs to be made for new blood and new ideas. Please let me know if you are interested in running for editorial secretary in two years. I would love to work with someone interested in taking over and giving that person the benefit of time to understand the job before actually sitting in the seat.

\* \* \*

In February I had the great pleasure to attend my second AAFS meeting not directly affiliated with a crime laboratory. The pleasure was created in that I didn't feel beholden to anyone to attend sessions I thought would benefit my laboratory, but rather to pick my schedule solely based on my personal interest. It gave the meeting

**The CAC needs a combination of personality types to be board members. Some who strive to run the association as its president and others who are satisfied by completing the many tasks needed to maintain such an active and important organization.**



**Greg Matheson**  
CAC Editorial Secretary

a very different feel for me. For the first time, I did not attend any DNA papers. Not that there is anything wrong with DNA papers, its just that after years of feeling it was necessary to at least be exposed to what is happening technically in the field, and understanding about 10% of it, I could bypass DNA and go wherever I wanted. I found I was spending a lot of time at this meeting in the Jurisprudence Section. It was fascinating, educational and disturbing. I find it unfortunate that there were so many negative perceptions presented of criminalists working in government laboratories. Not that all of our peers are perfect and there aren't a few bad apples, but that is true of every profession regardless of whom they are employed by. The unfortunate thing is that generalizations were being made which aren't generally true. One presentation in particular is the inspiration for an ethics presentation I am making

at the next CAC meeting. This only goes to show you can get inspiration from a variety of different places.

I think I have said this before, but if you get the opportunity to attend a professional meeting, try and find some time to visit presentations outside your area of expertise. You can learn a lot and by doing so it will make you a better, more well rounded, criminalist.

Being a criminalist is so much more than having the knowledge, skills and ability to analyze evidence in your primary area of expertise. Reach out, learn more and show the detractors that being a forensic science is so much more than they think.



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## Fevered Thinking

*Ed Nordskog's "Torched" Minds is a Recommended Read for Investigators.*

*Review by John DeHaan*

"Torched" Minds by Ed Nordskog is a refreshingly frank and candid study of a class of particularly dangerous criminals—the serial arsonists. In the unvarnished language of a tremendously experienced arson detective (with over

1600 cases from decades of experience with the Los Angeles County Sheriff's Dept.) a wide variety of cases are examined (via case studies) and then analyzed. The cases include many in which Det. Nordskog participated, not as an arm-chair critic, but in the streets pursuing clues and hunting the perpetrators down. In doing so, he punches some well-deserved holes in common conceptions about serial fire-setters and their motives, profiles (and profilers) and statistics. The cases are well-chosen, spanning the years from a few at the end of the 19th Century, through the Twentieth, and right up to nearly current cases of 2008 and 2009. They come from across the U.S., but in-

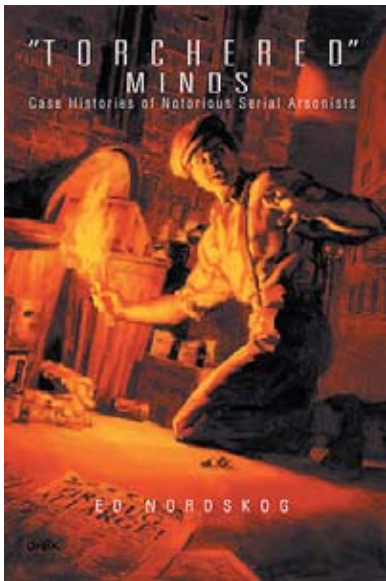
clude cases from Canada, Germany, Argentina, Norway, Australia, New Zealand, and the United Kingdom. They include both structure and wildland fires.

Case studies are classified roughly by offense category, ranging from numerous serial arson murderers (such as Sweatt, Keller, Berkowitz, Toole, Orr and Oyler) who set numerous fires over periods of months to years causing often multiple deaths to murder/spree arsonists. Also studied are fire-setters motivated by extremist beliefs or hate, nuisance or "firebug" fire-setters, and wannabe heroes such as security guards. Of particular interest are the case studies and analyses of firefighter arsonists and a breed not often mentioned—female arsonists.

Nordskog pulls no punches when it comes to assessing the failures of detecting arson, administering "justice" (to both juvenile and adult offenders), reliance on self-proclaimed experts offering profiles and advice based on limited data and experience, statistics of fire and arson occurrences, and management of investigations. It is not all bad news and criticism. We can learn a great deal from the successes and failures of these cases. He offers some very sound advice on improving the detection and solution of arson—be it serial or "one-offs". He warns that arson cannot be prevented (any more than any violent crime can be prevented) but that we can greatly improve the rate at which arsonists are detected, hunted down and successfully prosecuted for the protection of everyone in the community.

This is a book that should be read by every fire/arson investigator—whether from the police or fire "side", by every fire or police chief (and all those making command or management decisions), and by every prosecutor and "social worker" making decisions about suspected fire-setters.

ISBN 13 978-1-4653-7553-7, Hardback (paperback avail), 308 pages, Xlibris, Corp. 2011, \$19.99.





## FEEDBACK

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August 6, 2012

California Association of Criminalists  
Laura Silva  
Oakland Crime Lab  
455 7th St. Room 608  
Oakland, CA 94607-3940

Dear Ms. Silva,

This is to acknowledge receipt of your gift of \$5,000.00 dated July 25<sup>th</sup>, 2012, to be used to support the Forensic Science Graduate program at UC Davis Extension. No goods or services were provided in exchange for this gift.

It is the policy of the University of California, Davis, and the UC Davis Foundation to utilize a portion of the gift principal and/or the short-term investment income on current gifts and grants to support the cost of raising and administering funds.

We very much appreciate your support of UC Davis Extension.

Yours truly,

Dennis Pendleton.

## Letters of Appreciation From Grant Awardees to the CAC Treasurer.



### CALIFORNIA STATE UNIVERSITY, LOS ANGELES

INSTITUTIONAL ADVANCEMENT

California Association of Criminalists  
c/o Ms. Laura Silva, CAC Treasurer  
Oakland Police Dept. Crime Lab  
455 7th Street, Room 608  
Oakland, CA 94607-3940

September 7, 2012

Dear Ms. Silva:

On behalf of California State University, Los Angeles and the CSULA Foundation, I would like to extend our sincere gratitude for your gift. Your generosity helps further our mission of providing a high quality, accessible and rich learning community for all those we serve.

Your charitable support is vital to our ability to maintain the highest academic standards and to create an environment in which teaching and learning can flourish, and scholarly and creative activity is well supported and recognized. The financial foundation provided by those who know best the value of what it is we do, our alumni, faculty, staff and friends, enables us to build a prosperous future for the broad University community.

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Again, we appreciate your investment in Cal State L.A. It greatly advances our efforts to serve the educational needs of our great city and state with diversity, access, and excellence.

With sincere thanks,

Kyle C. Button, CFRE  
Vice President for Institutional Advancement

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July 31, 2012

Ms. Laura Silva  
CAC Treasurer  
California Association of Criminalists  
455 7th Street Room 608  
Oakland Crime Lab  
Oakland, CA 94607-3940

Dear Ms. Silva:

On behalf of San José State University, I am pleased to acknowledge California Association of Criminalists's generous donation of \$5,000.00 recorded on 07/30/12 to support the CAC Forensic Science Scholarships Fund.

Your generous participation in *Acceleration: The Campaign for San José State University* is a testament of your belief in the power of education. Your gift strengthens our ability to educate the next generation of leaders in our global community.

Thank you for being a part of this exceptional moment in the history of San José State University. Please know that your gift is deeply appreciated and will be carefully stewarded. If you have any questions, please don't hesitate to call 408-924-1799.

Sincerely,

Nancy Bussani  
Vice President, University Advancement

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# Evaluating High Dynamic Range (HDR) Processing With Regard to the Presence of Individualizing Characteristics in Shoeprint Impressions

Kristin Rogahn\*

## Abstract

Difficult lighting situations that lead to challenging photographic conditions are common at crime scenes. It is imperative that the photographer accurately documents the scene details despite vast differences between the brightest areas and the darkest shadows. High Dynamic Range (HDR), unlike painting with light, is a method for processing a series of photographs into one image that captures the fullest range of highlights and shadows present in the original impression. HDR is a method used to increase the span between shadows and highlights in an image by taking more than one picture of the same scene – shots that maximize shadows, maximize mid-tones, and maximize highlights – and then merging them into one unified picture with tremendous tonal range. This research found that HDR processing of multiple images does not produce a significant increase in detailed information compared with viewing the same images in Photoshop. However, exposure (auto)bracketing increases the ability to capture more detailed images of footwear impressions than a single image alone, and allows the use of HDR software for rapid processing and comparison.

## Introduction

The ease and accuracy with which the laboratory is able to analyze footwear evidence is largely determined by the quality of the evidence collected in the field. If crime scene personnel have the capability of capturing images that more closely resemble the true nature of the evidence in terms of depth, contrast, and detail, then the time spent correcting and reprocessing the images by the footwear examiner will be minimized. The footwear examiner will be better equipped to justify their conclusion, will be able to do so with a higher degree of certainty, and will do so with increased ease and efficiency. Having quality data with which to make informed and reliable conclusions will help to expedite footwear analysis from evidence recovery to reporting.

