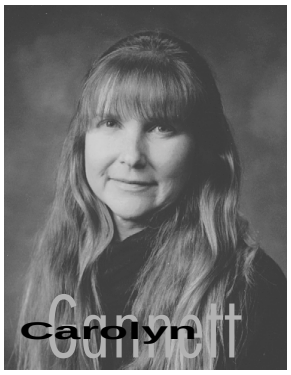
The CAC News

News of the California Association of Criminalists • Fall 1997

The President's Desk

Professionalism and Stepford Crims



The Forensic Science community is saddened by the recent loss of two of its prominent members—Al Biasotti and Bryan Culliford. They will be remembered as individuals who contributed a great deal to their profession. Our thoughts are with their families and friends.

Both these individuals achieved respect amongst the Forensic Science community through their pursuit of professionalism. "Professionalism" is a word that has been bandied about by our members over the last few years. The CAC has taken steps to try to improve professionalism within Criminalistics.

But what does "professionalism" mean? Are we promoting it in the best manner? Have we made any headway in the last few years? Is there something more that you as an individual can do to improve professionalism within our labs?

My 6 years of experience on the CAC Board has lent me the opportunity to meet and talk with analysts from many different laboratories within and outside of California. As president, members have approached me to discuss their concerns. It is disturbing that a common theme continues to be brought to my attention: professionalism being stifled by laboratory management—not simply not encouraged, which is sad enough, but actually stifled.

In particular, there is the concern that analysts are discouraged from being anything more than mere technicians. Punch in, punch out, do not make waves, do what you are told, and do nothing more. Do not upset the equilibrium by introducing new ideas or pointing out weaknesses and possible solutions. Do not strive to excel—you may make your coworkers and your managers look bad. Your time spent teaching or being taught shall be severely limited. Your productivity shall be more important than organizing workshops or meetings with colleagues throughout the state. Be as innocuous and bland as possible. Strive to be average. And always, *always* smile, especially at the cameras watching you from above. In short, be a Stepford Crim.

Such management propagates itself. The Stepford Crim is seen as the desirable employee and hence reaps the rewards from above. These are the employees that are granted the promotions. Stepford Crim becomes Stepford Supervisor or Manager, assuring the continuing legacy of the Stepford Lab.

A government lab has no external impetus to break this cycle. There are no other labs competing for their business, pressuring them to produce the highest quality work possible in the most efficient manner. On the contrary, there are reasons *not* to break the cycle: it takes time, energy, thoughtfulness, and just plain old-fashioned work. Why do all this if you do not have to? Remember, this is a *Stepford* Lab.

Any of the above hit a nerve? Strike a chord? Ring true for you? Each of the traits I have presented hails from a long list of real situations brought to my attention by our members. And no, I did not make up the part about the cameras.

Granted, I have presented a fictitious lab consisting of concerns hailing from many labs. There are definitely analysts, supervisors, and managers in both the public and private sector that strive for and encourage excellence simply for the sake of being excellent. But the problem of encouraging the technician's mentality is a common theme running through many of my discussions with colleagues.

If you are a bench-level analyst, are you encouraged to be a technician? Are you discouraged from being more? Do you even care to be more? Is there anything wrong with not being more as long as you are doing good work and putting in a fair day's labor?

If you are a supervisor or manager, do you do anything to discourage any of your employees from being more than a technician? If so, why? If not, why not? Is the Stepford Crim mentality valued when considering promotions? Why? Why not?

Before answering any of the above questions, ponder the following:

What is professionalism? How important is it in the laboratory? How can it be achieved on a day-to-day basis in the laboratory? How can it be achieved in the long-run? What can the bench-level analyst do to promote and encourage professionalism? What can laboratory supervisors and managers do to promote and encourage professionalism? What should laboratory supervisors and managers *not* do to discourage professionalism? What are you, as an individual, willing to do to improve professionalism in your laboratory? Do you practice your answers to the above questions? If not, why not?

I challenge each individual reading this to ponder any of these questions. Mull them over in privacy when you can be completely honest with yourself. Discuss them with your coworkers. Toss one into an otherwise mundane conversation with your analysts or your supervisors or your managers. Slap them up on the bulletin board. Even if responses are complacent or negative, at least the concept of professionalism is being discussed.

I further challenge each and every one of you to commit any of your answers to writing and submit them for publication in the *CACNews*. Show that you care enough to respond. Demonstrate that you are interested in doing more with your career than becoming a Stepford Crim.

Carolyn

The CACNEWS

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On the cover...
A close up view of Jeffrey Bishop's rendering of Sherlock Holme's study. The intricate sculpture was presented to the Forensic Science Society this summer. On this page is a detail view of the gift.

The CACNews is published four times a year (January, April, July, and October) by Calico Press, L.L.C., for the California Association of Criminalists, a private foundation dedicated to the furtherance of forensic science in both the public and private sectors. Please direct editorial correspondence to the Editorial Secretary.