HDR processing has the potential to be useful to all impression evidence examiners, especially for those who perform the bulk of their analyses on-screen. HDR processing uses multiple exposure-bracketed source images. Using a camera's auto-bracketing feature to capture impression evidence provides more useable evidence photographs. Auto-bracketed source images provide the footwear examiner with multiple processing options, as well as capturing additional information that might not have been captured in a single image alone. This is especially true when the evidence cannot be properly lit, or it contains glare or reflection.

Dynamic range is the ratio between the maximum and minimum luminance values of a physical measurement. The

definition can change slightly depending on if the dynamic range refers to a scene (lightness to darkness), a camera (saturation to noise), or a display (highest and lowest intensities emitted). High Dynamic Range (HDR) imaging is achieved by merging multiple photographs, which are individually referred to as Low Dynamic Range (LDR) photographs. HDR imaging is a process, not an end product. It is the use of a mathematical algorithm that combines luminance values between the lightest and darkest areas of an image. By combining images, a more accurate representation of the range of intensity levels can be achieved.

In order to more closely reproduce the highlights and shadows of an original scene as the human eye sees it, the amount of information in an image ("bit depth") must be increased. However, 24-bit HDR images present considerable difficulty in photography in that they cannot be displayed correctly on standard display devices like monitors and printers, which can only reproduce a low range (16-bit or 8-bit images). In order to compress the shadows and highlights into an 8-bit image, the HDR image must be *tone mapped*. Tone mapping consists of a variety of algorithms used to compress the 24-bit information differently, depending on the desired outcome. How is this done? There are a total of 256 tonal or color values in a histogram. In order to increase the contrast of a single image, the histogram must be altered. This alteration results in empty channels, called "combing." When HDR is used, there is additional information available from the combined images. This information can be "filled into" the histogram when tone mapping, resulting in an image with 256 color values, increased contrast, and no combing or loss of information. A tone mapped image is not an HDR image because it no longer represents the original values of light captured. Rather, it *reproduces* the dynamic range captured so the image can be viewed on standard monitors or prints.

## Materials and Methods

The footwear chosen for this study displayed a significant number of unique marks obtained from normal daily use. Ten individualizing characteristics were designated on each of two different worn-out athletic shoes (Brooks and Puma) that showed a variety of edge characteristics, depths, sizes, contours, and textures that would be similar to marks seen in casework. These unique identifying marks were graded from A (easy to see) to C (difficult to see), based on their ability to be visualized on the outsoles (Figs. 1 & 2). Three-dimensional impressions provide greater photographic challenges than two-dimensional impressions. Therefore, three-dimensional impressions (the worst-case scenario) were chosen for this study. In order to minimize substrate variables, clay impressions were made using each of the athletic shoes (Figs. 1a & 2a). These exemplars were made in order to compare the quality of a unique mark in a single photograph to that same mark

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in a photograph processed with HDR. The impressions were photographed in full sun using a Nikon D700 DSLR camera with ISO 200 at f/11 and 1/500s shutter speed. The impressions were then placed in half light and half shadow to simulate unfavorable lighting conditions, and photographed using both the Nikon D700 DSLR camera with tripod and the Nikon Coolpix P5100 point-and-shoot camera with tripod. Both cameras were set to aperture priority and programmed to auto-bracket by adjusting the exposure (without flash) with varying shutter speeds. The Nikon D700 produced a series of 9 RAW (12-bit) and JPEG (8-bit) photographs at increments of 0.5 eV exposure, over a total range of 2 stops in either direction from “ideal” (4 stops total). The Nikon Coolpix took a series of 3 JPEG photographs at increments of 1.0 eV exposure, over a total range of 1 stop in either direction from “ideal” (2 stops total). This produced a bracketed series of original photographs with varying exposures. Selected photographs from this series were processed using High Dynamic Range (HDR) software. Other photographs from this series were processed using simple digital editing techniques commonly used in the laboratory for the examination of footwear. The HDR images were compared to the original images as well as the digitally edited

images (see examples). Several “ideal” footwear photographs were also taken using oblique light. These were also available as reference photographs for comparison purposes. Green arrows were used on the photos to indicate marks that could be used for identification; red arrows were known identifying marks that could not be sufficiently visualized in the photo to be used for identification purposes.

## Software Programs

The following software applications contain a variety of tone mapping algorithms that produce images for various end uses. The algorithms used in this study were chosen for their ability to produce realistic images (i.e., no excessive tone mapping), and their usefulness was compared with respect to the objectives of this project.

Picturenaut HDR Software is free, offers an auto-align feature, and produces realistic images. The software lacks the options available to create a “dynamic look” to the final image, but that is of no concern for this application. Instead, the lack of options makes for an easy-to-use, straightforward process.

Photomatrix Pro HDR Software is the most popular

option on the market. It is reasonably priced, easy to use, and produces realistic images. This software has a problematic auto-align feature, but gives greater control over the tone mapping process than Picturenaut, and was the best choice for producing detailed, realistic images overall.

Photoshop CS5 is the most expensive option. Its HDR capabilities not only offer an auto-align feature, but also a large selection of options for processing. It creates realistic images, but the end result is often not as useable or aesthetically pleasing as that of Photomatrix.

Even with an impression that has an abundance of individualizing marks, proper lighting could make the difference between a determination of “identification” and simply an “inclusion.” Depending on the number and quality of the photographs captured at the scene, the footwear examiner is then faced with a number of choices.

### *A single image:*

Unfortunately, a photographer might capture only one, poorly-lit footwear impression at the scene. When this is the case, true HDR is not possible. However, several editing options can be used to improve clarity and contrast, ultimately providing a photograph that can be examined for similarities in pattern, size, wear patterns, and individualizing characteristics.

Simple processing was done by using Photoshop CS5 to edit the

Fig 1.



*Original Outsole (image inverted)*

Fig 1a.



*Original Impression in Clay*

Fig 2.



Original Outsole (image inverted)

Fig 2a.



Original Impression in Clay

Fig 3.



Best RAW format image with levels adjustment

Fig 4.



Photoshop - 2 images layered, with partial opacity

photographs (Fig.3). Raw images were opened using the 16-bit setting. After a new *levels adjustment layer* was created, clicking on the *layer mask* thumbnail in the adjustment layer allowed choosing the *gradient* tool from the toolbar and adjusting the mask accordingly. The white and black point levels for the image were adjusted to meet each end of the histogram to create the best possible image.

#### Two overlaid images:

Two photographs were selected from the series of original images to illustrate other processing options if two poorly lit, but complementary photographs of the same shoe impression exist. This might happen if the oblique lighting is too bright, too close to the print, or if the impressions are taken under uneven lighting conditions. When two photographs can be sufficiently overlaid (manually or by using the auto-align feature), the images can be "stacked" on top of each other, and selectively masked or deleted to show only the best areas of each image. Although these processes are not true HDR either, they can be useful to the footwear examiner.

This simple editing was performed using Photoshop CS5 in the 16-bit setting. Three general techniques were used: 1) *overlay with blending mode* 2) *layer mask with gradient* and 3) *erase with feathering*. For these techniques, two complementary image layers were perfectly "stacked" on top of each other manually using the *Edit>auto-align* feature, or holding the shift key when overlaying the two photographs. (Note: The overall appearance of the resulting image will be determined by the image layer sequence.)

*Overlay with blending mode:* Once the photographs were stacked, the "top" image was selected and a blending option was chosen from the pull-down menu by scrolling through the different modes. Changing the opacity of the same layer provided an additional adjustment option (Fig. 4).

*Layer mask with gradient:* After the photographs were stacked, a *layer mask with gradient* was added to the "top" image to even out bright spots and lighten shadows (Fig.5).

*Erase with feathering:* Similarly, selecting the *marquee tool* and clicking *delete* was used to select the area that should be erased, allowing portions of the complementary photograph to be seen. *Feathering* the selection blended the edges with the complementary photo.

#### Three or more images:

HDR processing can be done when three or more photographs are captured using a tripod and a wide range of exposures. The human eye has far greater tonal range, color depth, and dynamic range than a camera. The goal of the HDR process is to create an image that more closely approximates what the human eye can see of the original evidence. HDR processing involves combining several selectively exposed footwear images, and merging them into a single image. This provides a much greater tonal range compared with a single traditional low dynamic range image. By capturing the lightest highlights and the darkest shadows of the scene, one cohesive image can be produced that will theoretically display the best areas of each individual source image while still retaining all of the detail and image quality. It should be noted that none of the original source images was able to capture all of the content and detail of all ten individualizing marks in one photograph. However, HDR processing was able to do so. The relative success of HDR processing relied on taking a large



number of bracketed images over a wide exposure range. HDR processing was accomplished in the following ways:

Picturenaut (Fig.6): Click *File>Generate HDRI* and add the desired photographs and click OK. Click *Image>Tone mapping* to choose one of four preset tone mapping algorithms: Bilateral (contrast and saturation adjustments), Exposure (exposure and offset adjustments), Adaptive Logarithmic (exposure, bias, shadow luminance, and contrast adjustments), and Photoreceptor (exposure, dynamic compression, saturation, and contrast adjustment). Since each lighting situation is unique, one specific preset algorithm will not work for every situation. Each preset algorithm also allows for manual adjustment of the image so the user can fine-tune the final image as necessary. Once the tone mapping is completed, the image can be saved and printed.