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Southern Section Report

It has been touch-and-go for your new regional director as I've been battling a debilitating case of SLS (Summer Laziness Syndrome). Recently though, I've been rebounding and by the time you read this I will have managed to nag a few colleagues of mine at LAPD into helping me put on a dinner meeting held at Aerospace Corporation in El Segundo on Sept. 18th. Aerospace is host to a new facility known as the National Law Enforcement and Corrections Technology Center (NLECTC). NLECTC's mission is to "develop and apply technologies and systems that will assist law enforcement and corrections organizations in performing their missions more effectively." Simply put, NLECTC gives the Aerospace rocket scientists and software geniuses an opportunity to develop really neat gadgets that help solve crimes The staff of NLECTC enjoys treating their visitors to fine demonstrations including a sophisticated sensor system used to detect methamphetamine labs from far away. An educational and entertaining time is always had by all.

Most of the study groups will also have met on September 18th. Many thanks to the study group chairs: Dan Anderson, Toxicology; Jim Stam, Drugs; John Simms and Crystal Wysong, Alcohol, and Mary Hong, Forensic Biology. Wayne Moorehead, Trace, hosted his study group on September 17 in San Diego in conjunction with a meeting of the recently reformed Arson Analysts group.

The fall seminar is just around the corner and it is shaping up to be the one seminar that you definitely don't want to miss. Liz Thompson, Kenny Wong and the staff of the Orange County Sheriff-Coroner Crime Lab are working hard to put together what appears to be a fantastic program of workshops, technical presentations and the event that I'm looking forward to—the "interactive" panel discussion mysteriously titled "Is Something Wrong?" which will showcase stars of the O.J. Simpson trial including Henry Lee and Barry Scheck. I checked with Liz and she assured me that the panel "interactions'' will be limited to just questions and answers, so be sure to check your cream pies at the door! See you in Irvine.

—Joe Hourigan

CCI Course Offered

All CAC members interested in the three-day "Courtroom Presentation of Evidence" course are invited to submit applications. The course is scheduled for Dec. 3-5, 1997 in Sacramento at the California Criminalistics Institute (CCI). Members from public agency and private sector labs may apply. The class is limited to twelve students and is POST reimbursable, Plan IV. Student selection will be based on significant funding from the CAC A. Reed and Virginia Mclaughin Endowment. This course was recognized by the Office of traffic Safety with their 1997 Outstanding Achievement Award. For further information contact **Lou Maucieri** at (916) 227-3575.

Morpheus on the web

If you've ever wondered how raw opium is converted into pure morphine and then into heroin, a thorough treatment of the subject can be found on the internet. Surfing to the location **http://www.omnilex.com/public/ps.html**, you will find what is billed as a "Cooperative Project Between Omnilex, Inc., and The U.S. Department of Justice, DEA, Intelligence Division."

The Table of Contents includes "History of Opium and Heroin", "Pharmacology of Opium", "Opium Harvesting", and even "Field Selection and Clearing." Each topic is illustrated with a good-sized, high-quality color photograph depicting a step in the process.

The "Double U-O Globe Brand" stamp was originally used to mark the high quality heroin from northeast Burma's Shan state. Now it's used generically by many heroin producers in many regions. Most often found stamped in red , it is seen on the clear polyethylene bags used to pack the bricks.

NEAFS Meeting

Are you overwhelmed by the high cost of meetings, the exorbitant fees, the exotic locations? If so, please join us at the Annual Meeting of the Northeastern Association of Forensic Scientists, the "blue-collar SOFT", Oct. 15-18,1997 in White Plains, NY. Members: $50/30; Nonmembers: $75/55; Rooms avail. at $102/night. Those who are interested in presenting a Forensic Tox. paper should contact Guy Vallaro, Ph.D., Westchester Co. Forensic Tox. Lab., at guymv@aol.com or (914) 593-5620.

SAFS Meeting

The Southern Association of Forensic Scientists, is having its Fall meeting in Longboat Key, FL, near Sarasota in the first week of September. There are 11 workshops scheduled for September 2, 3 and 4. Topics: ABC GKE Study Workshop, Forensic Paint Examination/Use of RCMP/TWGMAT Automotive Paint Database, Blood Appreciation/ Bloodstain Pattern Analysis Wkshp, FTIR Techniques for Drug Chemists, Issues (and Non-Issues of Lab Safety), Forensic Lightbulb Wkshp, DEA—Timely Topics, Perkin-Elmer Biosystems 310, Internet for Forensic Scientists, An Intro to Forensic UV-Vis Microspec., Tandem MS for Toxicologists. Contact David Baer directly at DavidB7818@aol.com or at 407 245-0888 (Orlando Crime Lab) for more info.

Metropolitan St. Coll. of Denver

Full-time tenure track position in chemistry with a specialty in forensic science (criminalistics).

Direct the Forensic Science emphasis within the chemistry department. Requires education and work experience in forensic science. An earned doctorate is required. Preference will be given to a Ph.D. in chemistry. Strong commitment to teaching. Ability to work with diverse groups. Salary commensurate with education and experience. Begins effective August 1998—based on a 10-month contract.

Applicants must submit a letter of application, a current vita, and the names of three individuals qualified to commend on the applicant's qualifications to: Dr. Gerhard Lind, Chair Department of Chemistry - Campus Box 52 Metropolitan State College of Denver PO Box 173362 Denver, CO 80217-3362. Application letter, current vita, three references must be received no later than Oct. 31, 1997.

Questioned Documents Examiner (Forensic Scientist)

Salary: $30,572-$47,730. The Dept. of Criminal Justice Svcs seeks qualified applicants to serve as a QD Examiner in the Div. of Forensic Science, Richmond, VA. Examines, compares and identifies questioned documents; provides investigative assistance to law enforcement officers concerning document evidence; and testifies in court.

Applicants must submit a State App. (#10-012) to the Dept. of Criminal Justice Svcs, 805 East Broad Street, 10th Floor, Richmond, VA 23219, Attn: Human Resource Officer, no later than 5:00 p.m., Oct. 16, 1997. Call (804)225-4399 for info.

Texas Workshop Highlights

Third Annual Forensics Workshop at the Randolph,TX, AFB is scheduled for Oct 20-24, 1997. Scheduled: Crime Scene and Evidence Issues, Sharp Force Injuries, Blunt Force Injuries, Asphyxial Deaths, Sex Related Deaths, Fingerprint Development Techniques, Computers in Crime, Death Investigations and Unusual Deaths, Time of Death Determinations, Drug Related Deaths, Forensic Odontology, Forensic Photography, Interviewing Children, Child Sexual Assault Injuries and Exams, Child Abuse Injuries, Forensic Anthropology, Forensic Entomology, Bloodstain Pattern Analysis, DNA Evidence, CODIS, Urinalysis Issues, Shaken Impact Syndrome, Gunshot Wounds.

Sign-up by 30 Sep 97, Contact Ty R. Cresap for more information. Cost to military is free. Non-military - $10. (210) 652-4563

On-Line "Forensic DNA 101" Offered

"Forensic DNA 101" provides the student with the foundational knowledge of forensic science, molecular biology, and genetics that is needed to understand forensic DNA typing. The student will learn how these fundamental concepts and techniques are applied in the specific DNA tests that are currently used in forensic laboratories. Starting Date: Oct. 13, 1997 Ending Date: Nov. 9, 1997. "Forensic DNA 102" will take the student through a case scenario, emphasizing the interpretation and significance of results. Advantages and limitations of the various techniques will be discussed in more detail. The role of forensic DNA typing in the judicial system will also be briefly reviewed. Starting Date: Nov. 10, 1997 Ending Date: Nov. 30, 1997. Instructors: **Keith Inman**, M. Crim. and Norah Rudin, Ph.D. Dr. Rudin and Mr. Inman have co-authored "An Introduction to Forensic DNA Analysis", (required textbook for this course.)

There will be periodic self-correcting exercises to test your learning throughout the course. Discussions will be held in the NetForum discussion area. The student is encouraged to post frequently, but is not required to do so. A Certificate of Completion may be earned by gaining a passing score on a post-test which can be taken at the end of the class. Total registration fee per student is $45.00 per course, which does not include the price of the textbook. Students who register for both Forensic DNA 101 and Forensic DNA 102 at the same time, can enroll in both courses for $80. To register, please follow this link to the curriculum page, and select the desired course: http://www.corpus-delicti.com/curriculum.html

The deadlines for registration are : Forensic DNA 101: Friday, October 10th, 1997 Forensic DNA 102: Friday, November 7th, 1997. Please note: A late fee of $10 will be charged for any payment postmarked or authorized after Oct. 10, 1997.

Senior Trace Evidence Analyst

The Bexar County Forensic Science Center, located in San Antonio, TX, has the position available at a salary of $38,628 - $50,220 per year, commensurate with experience and qualifications. Job Description: Oversees daily work of Trace Evidence Analysts and assists in training of laboratory procedures. Performs microscopic and analytical laboratory testing of trace evidence including gun shot residue analysis. Generates reports and documents concerning evidence analysis and findings. Testifies in court proceedings as a forensic expert witness. Frequent contact with law enforcement agency personnel, attorneys and other forensic professionals. Qualifications: Bachelor's degree in the Physical Sciences or closely related field and four (4) years of trace evidence experience. Contact Mr. Tim Fallon, Criminal Invest. Lab. Mgr. (210) 615-2142.

Nor-Cal Explosives Seminar

Sacramento County Lab of Forensic Services is the host for the upcoming "Nor-Cal Explosives Seminar." The date for this one-day affair is Tues., Oct. 14, 1997. It will be held at 4800 Broadway, Sacramento, with range activities scheduled in the afternoon. Pre-registration is $15 but this offer ends Sept. 30 after which it will be $25. Contact Bradley Johnson, (916) 874-9240.

Forensic Scientist (Trace Evidence)

$3,341 - 85,331 /mo, Requires Baccalaureate Degree in Chemistry, Biochemistry, Biology, Criminalistics, Physics or a directly related natural science major and two years of professional criminalist and forensic experience in trace-evidence, including using related analytical equipment. You must reside within the City and County of Denver three months after completion of the probationary period. Applicants possessing the highest qualifications in terms of length and quality of experience and education will be invited to further examination. Current vacancy is at Denver P.D. Crime Lab. Apply by calling (303) 640-3946 to request an application. Completed application can be faxed to (303) 640-1048 or mailed to Career Service Authority, 110 16th Street, Denver, CO 80202-5206 and received by Friday, Oct. 10, 1997, in order to be accepted.