Photomatix Pro 4 (Fig.7): Select the *Load Bracketed Photos* button, select the desired photographs and click OK. Choose the desired preprocessing options (including image alignment, ghost removal, and noise reduction). The *Tone mapping/Fusion* button offers two processing options: Tone mapping (which offers versatile adjustment options for a wide range of lighting conditions), and Exposure Fusion (which generates a more natural look with noise reduction). Two toning methods are also present. A wide range of preset algorithms is available, the results of which are conveniently displayed as thumbnails at the bottom of the screen. Numerous manual adjustments are on hand for each of the preset options to allow fine-tuning of the image as desired. Click the *Process* button, then save and print the final image.



Photomatix offers a significant number of additional tools, including the ability to save preset adjustment settings, and adjust a batch of photographs. A tutorial button is located on the home page, and the help options are comprehensive and easy to understand.

Photoshop CS5 (Fig.8): Select the *Mini Bridge* tab in the upper panel in Photoshop, and select the desired photographs. Click the *Tools* icon (a rectangle with an arrow) in the upper right side of the toolbar. Select *Photoshop>Merge to HDR Pro*. The original source images are shown as thumbnails across the bottom of the screen. The source images can be selected or unselected, offering the ability to compare the effects of including or excluding source images and removing ghost (out-of-focus or misaligned) images. Several tone mapping presets and toning methods are available in the preset pull-down menus. If any additional manual adjustment is necessary, the preset will automatically switch to "Custom" setting, allowing the user to effect specific changes. When the desired tone mapping effect is achieved, click OK. The image can be saved and printed.



Photoshop offers the most extensive number of tools available for image enhancement, and the ability to pre-process or post-process images without having to switch between software programs. An extensive array of tutorial material is available online.

## Results

Ten individualizing characteristics were originally defined on the right outsole of the Puma athletic shoe, and graded by letter (A-C) on the basis of ease of visualization.



Photoshop - 2 images layered, with gradient erase



Picturenaut HDR software using 3 source images



Photomatix HDR software using 3 source images



Photoshop HDR software using 9 source images



Marks #9 and #10 were relatively easy to identify visually as individualizing features in the shoe outsole, and in the original impression in clay. Marks #1, 4, 7, and 8 were more challenging to identify, and marks #2, 3, 5 and 6 were difficult to visualize and identify because of their size, depth, or location. With proper oblique lighting from four directions, all of the individualizing marks could be seen in the original impression. However, only eight out of ten individualizing marks were identifiable in any *single* photograph of the original impression in clay. As expected, the original bracketed source images of the impression in shadow were only able to capture about 50-80% of the identifying marks at one time. When the original bracketed source images were edited, however, the results improved. Simple editing of a single image with Photoshop was able to define seven out of ten individualizing marks. Simple editing of two complementary images was able to define all of the marks. HDR-processing was able to define between 50-100% of the individualizing marks, depending on the software and the number of original source images used.

Ten individualizing characteristics were originally defined on the right outsole of the Brooks athletic shoe, and graded by letter (A-C) on the basis of ease of visualization. Marks #3, #5, #6, #9 and #10 were relatively easy to identify visually as individualizing features in the shoe outsole, and in the original impression in clay. Marks #1, 4, 7, and 8 were more challenging to identify, and marks #2, 3, 5 and 6 were difficult to visualize and identify because of their size, depth, or location. With proper oblique lighting from four directions, all of the individualizing marks could be seen in the original impression. However, only eight out of ten individualizing marks were identifiable in any *single* photograph of the original impression in clay. As expected, the original bracketed source images of the impression in shadow were only able to capture about 50-90% of the identifying marks at one time. When the original bracketed source images were edited, however, the results improved. Simple editing of a single image with Photoshop was able to define ten out of ten individualizing marks. Simple editing of two complementary images was able to define all of the marks. HDR-processing was able to define between 50-100% of the individualizing marks, depending on the software and the number of original source images used.

## Conclusions and Discussion

HDR processing of bracketed footwear photographs was a surprisingly easy and straightforward tool for image processing, but did not always provide the

significant increase in detailed information that was expected. The number of bracketed original source images used, the type of software, and the nature of the individualizing marks all played significant roles in whether an identification could be made.

A large number of bracketed, original source images over an extended range of exposure values provided the best possible outcome for processing with HDR software. RAW format provided the greatest ability to visualize small details on-screen. Although not an ideal format, bracketed JPEG images also showed marked improvement in the level of available detail over a single photo. In addition, many of the options for tone mapping and post-processing were highly

**Table 1 - Puma Impression in Shadow**

	1 (B)	2 (C)	3 (C)	4 (B)	5 (C)	6 (C)	7 (B)	8 (B)	9 (A)	10 (A)
Photo 5209					x	x	x	x	x	x
Photo 5210						x	x	x	x	x
Photo 5211						x	x	x	x	x
Photo 5212						x	x	x	x	x
Photo 5213						x	x	x	x	x
Photo 5214	x				x		x	x	x	x
Photo 5215	x	x	x	x	x		x	x	x	
Photo 5216	x	x	x	x	x			x		
Photo 5217	x	x	x	x	x			x		
Photoshop HDR using 3 images						x	x	x	x	x
Photoshop HDR using 9 images	x	x	x	x	x	x	x	x	x	x
Photomatrix HDR using 3 images	x	x	x	x	x	x	x	x	x	x
Picturenaut HDR using 3 images	x					x	x	x	x	x
1 image Photoshop levels adjustment	x	x				x	x	x	x	x
2 images Photoshop layer mask	x	x	x	x	x	x	x	x	x	x
2 images Photoshop blend mode						x	x	x	x	x

**Table 2 - Brooks Impression in Shadow**

	1 (C)	2 (B)	3 (A)	4 (B)	5 (A)	6 (A)	7 (C)	8 (B)	9 (A)	10 (A)
Photo 5200		x	x		x	x	x	x	x	x
Photo 5201					x	x	x	x	x	x
Photo 5202					x	x	x	x	x	x
Photo 5203					x	x	x	x	x	x
Photo 5204			x		x	x	x	x	x	x
Photo 5205	x	x	x		x	x	x	x	x	x
Photo 5206	x	x	x	x	x	x		x	x	x
Photo 5207	x	x	x	x	x	x		x		
Photo 5208	x	x	x	x	x	x				
Photoshop HDR using 3 images		x	x		x	x	x	x	x	x
Photoshop HDR using 9 images	x	x	x	x	x	x	x	x	x	x
Photomatrix HDR using 3 images	x	x	x	x	x	x	x	x	x	x
Picturenaut HDR using 3 images	x	x	x	x	x	x	x	x	x	x
1 image Photoshop levels adjustment	x	x	x	x	x	x	x	x	x	x
2 images Photoshop layer mask	x	x	x	x	x	x	x	x	x	x
2 images Photoshop blend mode	x	x	x	x	x	x	x	x	x	x

subjective. Simple editing of bracketed photos without the use of HDR produced the most aesthetically pleasing image overall for court purposes while still retaining all of the detail in the original photographs. Only Photomatrix produced an overall image of comparable aesthetic value.

The usefulness of exposure-bracketed images cannot be overstated. Capturing even three exposure-bracketed photos provided additional information about the footwear that would have otherwise been lost. When a poorly lit footwear impression was captured using a bracketed series of images, detail could be recovered with ease in both the deepest shadows and the brightest highlights. In practice, exposure bracketing and HDR processing was also able to overcome many other difficult lighting issues on two-dimensional surfaces. These included reflections and glare on polished or tile floors and surfaces, flash hot spots, mottled shadows, and difficult contrast situations. This technique effectively provided the examiner with sufficient detailed information in the source images to provide an identification.

It is important to remember that the application of HDR to footwear impression photography does not allow for the identification of individualizing characteristics above and beyond that which the original images provide. RAW format captures the most digital information possible in the original images. JPEG format is acceptable only if the photographer can guarantee a perfect photograph every single time. Since this is simply not realistic, RAW format should be standard for comparison-quality photographs. This is critical because any improperly exposed digital image will lose detail in both the shadowed and highlighted areas. Since RAW images contain significantly more bit-depth information (i.e., how each pixel expresses color) than JPEG images, this additional information makes detail recovery possible in RAW format that would not be possible in JPEG format. HDR images contain more bit depth information than any single image, allowing for far greater adjustment of contrast and color saturation without alteration of the image or loss of information.

HDR was capable of producing increased tonal range to the same degree over the entire image, but produced only a marginal increase in contrast in the most difficult-to-see features. Since the HDR algorithm introduced unknown variables into the processing workflow, it was important to weigh this aspect against the benefits of the resulting images. After analysis of the

HDR images, it was determined that HDR was a powerful and useful tool in terms of its efficiency and degree of image enhancement for the visualization of unique features on-screen.

Of note, there is an important difference between using these tools to temporarily help visualize a unique mark on-screen, and using these tools for the ultimate identification of that mark from the original source images. The most professional and ethical conclusion of identification is always one that is based on the comparison of unaltered original photographs. If an image detail seemingly exists on-screen that cannot be seen in any of the original source images, the information should be considered unreliable and no conclusions should be drawn regarding that mark. If,

however, the tools for on-screen analysis are used as a way to locate, differentiate, or further justify the existence of a feature already established in the original source photos, the examiner may use this type of "refining" tool to better understand and characterize the nature of the mark. Because of the speed, efficiency and accuracy with which on-screen comparisons can be done, this comparison method will undoubtedly be seen in the futures of most comparative analysis disciplines.

For this reason, if difficult lighting situations, limited equipment, time constraints, or resources pose a challenge at the crime scene, use the auto-bracketing feature. Auto-bracketing over a large exposure range is now available on many digital cameras. This will provide a quick, straightforward, and forgiving means of capturing the "best image" possible in the form of multiple source images.

## Acknowledgments

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# IMPROVISED EXPLOSIVE DEVICES

*A CAC Seminar Workshop Presented by  
John Jermain<sup>1</sup> and Robert Born<sup>2</sup>*

On November 6, 2012, the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) and the Federal Bureau of Investigation (FBI) hosted an explosives seminar for the California Association of Criminalists 2012 Fall Seminar. The seminar covered a lecture portion on the forensic analysis of improvised explosive devices and basic electronics; practical exercises involved constructing improvised electric matches, improvised detonators, and electrical circuits with variable switches, and a final project which entailed the construction of a mail package bomb with multiple safe/arm and firing switches.

## Forensic Analysis of an Improvised Explosive Device

An improvised explosive device (IED) is a combination of components that are neither designed nor produced to be used in conjunction with each other and that, when assembled together, constitute a mechanism that has the capability of exploding. When building an explosive device, there are two essential components needed: the main explosive charge and the fuzing system. However, many devices employ additional components, such as a switch (safe to arm or fire), a power source, a container, and enhancements to the explosive device, such as shrapnel.

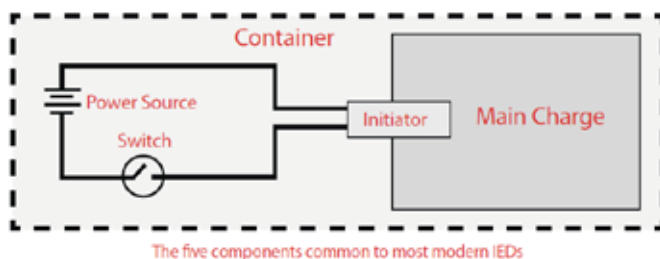
With the exception of combustible residues or unconsumed explosive particles, the main charge is consumed in the explosion. But when it comes to the other components of the explosive device, such as the container, switch, and power source, they generally survive the explosion, but suffer severe blast damage. Studies have shown that approximately ninety percent, by weight, of the non-explosive components survive the explosion. The understanding of the types of fuzing systems and construction techniques utilized to build improvised explosive devices will assist forensic investigators in the identification of evidence collected at a bombing scene.

The most common explosive device encountered in the United States is a pipe bomb. A pipe bomb consists of a length of pipe which is sealed on both ends with a closed fitting. The low explosives, when ignited, will produce a great deal of gaseous products, which will eventually rupture the pipe assembly. This type of device is generally utilized due to the fact that it is quite difficult to obtain high explosives as well as that the components for a pipe bomb can be easily purchased from numerous sources. When dealing with the device assembly, there are numerous configurations of pipe

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that can be utilized. The three most common types of metal pipe are galvanized steel, black steel, and copper. The three most common types of plastic pipe are polyvinyl chloride (PVC), chlorinated polyvinyl chloride (CPVC), and acrylonitrile butadiene styrene (ABS). The end caps, which are either threaded or fitted, contain a great deal of information regarding the specifications and manufacturer of the material. In most cases, the end cap will have the nominal diameter, country where it was manufactured, the distributor, and the application code ("NSF 61-4") casted into the metal or plastic. In some cases, the end cap may be attached to the pipe with a cement or adhesive. By analyzing this material, the type of cement or adhesive used in the construction of the explosive device can be determined.

An initiator for the explosive main charge may include a number of devices that are used with a mechanical or electrical fuzing system. These include safety, hobby, visco, pyrotechnic, or cannon fuse; electric match and squibs; electric, shock tube, or electronic detonators; and improvised initiators. Three improvised electric matches that are commonly manufactured utilize a resistor, pencil lead, and steel wool as the filament or bridgewire. These three components will heat up very rapidly when an electrical current is passed through them. If these components are placed between two match heads, they will ignite, thus setting off the improvised electric match. An improvised detonator that has been seen on several bombing incidents uses a single battery cell from a 9-V battery, which is filled with an improvised primary explosive such as triacetone triperoxide (TATP). The TATP primary explosive is detonated when it is exposed to the filament of a Christmas tree bulb, which is attached inside the open battery cell. This improvised detonator has the capability of initiating a high explosive.

A battery is an essential component of an explosive device, as a source of electrical power to an electrical fuzing system. Along with the battery, many devices use some type of battery holder or connector to connect the battery into the electrical system. The most common type of battery used in explosive device construction is a dry cell battery, which consists of a metal casing, an electrode in the center of the case, and an electrolyte. The outside of the battery is normally thin sheet metal and exhibits the identification of one of the following as the electrolyte: lithium, alkaline, mercury, nickel-cadmium, silver-oxide, and carbon-zinc. There are many worldwide manufacturers, types, and brands of batteries.

(opp.) Isaac Eaquinto and Christina Henry build a series circuit utilizing a throw switch as the safe/arm and a pushbutton switch as the firing.

(r) Robert Thompson and Dr. John Bond construct various electrical circuits, which will be utilized in their improvised explosive devices.

However, the most commonly used in explosive device fabrication are 1.5-V, 6-V, and 9-V batteries, and include, in order of their physical size from the smallest to the largest: AAA, AA, C-cell, D-cell, 9-V, 6-V, and 12-V. The manufacturer, type, and brand of the battery are present on the external shell of most batteries, and this data does survive most explosions.

Electrical wiring is essential in the construction of an explosive device having an electrical fuzing system. The types of wire normally found in an explosive device include single conductor/single strand, double conductor/single strand, and double conductor/multistrand wires. The conductor is usually copper, but can be tinned copper (copper wire with a thin coating of tinning material to protect the wire from oxidation), iron and tinned iron, or other more exotic metals, such as gold. Wires are covered with clear or colored insulation material, which may assist in establishing a general or specific source. Additionally, by measuring the diameter of the metal conductor, the gauge (size as determined by the American Wire Gauge standard) of the wire can be determined.

The final component essential to the electrical fuzing system is a switch. A switch is a device used for making, breaking, or changing a connection. In regards to explosive devices, a switch can either be used to arm the device or initiate the device. The three actions of a switch are command, time, and victim operated. A command switch is a type of switch that is activated by the attacker in which the attacker controls the device at the moment of initiation. Examples of a command switch are an RC controller, radio transceiver, cell phone, pager, and keyless car entry. A time switch is a switch that functions after a set time. Time switches can be electronic, mechanical, chemical, or pyrotechnic, such as a fuse. The final switch, victim operated, is activated by the actions of an unsuspecting individual. Examples of a victim operated switch are passive/active infrared, trembler, tension pull or release, magnetic, pressure or pressure release, and light sensitive.

The main explosive charge is any chemical compound or mixture whose purpose is to function by rapidly releasing gases from a confined space accompanied by high temperature, violent shock, and a loud noise. Based on the characteristics of explosives, they can be divided into two categories: low explosives and high explosives. Low explosives are mixtures of chemicals, which have a rate of combustion less than the speed of sound (3,300 feet/second). These types of explosives cannot support a detonation wave and, therefore, must be con-



fined in order for an explosion to occur. Some types of commercial low explosives include black powder, black powder substitutes, smokeless powder, and pyrotechnics. High explosives are chemical compounds or mixtures that have a velocity of detonation greater than the speed of sound and do not require confinement. Examples of high explosives included primary high explosives such as lead styphnate and mercury fulminate, secondary high explosives such as trinitrotoluene and composition C-4, and blasting agents such as ammonium nitrate / fuel oil. All of these explosives can be analyzed using a variety of analytical instruments. Infrared Spectroscopy can be used to identify low explosive components, such as potassium nitrate and potassium perchlorate, as well as organic high explosives, such as cyclotrimethylene trinitramine (RDX) and pentaerythritol tetranitrate (PETN). Gas Chromatography/Mass Spectrometry (GC/MS) can be used to identify smokeless powder additives, as well as organic high explosives from a post-blast bombing scene. Scanning Electron Microscope / Electron Dispersive Spectroscopy (SEM/EDS) can be used to identify metal fuels such as aluminum and magnesium, which are commonly found in pyrotechnics. X-Ray Diffraction is an excellent technique which is often used to analyze blasting agents, which can have numerous oxidizers and fuels in the explosive mixture. For low explosive post-blast analysis, ion chromatography is utilized to identify nitrates, chlorates, and perchlorates, which are often used as oxidizers in low explosives. For dealing with liquid explosives and precursor chemicals, Raman Spectroscopy can identify explosive components such as hydrogen peroxide, commonly used in the manufacturing of homemade explosives.