Criminalist II

$46,767 - $61,541

Latent Print Examiner II

$46,767 - $61,541

Latent Print Examiner I

$42,370- $55,754

Criminalist position requires performing a variety of scientific laboratory analyses on physical evidence to provide scientific consultation; interpret test results and form conclusions; prepare reports; and testify as an expert witness. Position requires specialized experience in clandestine lab response and controlled substance analysis.

Latent Print positions require conducting fingerprint comparisons of latent prints and finger and palm print exemplar files; process items of evidence for latent prints; and testify as an expert witness on latent print examinations.—Las Vegas Metro. P.D., Personnel Bur., 400 East Stewart Ave., Las Vegas, NV 89101; (702)229-3497.

Reflections

Raymond Davis

When that many people show up at your retirement party then you will know that you have left your mark on your profession.

I first met **Al Biasotti** when we joined the Department of Justice in the summer of 1972. That was probably the only thing we had in common. I was just beginning my career in forensic science and Al already had 20 years of experience under his belt. The most important impression he left with me was that he was all business. Al was stoic and I rarely saw him laughing or engaging in normal conversations. When Al did laugh it was usually something he found amusing rather than someone else making him laugh. Like I said, Al was all business. When DOJ hired about 30 young, mostly inexperienced men and women during that summer of 1972, Al seemed more a patriarch than a fellow criminalist. He was very professional and professorial. He was the one we looked to for information and guidance. I remember an episode during my Forensic Alcohol Supervisor's course when Al participated in the mock trial. This was the part of the course where we were asked a series of difficult questions and then later mocked for our answers. He was asked to "take the stand" and show us young pups how a real expert testified. Al's testimony was flawless and he answered all the difficult questions with ease and clarity. But the one thing that really struck me about his demeanor was that he sat ramrod straight in his chair and never smiled. Like I said, Al was all business.

As the years rolled by I soon began doing firearms cases and from time to time would seek Al's help on my cases. It was great having someone of his caliber around to ask questions. Pun intended! I remember asking him for help on a particularly difficult bullet comparison. After 40 minutes of fiddling with the lighting as well as the bullets he informed me that with a little more work I would be able to make an identification. Encouraged, I spent the rest of the day working on that comparison. Al's enthusiasm gave me the confidence to make that identification.

Al was not an easy person to get close to. Maybe because of his seriousness or maybe it was just me, I don't know. I do know that Al was a man of great faith. His family was very important to him. As serious as he was about his profession, I know that God and his family came first. I know this not because Al told me so but because of how he conducted his life. He never had to brag or talk about himself. He let his work speak for him, and the manner in which he conducted himself around others, always treating people with respect. He never raised his voice, he never put anyone down and always listened as patiently as possible. He suffered fools and foolish ideas in silence. That doesn't mean he wouldn't voice his disagreement if he had one. He would but he would do so with respect. He was a kind and generous person who gave of himself to better the profession. And we are the beneficiaries of his character.

In 1990, I learned that DOJ was giving him a retirement party and so I flew down from Seattle to attend it. **Lou Maucieri**, Program Manager at CCI organized and emceed the event. It was held at the Old Sacramento Inn and approximately 25 people were there. It was a great evening and I never saw Al look happier. Seeing him there with his wife, fellow colleagues and old World War II buddies I would like to think that at that moment Al felt that "it didn't get any better than this." When that many people show up at your retirement party then you will know that you have left your mark on your profession. It was a great evening and all the guests had been asked to give a greeting on a video tape which was given to Al after the event.

I saw Al only twice after that until I took a firearms class at the California Criminalistics Institute in December, 1995. Al was teaching the "Criteria for Identification" class along with **John Murdock** and **Fred Tulleners**. John is a great teacher and teaming up with Al made it a memorable class. It was a tough and demanding class and Al wouldn't have it any other way. Although Al was not in the best of health, sometimes forgetting a point he was trying to make I could still sense the passion he had for his craft. I wondered why he was still working after his retirement and then realized that this was his life's work. It was important to him to continue to educate and pass on his knowledge and wisdom to others. In that manner, he was very successful. Al has left his mark on our profession and for those who had the chance to work with him he also left his mark on us. Thank you Al for everything. God bless you.

Raywood

Microscopy in the Changing World of Trace Evidence

William Chapin
Johnson Co. Crime Laboratory

There is little doubt that this is an era of change in the nation's criminalistics laboratories. Perhaps more than in any other area, trace evidence analysis, in which forensic microscopy plays a major role, is feeling the impact of three intertwined, influencing factors. These factors are (1) the repercussions of DNA testing methodology, (2) the O.J. Simpson trial and (3) attitudinal changes within our society. DNA technology has given us pages and pages of precise procedures, protocols, studies and statistical data banks. The Simpson trial focused attacks on documentation of minutia, called into question individual integrity and created doubt concerning the very heart and soul of forensics opinion testimony. Finally, society as a whole is losing the "trust-factor", rendering the analyst's opinion to be perceived as questionable. In conjunction with this loss of trust is an unwillingness on the part of many individual analysts to form a personal opinion (based on pertinent facts) and defend it. Instead of opinion testimony, the expert is asked to discuss interpretations of data within the realm of computer searches and statistics drawn from data bases. This approach is perceived to force "objectivity" rather than "subjectivity." Regardless of the approach, the interpretation of the data remains constant, but the perception of its validity becomes the principal focus. These forces crucially impact microscopy, the types of samples examined, the interpretation of the results, courtroom preparation, testimony, and the perceived validity of the formulated opinion. Courts and administrators ask, "Where are the charts, the numbers, the appropriate databases—in effect, where is the impartiality?" These will prove to be difficult hurdles to overcome.

In light of these driving forces, what is the state of forensic microscopy in the United States? General microscopy is alive and well; however, critically used microscopy is in trouble. This statement is best illustrated in examples of the common uses of microscopy in forensic science. Stereomicroscopy, used for screening and sample preparation, is common and routine in nearly every forensic laboratory. Polarized Light Microscopy (PLM) finds widespread use in the area of fiber identification with applications in other areas (i.e., mineral identification, pollen, woods, paints, dust, biologicals) by a handful of individuals. Comparison Microscopy (brightfield and polarized) is the mainstay in the fields of hair, firearms, and tool marks with a few laboratories utilizing this technique in fiber analyses. Of the interference techniques, Phase Contrast finds principal usage in Emmons' Double Variation method for the determination of refractive indices of glass; however, most laboratories are automating that analysis with the use of Glass Refractive Index Measurement (GRIM) systems. Isolated individuals are using Phase Contrast, Nomarski or Hoffman Modulation for spermatozoa identification. Fluorescence and microspectrophotometry equipment are found in a few forensic laboratories. Of course many laboratories are utilizing Scanning Electron Microscopy (SEM), but mainly as a microsampling device for elemental analysis (i.e., Energy Dispersive X-ray). Fourier Transform Infrared Spectroscopy utilizing a microscope (MicroFT-IR) is common, but for the most part the microscope is used as a microsampling device without consideration of microscopical theory. Historically, most of the FT-IR "microscope attachments" have not been constructed utilizing classical principles of microscopy.

Administrators who are not familiar with microscopical techniques find it difficult to fully comprehend the necessity for the training, practice, and time required to build basic skills.

By evaluating this list, it is obvious that "critical microscopy" is not a mainstay. In this context, critical microscopy is defined as the utilization of an array of microscopical techniques to characterize particulate material. In forensics, the quick, rough, and dirty work requiring little in the way of classical training is common, whereas little attention is paid to less routine and often more revealing samples. At the recent 1996 International Trace Evidence Symposium in San Antonio, one individual told of their laboratory's attempt to hire a trace evidence examiner. Of 25 people interviewed, none could verbalize a quick and simple means of microscopically separating glass (isotropic) and quartz (anisotropic). Another horror story is the identification of rayon (regenerated cellulose) rather than cotton (cellulose) because a compound microscope was not utilized in addition to infrared analysis.

This article was published in a recent issue of *Microscope,* 45:1, pp 15-17, (1997), and I thought it apropos to have it reprinted in "*CACNews*." It was my opinion that some criminalists may not have the opportunity to peruse *Microscope* but a large number are faithful readers of *The CACNews.* It is reprinted here by author's permission.

One of the points that Mr. Chapin brings out is the "subjective vs. objective" criteria. I think it is well to keep in mind the words of Dr. John Thornton in this respect, as presented in his republished article in the *AFTE Journal*, Vol. 11, No. 2, (April, 1979), "Firearms Identification Based Upon Bullet Comparisons: Expertise on Guess-Work," p 17:

> *"...First of all, we must be aware of semantic pitfalls which cluster around the words 'objective' and 'subjective.' They are tricky words at times depending upon the level of abstraction at which they are used. In general usage, 'subjective' has come to mean 'as we perceive something', while 'objective' has come to mean 'how that something actually is.' In a more casual usage, and in progressively greater vogue, there is a tendency to correlate 'objective' with 'valid'. This is not the original meaning of the word, and may well be the result of the influence of the cliche, 'a lack of objectivity', which has come to denote bias...."*
>
> *—Frank Cassidy, CA DOJ Lab*
> *Santa Barbara*

These examples by no means represent the majority of microscopists, but they are incidents that are troublesome. There are perhaps 15-25 true forensic microscopists in the field, individuals who critically examine paint particles, identify components of dust, determine the possible origin of a clothing stain or assist in the identification of a drug sample adulterant. The largest concentration seems to be in the Midwest where circumstances have allowed for several training courses, considerable cross-communication and above-average administrative support. Many additional trace examiners recognize the power of microscopy and are interested in improving their use of the microscope. This was exhibited in a recent Unknown Particle Identification workshop taught at a meeting of the Midwestern and Southern Associations of Forensic Scientists in Paducah, Kentucky. The workshop had 20 plus individuals all of whom were seeking to improve their skills for quickly identifying a wide variety of particles and to learn more concerning how to approach baffling situations. Unfortunately, microscopy is a field in which the necessary training and the difficulties of particle manipulation are not fully appreciated until the process is engaged. Administrators who are not familiar with microscopical techniques find it difficult to fully comprehend the necessity for the training, practice, and time required to build basic skills. An analyst may attend a one-week instrumental spectroscopy training course, learn the operation of a spectrometer and return to the laboratory with the ability to generate impressive charts and reports; however, microscopy does not lend itself to "instant visibility" in the form of printed graphics. Even for the analyst, microscopy can be a frustrating and infuriating process until sufficient training has been received and adequate time devoted to developing the necessary skills for efficient particle handling.