## Basic Electronics and Improvised Explosive Device Assembly

After understanding the basic components of an explosive device, the participants were tasked to build an improvised explosive device. But before this could occur, they had to build a variety of circuits, which would be used to initiate the explosive device. The four main components needed for a circuit are a power source, a conductor (wire), a load, and a switch. The load is the component for which the entire circuit is constructed and is designed to perform a specific function when current passes through. Examples of a load would be the initiator for the explosive device, such as a blasting cap, flash bulb, and the bridgewire in an improvised electric match. A switch is used to establish, interrupt, divert, transfer, or otherwise control the flow of an electrical current or signal. Some of the switches used in the circuit building exercise included

a magnetic reed switch, a microswitch, a relay, a push button switch, a toggle switch, a slide switch, and a throw switch.

Once the participants had a good understanding of the components used in an explosive device, FBI Agent Rob Born had them construct a variety of circuits, which would be used to initiate their devices. The three types of circuits that were constructed were a series circuit, a parallel circuit, and a series-parallel circuit, which utilizes both at the same time. A series circuit has only one path for current to flow through, with the current being the same throughout all parts of the circuit. A parallel circuit has two or more paths for current to flow through and can contain two or more loads which would initiate the device.

The final exercise for the explosive seminar was the construction of a mail bomb utilizing various circuits and switches which would initiate the device. The participants were given a large priority mail box from the United States Postal Service. They were required to build a series or parallel circuit with at least two switches incorporated into the fuzing system. In most cases, the group incorporated a safe to arm switch, either a slide switch or a toggle switch, and a firing switch to initiate their mail bomb. In most cases, the mail bombs were designed to function when the lid of the box was opened. This was accomplished by attaching the reed switch to the lid, which would break its magnetic connection once the box was opened. One group made their mail box a decoy, where it would be left on the ground outside the victim's dwelling. Once the unsuspecting victim lifted the box off the ground, the microswitch built into the base of the box would close the circuit, thus initiating the explosive device.

Once all of the participants presented their mail bombs to the class, it was interesting to notice how every device was built using different switches, different circuitry, different loads, and various methods to initiate the explosive device. These individual characteristics are known as the "bomber's signature," which will give clues to assist investigators in finding the bomber. By recognizing how all the components work in conjunction to initiate the device, forensic examiners will have a better understanding of how to analyze an improvised explosive device when it is submitted to their laboratory.

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Samantha Peek demonstrates how the circuitry and switches of her mail bomb would initiate to FBI Bomb Tech Rob Born.



Participants construct improvised electric matches (resistor, lead, and steel wool) and an improvised detonator consisting of a Christmas tree bulb and battery cell housing.



Dr. John Dehaan and Ricky Delgado build a parallel circuit utilizing a slide switch as the safe/arm, with a magnetic reed switch and a throw switch as the firing.



# Ethical Dilemmas

DISCUSSION CORNER WITH CAROLYN GANNETT

## SEMEN SPATTER ANALYSIS

### The Scenario:

At separate times, a detective asked two bloodstain pattern analysts (BPAs) in the same lab to do a semen stain pattern analysis for one of his cases. Both BPAs independently explained to the detective why they could not do it: seminal fluids behave differently from fluid blood, and semen pattern analysis is not a validated area of expertise. Nine months later you learn that the detective subsequently asked the case's DNA analyst (who is not a BPA) if he would do the semen stain pattern analysis. He had said yes and completed a report that was technically and administratively reviewed and signed by his supervisor, who also is not a BPA. The suspect pleaded guilty before the case went to trial. The DNA analyst has never belonged to a professional forensic science association. The supervisor belongs to CACLD.

Did the DNA analyst do anything unethical in completing a semen stain pattern analysis? How about the supervisor, by signing the report?

Should you take any action?

### Did the DNA Analyst do Anything Unethical?

Doing something illegal requires violation of a law. What is illegal in one jurisdiction may not be illegal in another, because laws are not identical for all jurisdictions.

Analogously, doing something unethical requires violating an ethics document. What is unethical according to one ethics document (which typically applies only to members of its professional association) may not be unethical for members of another association.

The DNA analyst does not belong to any professional associations, so he cannot be charged with unethical conduct by them. Those documents do not apply to non-members. The only way he could be found to have been unethical is if his laboratory enforces an ethics document and he violated its content.

Herein lies the importance of a laboratory adopting an ethics document and enforcing it. Employees are not required to belong to associations. It is possible, and it has occurred, that employees have practiced forensic science without being accountable to any ethics document, sometimes practicing for many years without even so much as being exposed to a forensic science ethics document.

Fortunately, ASCLD/LAB took measures a couple years ago which help to counter this. Managers of labs accredited

... your inaction may make you a party to future transgressions...

through ASCLD/LAB-International are required to ensure that their employees annually review ASCLD/LAB's *Guiding Principles of Professional Responsibility for Crime Laboratories and Forensic Scientists*.

Let's assume this scenario occurred recently in an accredited lab. What in ASCLD/LAB's *Guiding Principles* might apply?

Perhaps the most salient transgression could be that the DNA analyst is practicing outside his area of expertise. It could be argued that he is so far outside of it that he does not even realize that no such area of expertise as "semen stain pattern analysis" exists. The bloodstain pattern analysts at least knew enough about fluid dynamics that they realized semen spatter analysis could not be attempted. A section of the *Guiding Principles* that might apply is paragraph three.

*The ethical and professionally responsible forensic scientist and laboratory manager . . .*

*3. Are aware of their limitations and only render conclusions that are within their area of expertise...*

Another potential transgression: applying an area of expertise prior to becoming trained and passing competency tests. Knowledge of fluid dynamics, or any specialized area, is not required in order to be aware of paragraph nine:

*The ethical and professionally responsible forensic scientist and laboratory manager . . .*

*9. Are properly trained and determined to be competent through testing prior to undertaking the examination of the evidence.*

Also potentially applicable are the basic principles of scientific validity.

*The ethical and professionally responsible forensic scientist and laboratory manager . . .*

*8: ...stay abreast of new equipment and techniques while guarding against the misuse of methods that have not been validated. Conclusions and opinions are based on generally accepted tests and procedures.*

*17: Support sound scientific techniques and practices...*

### How About the Supervisor?

The supervisor who signed off on this report may have committed all the same transgressions of the *Guiding Principles* as the analyst.

Because she belongs to CACLD, one might think there may be violations of that association's ethics document, too. However, CACLD does not have an ethics document. The only nod that the association gives to ethics can be found in its Mission Statement, which is the same wording found in its Bylaws Article II, Section 1, 1.1:

*The objectives and purposes of the Corporation are:*

*• To promote, encourage and maintain the highest professional and ethical standards of practice in the field of forensic science laboratory services.*

There might be individual members in CACLD who believe some aspects of the supervisor's conduct were unethical. But, without an ethics document, the question arises as to what CACLD (as an association, not as some individual members) considers the highest ethical standards. And, without an enforcement policy, another question arises as to how CACLD can maintain the highest ethical standards. So, it appears that being a member of CACLD would not result in additional violations.

*please turn to page 19*



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## We're Probably Thinking ... ... About Probabilistic Approaches to Weighting Evidence

*Probability is expectation founded upon partial knowledge. A perfect acquaintance with all the circumstances affecting the occurrence of an event would change expectation into certainty, and leave neither room nor demand for a theory of probabilities.*

*An Investigation of the Law of Thought, George Boole*

Last month, we had the opportunity to attend the LAAFS meeting in Washington D.C. It had been several years since either of us had attended and we were astounded at the sheer number of attendees; according to an official source, over 5000 forensic scientists attended the meeting! Who knew? While we almost never managed to sit down for lunch, we had several lovely dinners, often with good friends, at the various restaurant venues within walking distance of the Marriott Wardman Park hotel. The most unusual venue was New Heights restaurant, which served a prix fixe menu with either a wine or gin pairing. And yes, one of us tried the gin...

... which is a good thing, because mental lubrication was definitely necessary to discuss a topic that received significant attention over the course of the meeting, a probabilistic approach to determining the weight of evidence. While this is hardly a new idea, it has been gaining momentum over the last several years. DNA analysts, in particular, no longer have a choice – they can board the train, or let it run over them. While plenty of papers on advances in analytical techniques were presented, almost all of the papers discussing interpretation and weighting of DNA evidence offered a probabilistic viewpoint. In fact an entire DNA workshop was devoted to the topic (full disclosure; it was ours), and 90 DNA analysts from all over the world sat through a four hour workshop on likelihood ratios and drop-out probabilities. For agencies to shell out the workshop fee in this era of budgetary restraint suggests an acceptance of the inexorable move to probabilistic tools for interpreting and weighting evidence (although the offer of free software might have been a factor as well).