There are additional obstacles with which forensic microscopists must deal. First, an effort must be made to maintain the number of microscopists in the field. More and more trace evidence examiners are being moved to serology or drug sections in an effort to increase the total number of completed laboratory cases where these areas are perceived to be more "cost effective." In some laboratories this move is more subtle than a direct section shift. It is a rearrangement of duties rendering the trace examiner so overwhelmed in routine matters that time cannot be devoted to critical microscopical development or background research needed to validate opinions. Additionally, many trace evidence examiners are forced to produce more results accompanied by justifying instrumental documentation rather than "purely subjective" microscopy notes.

A second obstacle is the perception by society that without computer searches and data bases for every conclusion, opinions are of lesser value. This thought process was a main focal point at the International Trace Evidence Symposium where databases utilized for the basis of opinion testimony were discussed at length. There are valid instances for their generation and use; however, to imply that they are necessary for a valid interpretation in all forensic applications will seriously handicap forensic microscopy and other trace evidence conclusions. It may be possible to create a database addressing how many cars produced in the United States have maroon, solution-dyed, octalobal, 50um, nylon-6 carpet fibers in their trunks and how the fibers may he distributed among Fords, Chevrolets or Toyotas, but a set of fibers from a victim that match these criteria and contain lipstick traces (smears from transporting an open cosmetic case), cat hairs (from transporting a dead cat), grease (from an old bicycle chain) and ashes (from a grill used at a tailgate party) renders the database useless due to the unique circumstances. Moreover, how is a valid database created so that it can be used to "objectively validate" an opinion in a situation such as this? The answer is that adequate databases simply cannot be generated for every situation. Certainly the situation just described is nearly unique, but a statistical analysis cannot realistically be applied. To force database and "statistical" interpretations in forensic microscopy is a dangerous trend that could result in much unquestionably valid evidence being considered useless, simply because a statistical number cannot be attached.

A third obstacle is the idea that all samples are predictable and can follow a precise written procedure. Driven by many of the forces already discussed is the production of detailed procedural manuals. For certain disciplines within forensic science (i.e., DNA and drug analysis) these are straightforward documents. This is not true for the unpredictable aspect of trace evidence. Manuals must be more loosely written and include such catch phrases as "should", "if appropriate", and "at examiner's discretion." These phrases correctly give the examiner authority to make decisions based on his or her evaluation of the evidence. To put into writing more specific procedures would handcuff this vitally important field and negatively impact information to the law enforcement and judicial communities. Unfortunately, those phrases so vital to trace evidence analyses are perceived as being "subjective" rather than "objective." Unfortunately, in today's society the word "subjective" carries with it a negative connotation and the word "objective" a positive connotation.

The final obstacle to be explored is the inclusion of appropriate training costs and time to develop particulate handling and interpretational skills with the initial cost of purchasing microscopy equipment. Even with these appropriate factors included, the total cost of microscopical analysis is dramatically less than the total cost of instrumental analysis. There is an added benefit in that microscopical results are often more revealing and pertinent to the investigation. However, since there are no charts or printouts, this is a difficult concept to appreciate and once, again, the perception of "subjective" (the examiner's description of what he or she saw) versus "objective" (the associated charts, graphs or statistics) causes difficulty for the forensic microscopist.

What is the outlook for forensic microscopy? At a rudimentary level it will flourish. No one disputes the speed of microscopy or the insight it yields during the initial phases of evidence examination. More and more evidence is being screened to make decisions concerning additional testing. Centralization of full-service trace evidence units will provide more opportunities for initial microscopic analysis of evidence to determine appropriateness of further testing. This will ensure at least a rudimentary use of microscopy and fodder for the serious microscopist. As long as there is access to microscopes, there will be individuals creatively finding time to develop and utilize their expertise. There will also be a few administrations recognizing the need for proper training and time to develop microscopy skills. This will keep "critical forensic microscopy" from being entirely eliminated. Perhaps our biggest proponent will be the forensically-oriented private laboratories. Publicity concerning the analysis of evidence in high profile cases usually is generated in a private laboratory. When the stakes are raised, it is of-

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The View from Harrogate

more ☞


EXIT

You Will be Known by the Sweat of Your Brow

or, Who is the Cat in the Hat?

**Donald T. Jones, Daniel J. Gregonis, David C. Stockwell, and Caroline M. Kim*

Summary

During a blind study the sweatbands from seven baseball caps were extracted in an attempt to match them to the correct wearer. DNA was isolated using the organic extraction method followed by Centricon concentration. The quantity of recovered human DNA was determined by slot blot analysis. Of the seven sweatbands, five yielded human DNA, of which four samples were able to be amplified though the polymerase chain reaction (PCR) method using the Perkin-Elmer Amplitype PM+DQA1 typing kit. The amplification product gel showed indications of a degradation in the samples. This was reflected in the partial typing results for two of the samples. The results of one sample indicated a mixture by producing a strong primary profile and several weaker alleles. Nonetheless, the four baseball caps which yielded DNA results were each matched with the correct wearer in a limited reference population of ten individuals.

Introduction

A recent homicide investigation in San Bernardino County required the analysis of some bloody clothing found in a trash dumpster in order to associate this evidence with the victim and possibly the perpetrator. The clothing consisted of a pair of pants with extensive medium energy blood spatter on them and a baseball cap with a small bloodstain on the front. The DNA results from the bloodstains on the pants included a DQ alpha, D1S80, and four locus RFLP match to the victim. The limited sample on the hat yielded only DQ alpha and DlS80 results which were the same as the victim. In order to answer investigators' questions regarding the wearer of these articles, samples from both the crotch area of the pants and the sweat band of the baseball cap were extracted. While the crotch area of the pants yielded no DNA, the hat sweatband yielded sufficient DNA to be typed at the DQ alpha and D1S80 genetic loci. The typing results were different than the victim and the same as those for the suspect in the case. In order to understand the significance of these findings, the following study was conducted in the San Bernardino County crime lab.

Sample Description

Seven baseball caps from different individuals were collected. The criteria for use in this study were 1) that the hat had been worn by primarily one person, 2) that it had been worn extensively (i.e., for several years), and 3) that the wearer would not mind ever seeing it again. The sweatbands from each hat were excised. Reference buccal swabs were collected from ten donors which included the seven individuals who had relinquished their ball caps. Both sets of samples were then coded and presented to the analysts.

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Methods of Analysis

The buccal swab samples were extracted and typed by one analyst and the sweatband samples were extracted and typed by two other analysts. The sweatband samples were initially washed with sterile water to remove all soluble proteins and salts. All samples were extracted in stain extraction buffer with proteinase K at 56 deg. C. This was followed by a phenol-chloroform-isoamyl alcohol extraction, n-butanol clean up, and concentration by Centricon 100 centrifugation. The DNA in the sweatband samples was quantitated by slot blot analysis with a human specific probe, D17Z1. The DNA in the buccal swabs was quantitated using both a yield gel and the slot blot method.

Due to the low yield DNA template amounts ranging from 180 pg to 3.6 ng were added to the PM+DQA1 reaction mix and amplified according to the manufacturer's recommendations. A post-amplification product gel was run prior to typing the samples using the PM and DQA1 typing strips provided in the kit. All readings were made by two independent analysts. The presence of an allele was determined by the presence or absence of the developed colored dot on the strip regardless of whether the "C" or "S" dot was visible on the respective strips.

Data Analysis

After all typing results were recorded, paired associations between the coded sweatband results and the coded reference buccal swab results were made. The pairings were then decoded and evaluated.

Results

Five of the seven sweatband samples yielded measurable human DNA; however, only four of these produced amplified product with the PM+DQA1 kit. The post-amplification product gel showed weak amplification for these four samples. The gel also indicated degradation in all samples, the most intense product band was for the GC locus with the loci with larger sized products (D7S8, HBGG, GYP A, LDLR and DQA1 in order) showing progressively weaker bands.

The typing results for the sweatband samples are listed in Table 1. Samples 5 and 7 did not yield any human DNA. Sample 1 did not amplify even though 1.8 nanograms were added to the amplification cocktail. Samples 2 and 3 were typed in all six loci with sample 3 having some very weak, additional alleles in four of the six loci. Sample four gave no DQA1 result but was typed in the five PM loci. Sample 6 was not typed for the DQA1 and LDLR loci. The typing results for the reference buccal swabs are listed in Table 2. Based on the results from Tables 1 and 2 the associations listed in Table 3 were made. All associations were correct.

Discussion

Forensic genetic analysis is used to associate individuals with evidential samples. Usually, clothing with a physiological fluid stain (blood, saliva, semen, etc.) is recovered from a suspect or victim and an investigator asks the question, "Whose blood (etc.) is it?" Occasionally, the clothing cannot be directly linked to an individual, thus an additional question is raised, "Whose clothing is it?" The approach used when answering this last question should be made with caution and should be validated by testing forensically relevant samples.

Baseball caps or hats represent a rather unique article of clothing because they are in direct contact with the skin area of an individual yet they are rarely laundered. This allows a buildup and concentration of secreted material over time. The sterile

water extraction of the samples in this study resulted in a tan or brown extract with particulate material at the bottom of the tube. No effort was made to test this soluble protein fraction for salt or amylase levels nor was any microscope slide prepared from the pellet for cellular identification.

One negative consequence of this mechanism of sweat deposit is the warm, moist conditions which could lead to proliferation of bacterial nucleases resulting in the degradation of the DNA into small fragments. While the PCR process allows for typing of fragmented DNA, extensive degradation will affect amplifiable target sequences relative to their size. Thus, the smaller allelic sequences, such as GC and D7S8, may not be affected while the larger ones are (see Figure 1). All four amplified hat band samples exhibited characteristics of extensive degradation in the appearance of the post-amplification product gel, the GC product band was the most intense for each sample and the larger product bands were of progressively weaker intensities. The locus-to-locus dot intensities on the typing strips also displayed weaker dots for the loci with larger amplification product sizes.

One hat band sample, A3, yielded a mixture which was identified by the presence of three DQA1 alleles and three GC alleles. Additionally, two other loci (LDLR and GYP A) showed marked dot intensity differences between the "A" and "B" alleles. The primary or most intense alleles at each locus corresponded nicely to those of the hat donor, B5, except for the GC results. The AS hat band gave a stronger "B" allele than the "A" and "C" alleles for the GC locus; the hat donor is a GC type "BC". This results points out the need for caution when interpreting dot intensities in mixtures, especially in a three allele system such as GC.