Forensic DNA is by no means the first or only discipline to explore a probabilistic approach to evidence interpretation. At this meeting alone, we noted papers applying probabilistic methods to such diverse topics as the detection of organic gunshot residue by ion mobility spectrometry, low-energy bone fractures, and analysis of reference surfaces using logistic-regression-based criteria. Of the constellation of disciplines commonly found in crime labs, fingerprints, in par-

ticular, has enjoyed a long history of research and publication using probabilistic reasoning. In spite of this fact, the field has yet to integrate such an approach into everyday work.

*Life is a school of probability. – Walter Bagehot*

While weighing probabilities is used intuitively by all practitioners<sup>1</sup>, ultimately the appropriate interpretation of all evidence must rely on a *formalized* probabilistic approach. While this transition will be more difficult for some disciplines than others, it is no longer acceptable to rely merely on training, experience, and the database in your head. This transition will not be simple, easy, or fast. Much of forensic science, especially the pattern and impression disciplines, has acquired both great mass and velocity in the use of holistic approaches to evidence interpretation, resulting in a directional momentum that will be difficult to change. Nevertheless, a course correction is required, and appears inevitable.

*We must become more comfortable with probability and uncertainty. – Nate Silver*

A probabilistic approach not only exposes situations for which insufficient information exists on which to base an opinion, it relieves the analyst of having to assert an opinion. We have written in depth on this topic previously. In particular, probabilistic approaches are developed through empirical validation supplemented by modeling of the variables involved in creating an item of physical evidence. Thoughtful and thorough models will generate probabilities that are portable; a universally accepted model will generate the same probability on the same evidence whether calculated in Washington D.C. or in Tasmania. Thus our experience is best used not to generate opinions regarding source attribution, but in developing an approach to evidence examination.

*The scientific imagination always restrains itself within the limits of probability. – Thomas Huxley*

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<sup>1</sup> What we mean by this is that when an examiner notes correspondence between an evidence and reference sample, he will then either consciously or sub-consciously ask himself how common or rare it might be to find the observed matching trait(s) in another randomly

chosen reference item. The more rare the observer believes the trait to be, the more significance (weight) is placed on the correspondence between the evidence and reference sample. This is an ad hoc probabilistic approach, whether appreciated as such or not, by the analyst.

One of the most valuable contributions of a probabilistic approach is that it allows us to quantitate a risk of error. This critical scientific concept has too often fallen prey to the demands of the justice system, holding the forensic scientist to an impossible standard of giving an opinion of certainty. “Scientific certainty” can never be “reasonable” because scientific certainty is a logical fallacy. Probabilistic methods allow us to modify a qualitative statement in a way that exposes legitimate uncertainty. And in the same way that false certainty risks misleading the trier of fact, illegitimate conservatism is no more helpful. Deliberately downplaying the strength of the evidence may or may not work in favor of the defendant, depending on the circumstances of the case, and it almost never works in favor of the justice system. The aim should always be to provide the most accurate and reliable scientific information without artificially attempting to rig the system in either direction. Because, despite the best of intentions, that artificial conservatism is not science.

*Probability is an inexact science – Brendan Curry*

So how do we get there? As we have said before, we (the profession) can’t do it alone. Forensic science is an applied science; we can’t be the innovators, the developers and the practitioners all in one. We must seek collaborations with university researchers, and we must be open to input from other professions (yes, even the economists). It should no longer be surprising to hear a researcher say, “We have a solution to that problem!” “Interdisciplinary” is a popular concept for good reason; advancement in almost any arena requires input from a variety of different domains and specialties. Forensic science can be considered the original poster child for encompassing a breadth of knowledge required to solve a dizzying

array of problems encountered during the investigation of crime. The community and profession of forensic scientists no longer consists only of people working at a lab bench hunched over a bloody shirt or extracting benzoylcegonine from a blood sample; it is comprised of a wide-ranging and actively collaborating network of practitioners, researchers, administrators, and policy makers, each functioning as nodes in the net of knowledge.

As a practical matter, however, clamoring for the conversion to a formalized probabilistic approach for weighting evidence is raising the sail with no wind to propel the yacht; until the appropriate tools are developed, tested, accepted and distributed, the field will be unable to realize the benefit of such an approach. No one – academician or criminalist – will perform likelihood ratios incorporating various terms for complex variables by hand. Nor will caseworkers perform the basic research to build the underlying empirical foundation. The latter issue can only be solved by strengthening our ties with academia.

We must also participate fully in the development of the increasingly sophisticated software tools that perform the complex calculations required to apply probabilistic methods to forensic disciplines. With DNA as one current example, solutions have entered the marketplace that are expensive, difficult to use, and/or opaque. These present unnecessary barriers to the implementation of approaches that already require a brain recalibration. We believe that tools implementing probabilistic approaches should be affordable, transparent and easy to use. And we have put our money (or at least our time) where our mouths are.

Speaking of our mouths, it might be time for something more nutritious than money or time ... or perhaps the rest of that gin.

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## Ethical Dilemmas cont'd from page 17

### Should You Take Any Action?

Not educating the DNA analyst and supervisor can lead to a repetition of the conduct. If you choose not to address the situation, your inaction may make you a party to future transgressions.

In this profession, we police each other. Enforcement of ethics is left to management, professional associations, and sometimes legal authorities. But, policing is different from enforcement. It relies on each of us as individuals recognizing a potential ethical transgression and taking appropriate action. Policing (including reporting) and enforcement are explicitly addressed in the *Guiding Principles*.

*The ethical and professionally responsible forensic scientist and laboratory manager . . .*

**5. Report to the appropriate legal or administrative authorities unethical, illegal, or scientifically questionable conduct of other laboratory employees or managers. Laboratory management will take appropriate action if there is potential for, or there has been, a miscarriage of justice due to circumstances that have come to light, incompetent practice or malpractice.**

Paragraph five is clear: to be ethical and professionally responsible, report the questionable conduct of the analyst and supervisor to the appropriate legal or administrative authority. Yet, in this and in other instances of questionable conduct, para-

graph five may leave you with some open questions regarding important details, such as:

- Which authority is appropriate, and based on what criteria?
- Is it ever appropriate to circumvent lab management when reporting an incident? If so, when?
- How much proof must you have before reporting a potential ethical transgression?
- Should you always talk to the alleged transgressor first? If not, what factors go into deciding whether to go directly to a supervisor?
- Can a matter be resolved between two employees without having to report it to a supervisor?
- When does an ethical transgression have to be reported to a professional association?
- What liability risks may be associated with reporting?
- What should you do if you report a matter to management but nothing is done?
- What if you become subject to reprisals?

Can you think of any other questions? Do you have any comments on this topic? Feel free to voice your thoughts on the CAC Ethics Forum at [www.ethicsforum.cacnews.org](http://www.ethicsforum.cacnews.org).

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I am a retired Supervising Criminalist from the Kern Regional Crime Laboratory in Bakersfield California. I've worked in the capacity of a criminalist both with the Kern County Sheriff's Department and the Kern County District Attorney's Office for a combined 35 years. I am also an adjunct professor with Oklahoma State University and a lecturer with Bakersfield Community College. In addition, I have started my own forensic science education and consulting firm Criminalistics Services International, LLC. My membership with the CAC began on my birthday in May of 1982. During those many years I have attended a number of CAC meetings, made presentations, served a brief stint on the Merchandise Committee, served on the Ethics Committee and chaired it for one year. Most recently, I chaired the CAC 2012 Meeting in Bakersfield and prior to that the Spring 2013 CACLD meeting. I have also been an active member with a number of other forensic organizations including the AAFS, where I serve as a FEPAC inspector, the IAI where I serve as chair of the Forensic Laboratory Analysis Subcommittee, AFTE, and CACLD. After 30 years as an active CAC member, I think it is time for me to be more involved in this organization. I now have the time, energy, and enthusiasm to devote my efforts as president-elect of the CAC. It would be an honor to serve you as your next president-elect.

I first joined the CAC as a student member in 2001 while working as a student assistant at the California DOJ laboratory in Berkeley. In 2002, I began working full time in the offender databank program, and three years later, I transitioned to the DNA casework section. During this time I attended study groups and seminars as often as I could, and served on the Nominating Committee for several years. For the past three years I have enjoyed serving on the CAC Board of Directors as the regional director north. In January, I transitioned to the position of treasurer. I have spent the past several months getting up to speed on the duties and responsibilities of this new position. I would like the opportunity to continue to serve the CAC in this new capacity. Thank you for your consideration.

I would appreciate your vote and support for an additional two years as your editorial secretary.

In early 2012 I retired from my position of director of the Los Angeles Police Department Crime Laboratory. Though I am no longer employed by a criminalistics laboratory, my love for and dedication to the forensic science profession has never been greater. Throughout my career, the majority of my professional involvement and commitment has always been with the California Association of Criminalists and I would like to continue to contribute to our association. I have had the opportunity to hold several committee and leadership positions in the CAC, but I have found my tenure as editorial secretary one of the most rewarding. If you feel I have done a good job as the editorial secretary, I would appreciate being re-elected.

I have been a criminalist with the DOJ Riverside Crime Laboratory for approximately the past 15 years, and have been a member of the CAC since 1997. I have previously served on the Awards Committee as the co-chair (2005-2009) and would now appreciate the opportunity to continue as your regional director, south. Professor Longhetti encouraged us from the very beginning to participate in CAC activities whether this participation was in the form of serving on a committee, Board of Directors, or attending study group meetings or seminars. I am glad I took his advice as I feel I am a better criminalist today having had the pleasure of meeting a myriad of individuals and being able to draw upon their vault of knowledge. I would appreciate the opportunity to continue to serve as the CAC regional director, south.

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# The Zambian Connection



by Laura Silva

I've been involved as a volunteer for the non-profit organization, Georgian Foundation for a little over two years now. The project I'm working on is to combat child sexual abuse in Zambia, Africa. When asked to write about my experiences with this group, I wasn't really sure what to write, and I must admit it has taken a little while to organize my thoughts. Our project centers on a multi-disciplinary approach to training police, medical, forensic, judicial, and advocacy professionals. Coupled with

training, it is our goal to help Zambians start the first forensic DNA laboratory in the country. This past August (2012), I went with three others to Zambia in an effort to lay the groundwork for development of the lab, and garner support for the training portion of the project. I must admit I was going in a little naïve in both international work and laboratory development, but what I did have was a willingness to try something new and a desire to make a difference.

I became involved with Georgian Foundation after I was asked to give a tour of our laboratory in Oakland to a visiting Pediatrician from Zambia. He told me of the country's problem with child sexual assault and it moved me to become involved.

The Republic of Zambia is a land-locked country about the size of Texas in the southern part of Africa. It shares its borders with eight other countries (Democratic Republic of the Congo, Tanzania, Angola, Malawi, Zimbabwe, Mozambique, Botswana and Namibia). Most people live in cities, but there are still many rural villages living on subsistence farming. Its economy has largely been based on copper mining, but it relies on other industries such as agriculture and tourism. The official language is English as it was formerly the British protectorate of Northern Rhodesia (it gained independence in 1964). Having one official language helps, as there are over 70 ethnic groups and at least as many different languages in the country. At first I was amazed that the country is at peace relative to the realities of many other African countries torn apart by conflict. However, the more time I spent in Zambia, I'm convinced the peace comes from the diversity. With so many different groups of people, everyone has learned to live together while respecting each other's differences and finding ways to go after common goals.

The country is not without its problems, which brings me to the Georgian Foundation's project. Child sexual abuse is a large problem in the country. In one day in the capital city of Lusaka alone, multiple children are brought into the one clinic developed to manage child sexual abuse cases, the One Stop Center. The One Stop Center estimates they take in about 1000 reported cases per year at the Lusaka center alone. It is not too difficult to predict that the true number of unreported sexual abuse cases is much higher.

Conversely, conviction rates for perpetrators of these crimes are very low, in part due to lack of evidence (investigative, medical, forensically relevant samples) and a very strict sentencing structure. The minimum sentence for sexual abuse is 15 years, which I'm told in a Zambian prison means almost certain death due to high HIV and Tuberculosis burdens, overcrowding and limited access to medical care. Magistrates are reluctant to convict without strong, irrefutable evidence that the abuse occurred. Even with strong medical findings of abuse, medical professionals cannot say beyond a reasonable doubt that a certain person was responsible. The defendant's defense counsel has sensationalized this fact time and time again.

Compounding the problem is the high burden the HIV/AIDS epidemic has taken on Zambians. Although much progress has been made combatting the spread and management of HIV infections, 13.5% of adults (age 15–49) are infected with the virus, with an estimated 45,000 deaths (2009), and 690,000 orphans<sup>1</sup>. Zambia is ranked 6th in the world for HIV/AIDS prevalence rates<sup>2</sup>. These sobering statistics are even more heartbreaking in the context of the increased risk sexually abused children have in contracting HIV and the complications of disease management in a poverty stricken population. The staggering number of orphans due to this epidemic drastically increases the at-risk population of children more likely to become victims of sexual abuse.

After listening to the visiting doctor describe the problems surrounding child sexual abuse, I offered to help. The next thing I knew I was their Forensic Team Leader. Looking back, I'm not sure I had much control over it thanks to the gentle nudging from Dr. Chuck Clemmons, the Foundation's



*Dr. Mwansa at the Oakland PD Crime Lab*



*Rural Village Huts (photo by S. Shubladze).*



*Local village bicycle shop.*



*Termite mound.*



The problems of collection and examination of evidence compound quickly and are often circular.



Chief Operating Officer and a pediatrician who really leads by example. He is licensed to practice medicine in the USA and Zambia and is on faculty at Zambia's main University Teaching Hospital (UTH). He travels to Zambia a few times a year and works year-round on this project along with managing the rest of his busy life as a practicing physician in the US and father of ten.

It was important for the Georgian Foundation to develop a program that addressed all aspects of stopping child sexual abuse: police/investigative, medical, laboratory, judicial and advocacy. They have created a multi-disciplinary approach to train each group how to effectively be part of the overall solution, but also understand how each of the other groups contribute and how everyone fits together. Parallel in importance was the goal to make sure the project involved Zambians, and it wasn't just another foreign NGO waltzing into the country to "make a difference" with no real buy-in from the people. This training program, the Experience and Exchange Fellowship Program (EEFP) is the centerpiece for the entire Georgian Foundation project and focuses on a genuine exchange of people and ideas between the USA and Zambia. On the ground in Zambia, the Georgian Foundation created an independent NGO, the *Zambian Center for Child Protection*, which works under the larger umbrella of the Foundation, but has an independent Board of Directors composed of Zambians who believe in this project and want to see it succeed.

It was easy for me to conclude that child sexual abuse in Zambia is not only a criminal justice problem, but also a public health problem. I think it was easy for the Centers for Disease Control and Prevention (CDC) to also come to this conclusion.

The EEFP had hosted several small exchanges mostly with the medical and police professionals prior to developing an expanded exchange program to send about 9 or 10 Zambian professionals to the US for up to two months of training. The CDC decided to fund this expanded training. This was an important step to keep the train rolling forward. I think this funding also helped to put our program on the map for the decision makers in Zambia.

The EEFP is currently working with a wide range of people and disciplines including Oakland Children's Hospital, the Napa District Attorney's Office, the Napa Courage Center,



(top) Lusaka Slums (photo by S. Shubladze).  
(middle) Lusaka neighborhood corner art.  
(bottom) Lusaka city traffic.





and Sorenson Forensics in Salt Lake City Utah. The first of the larger groups coming over is set to arrive in March 2013.

The goal of our trip to Zambia was two-fold. First, it was to organize and solidify funding we received from the CDC for the US-based training of police, medical and forensic science professionals from Zambia. The second goal of the trip was to solidify and organize support for the development of the first forensic DNA laboratory in the country. The Georgian Foundation has partnered with Sorenson Forensics to facilitate the laboratory side of things. We were impressed with the company's past and ongoing work in Africa developing DNA laboratories, and were even more impressed with the general business model the company has taken when it comes to international work. Although it is a business and money has to be made, there is a genuine dedication to helping people around the world through science and technology to bring us all closer together.



*Dr. Chuck Clemons with Zambian children.*

It was quite clear that forensically relevant evidence was not being routinely collected, examined by or even sent to the contract laboratory in South Africa in large part due to logistics. The problems of collection and examination of evidence compound quickly and are often circular. Very little evidence is collected and even less is sent out for DNA analysis causing the perception that nothing is being done. This can cause a certain level of apathy, which in turn causes even less evidence to be collected to the point where there is no evidence to send to a laboratory. The entire system from the investigative to the judicial ends can in turn become apathetic because of this vicious downward cycle.

Our team was composed of me, Chuck Clemmons the COO, Shota Shubladze, the foundation's Development Director and Tim Kupferschmid, executive director of Sorenson Forensics. As a bench scientist very comfortable in my own cubicle, lab space and occasional courtroom, I was very nervous on the flight to Zambia. I had never been so far away from home, never been away from my husband for such a long period of time, and had no idea what to expect of my host family, or my travel mates for that matter. On the (24 hour) flight over, as an type-A planner by default, I wanted to get a sense of what meetings were scheduled and what the next few weeks would like. I was not put at ease when Chuck told me we had no planned agenda. We were going to make meetings once we arrived. Ok....

But I was quickly surprised and eventually became at ease with a more informal approach to agenda planning. My host family, one of Chuck's adopted children from Zambia, was awesome, and lived in a nice sized single family home with working Wi-Fi. I was face-timing with my husband the next day (which by the way was a condition on my traveling around the world without him). Our first working day in Zambia we tried to get in touch with the manger of an area overseeing HIV/AIDS grants including the CDC funding for our EEPF. Chuck had worked with her many times during his previous visits and through his appointment to the University Teaching Hospital (UTH) in Lusaka. He suggested we just go down to her office and knock on the door. Again, a little uneasy, I went with the flow. He was right; we popped our heads in and she invited us to sit down with open arms saying, "I was wondering when I was going to see you. I heard you were in town. We



## The Zambian Connection



*Zambian police professional meeting the Oakland Police Department Chief during tour during EEFP visit.*



*Zambian police and medical professionals touring the Oakland Police Department Lab during EEFP visit.*



*Zambian police and medical professionals at Sorenson Forensics during EEFP visit.*

have a lot to talk about.” This first meeting was one of the most important lessons I learned about getting business done for the project. Although appointments are made, just showing up ready to work is often just as important. This first meeting set the ball rolling with many other meetings with people who had heard we were in town and heard about the project we were pursuing. By the end of the first two days, our calendar had filled up with meetings, people and places to see.

Our second big meeting was out of town to visit the city of Livingston’s One Stop Center and it’s director. After a tour of the facility and overview of their program, we discussed what they needed, how we could help, and about starting the DNA laboratory. Every single person at that table was so passionate about improving the process, and the sense of despair regarding the current system was palpable. Imagine being a trained physician or nurse and knowing what you *could* be doing and what tools *could* be available to you, but day after day knowing you couldn’t use them or there was no system to utilize what you had to offer. This feeling energized my team and me even more to get this program, especially the lab development, off the ground during our visit. If everyone involved saw that some sort of progress was made in this regard, it would infuse a fresh batch of enthusiasm to be part of the solution. I could see that our visit, however small a start it was, brought some of that enthusiasm.

We had similar meetings with medical staff at the One Stop Center in Lusaka and with the permanent secretary from the Ministry of Community Development Mother and Child Health. She had been a pioneer for women in medicine and had also been instrumental in getting the One Stop Centers up and running. She was now in charge of many programs that overlapped with our mission, especially surrounding advocacy for victims. She was one of the people who could get things to happen from the top down. We wanted to make sure that everyone bottom to top had a stake in the project and wanted to be part of the solution. Like the medical staff, she was very encouraged with our program and wanted to help.

At this stage in the process we realized our biggest hurdle—trying to identify how a laboratory run through the National Police Force was going to fit within the rest of the program. It made the most sense to have the storage of evidence and the laboratory as close to the collection of the evidence as possible. The most logical space was within the UTH laboratory wing next to already existing microbiology and clinical laboratories. Everyone thought this was a good idea, but time and time again we heard, “Who is going to pay for this lab? Have the police said they are OK with the lab at UTH?” Although we had been talking to individual people within the police department, we hadn’t had any assurance, and we had no idea if everyone would be on board with a plan to have a small DNA lab within UTH. There had been talk over the previous year about a large police facility to be built outside of Lusaka that would house a training facility as well as a large scale full service laboratory. It was going to be new construction, and take years to complete. Although this was a fantastic long-term plan, the project needed to have a smaller DNA laboratory up and running well before this larger lab could be completed. We were worried that money allocated to the larger facility may prohibit money for the DNA laboratory, and without police commitment, chances were slim the lab could be built. It was very clear that everyone we were talking to knew this fact all too well, and had a valid degree of skepticism about getting the green light on a smaller DNA lab.



Everyone thought this was a good idea, but time and time again we heard, “Who is going to pay for this lab?”

One of the board members for the Zambian Center for Child Protection, Nick Malaya, was a retired police officer and had worked with many of the people we needed to talk to. He did a wonderful job of getting everyone to agree to meet us at the Police Headquarters in Lusaka. This meeting happened at the end of our trip, and we were all very nervous. Along with our group, the CDC’s Zambia Country Director also attended. As a US-based organization, the CDC is always interested in helping projects like this, but they need certain assurances of significant buy-in from the country itself. He, like everyone else, was curious about the police position on this project.

We met with the heads of Forensic Services, Victim Support and Budget and Planning. We gave our project details and the results of all the meetings we had been having with medical and advocacy groups. Tim gave a great presentation on what Sorenson Forensics could offer in terms of laboratory development, validation and training. We proposed the lab be in re-purposed space within UTH in the interim while the larger facility was being built. The head of Budget and Planning inquired about the cost of this project, and Tim responded with a rough estimate. It was a HUGE relief when they all agreed that some unspent money in their budget could easily cover the laboratory development and validation. They were very excited about the plan and wanted to be part of it. This meeting brought so many parts of our trip together and it was SO exciting.

That same day, we met the permanent secretary from the Ministry of Home Affairs. His ministry oversees the National Police Force and, again, having buy-in and support from the top was just as important to us as the buy-in we had from the bottom. After hearing our project and progress over the last few weeks, he was very enthusiastic. He pledged to help us in our goal immediately. He was especially impressed that the project involved Zambians, and it wasn’t just another foreign NGO coming in to start a project. He was so enthusiastic he invited us to his country club the next night for a brie (BBQ). At this informal gathering he introduced us to everyone as an example of the exciting things that were happening in their country. He referred to us as partners to Zambia. It was a good night.

Also at this BBQ, I met some of the younger generation of Zambians, including the permanent secretary’s children. They had all gone abroad to college and upon graduation returned home to make their start and improve the lives of the people in their country. They were very excited about our project, and we talked about their vision for Zambia—leading the way for a “new Africa.” It was inspiring to hear these young people with so much passion for improving their country.

Our trip ended on such a high note. Enthusiasm was everywhere, but we also had a lot of work to do. We had a few



*Our African Trip, Day one meeting with the author, Chuck Clemons and Nick Malaya (Board Member from the Zambian Center for Child Protection). Our office was the dining room table of our host family.*



*Meeting preparation outside the building housing head of grants, Dr. Kankasa, with Shota Shubladze, Chuck Clemons, Tim Kupferschmid, Nick Malaya and Sylvia Kabita (host to our team and ZCCP Board Member).*



*Our host family Kabita and Sylvia Kabita (also ZCCP Board Members).*

## The Zambian Connection



*Our host family home and pseudo office.*



*One Stop Center meeting in Livingstone.*



*One Stop Center meeting in Livingstone, with Director Dr. Fubesha, our team and a CDC representative.*



*The author poses in front of the One Stop Center and UTH meetings in Lusaka.*



*The UTH grounds.*



*Ministry of Community Development Mother and Child Health meeting with Permanent Secretary Chomba.*

weeks to draft an MOU between all involved parties. We had a lot of training to plan. Since then, a lot has happened. We got official notification of the funding from the National Police Force, of laboratory space allocated for the DNA lab at UTH, and we got word that the Permanent Secretary from the Ministry of Home Affairs had recently been on national television talking about the development of the laboratory. I must admit that I had hoped for this kind of outcome, but I did not expect it. I couldn't be more proud of everyone involved on this project and I am really honored to be part of it.

It wasn't all business. We didn't have much free time, but while we were in Livingstone for meetings, we made time to tour Victoria Falls, which even in the dry season with low water flow was a sight to see! We went on a safari cruise where

I saw my first wild hippo, and while waiting to board the cruise, got an impromptu visit from some local monkeys and a pack of elephants. Had I known how dangerous elephants were, I may not have gotten as close as I did to take pictures. I attended a wedding for the son of one of our hosts and I went to church twice, where I heard the most beautiful singing from the church choir and congregation.

Reflecting back on my experiences with this project, I think my story is important. It is from the perspective of a bench scientist, working on casework day in, day out. Not that I don't LOVE what I do and feel like I am making a difference in the lives of the community I serve, but I think my story shows that we don't always have to fit into the confines of the box our job titles create. If we have the desire to explore other





*(l-r) Looking at Laboratory space in UTH.*



*Meeting with National Police Force representatives, with CDC country Director, our team and ZCCP.*



*Meeting with National Police Force representatives.*



*Victoria Falls, with the author, Shota Shubladze and Chuck Clemons.*



*Meeting with Permanent Secretary for the Ministry of Home Affairs, Mr. Maxwell Nkole, with our team and CDC country director.*



*Pack of elephants.*



*Site of wedding, photo by S. Shubladze.*



## The Zambian Connection



*Sunset over the Zambezi River.*

opportunities, the skills we have are needed everywhere around the world. I may not be a seasoned expert in building codes and equipment procurement or lobbying for a cause, but I do know the equipment and protocols/procedures we use, and there are others at the table who know a little more about all the other stuff. Teamwork is an amazing thing. And I'll tell you after my few weeks in Africa, now I do know a little more about all that other stuff!

Through all of my experiences, business and pleasure, Africa touched me deeply and unexpectedly. The kindness, generosity and passion of everyone I came in contact with was truly amazing. I know I'm not the first person to say this, but I left a piece of my heart in Zambia. I can't wait to go back!

<sup>1</sup>[www.cdc.gov/globalaids/Global-HIV-AIDS-at-CDC/countries/Zambia/](http://www.cdc.gov/globalaids/Global-HIV-AIDS-at-CDC/countries/Zambia/)

<sup>2</sup>[www.cia.gov/library/publications/the-world-factbook/rankorder/2155rank.html](http://www.cia.gov/library/publications/the-world-factbook/rankorder/2155rank.html)



*Church choir singing.*



*Victoria Falls,  
photo by S.  
Shubladze.*

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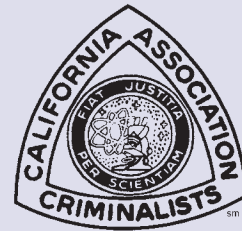


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