This study demonstrates that DNA results from the sweatbands of baseball caps can be used to indicate the primary hat wearer. The recovered DNA may be degraded and yield only partial results but valid clothing-to-wearer associations still can be made. Unequal dot intensities within a locus should be cautiously interpreted when determining a primary type.

Table 1. PM+DQA1 Typing Results for Sweatband Samples.

Sample	DQA1	LDLR	GYPA	HBGG	D7S8	GC	Amount Amplified
A1	*	*	*	*	*	*	1.8ng
A2	1.1	AB	B	AB	AB	C	3.6ng
A3	2,4.1(3)	A(B)	A(B)	AB	AB	B(AC)	360pg
A4	*	B	AB	AB	AB	BC	180pg
A5	**	**	**	**	**	**	**
A6	*	*	B	AB	AB	BC	180pg
A7	**	**	**	**	**	**	**

* Human DNA was recovered; however, no amplified product was obtained
** No DNA recovered from this sample
( ) denotes relatively weak alleles

Table 2. PM+DQAI Typing Results for Reference Buccal Swabs.

Sample	DQA1	LDLR	GYPA	HBGG	D7S8	GC
B1	1.1,2	B	AB	A	A	C
B2	1.2	B	AB	AB	AB	BC
B3	1.1	AB	B	AB	AB	C
B4	1.2,4.2*	B	B	C	B	AB
B5	2,4.1	A	A	AB	AB	AB
B6	1.1	B	B	B	A	C
B7	1.1,4.1	B	A	AB	AB	C
B8	1.2	AB	B	AB	AB	BC
B9	4.1	AB	A	A	A	AC
B10	2,4.1	B	A	AB	AB	C

*DQA1 "4.2" allele could not be distinguished from 4.3 allele.

Table 3. Associations of Hats and Wearers.

Hat A2 was worn by Donor B3.
Hat A3 was worn by Donor B5 (and at least one other person).
Hat A4 was worn by Donor B2.
Hat A6 was worn by Donor B8.

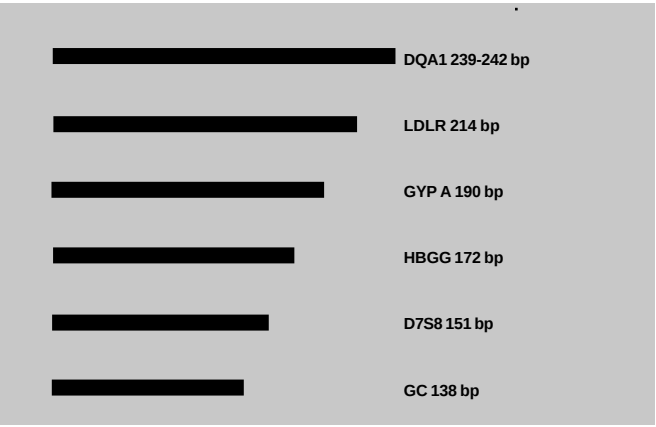

Figure 1: *Amplification product lengths for the six PM+DQA1 loci*

An Ethical Discussion

by Parker Bell

This is the last in a series which first debuted in 1989 and is reprinted here in memory of the author.

conclusion

PART 4

This ethical discussion relates to the issue of testimony in court. The CAC Code of Ethics provides that a criminalist will not knowingly mislead the jury. (Article III, Sections B. E, F. H. and I, e.g.) However, certain types of testimony are often presented repeatedly, where there may not be any particular thought given as to whether they may be misleading. Consider the following hypothetical.

Facts: The police criminalist routinely gives testimony in driving under the influence cases. A general line of questioning has developed with the prosecutor, almost to the point of being a script, as follows:

Q: Based upon your training and experience as well as testing you have done yourself, do you have an opinion as to a blood alcohol level at which all persons are under the influence for purposes of driving?

A: Yes, sir. Numerous studies have shown that all persons will be under the influence when their blood alcohol level is .08% or more.

The following occurs on cross-examination:

Q: What do you mean by the term "under the influence"?

A I mean that the individual is no longer able to drive as safely as he could have when he was sober; that is, there is more risk that he will have an accident.

Q: Are you familiar with the legal definition of "under the influence'?

A: No. I'm a toxicologist, not a lawyer. I just gave you the toxicology definition.

The "legal" definition of under the influence is found in California Jury Instructions Criminal (No. 16.831) as follows:

A person is under the influence of an alcoholic beverage when as a result of drinking such alcoholic beverage his physical or mental abilities are impaired to such a degree that he no longer has the ability to drive a vehicle with the caution characteristic of a sober person of ordinary prudence under the same or similar circumstance.

Issues: The "legal" definition of under the influence may not be completely clear, but it is certainly clear that it is an objective standard—i.e., a comparison of the defendant with alcohol in his system to the hypothetical normal sober person, rather than a comparison of the defendant in his questioned state to his own sober state. The criminalist is therefore not using the same definition that the jury is charged to apply to the defendant. The question of whether the defendant was under the influence is an ultimate issue for the jury to decide. It is proper for an expert to render an opinion on the ultimate issue for the jury's consideration, but is it proper for the criminalist to render an opinion on whether the defendant was "under the influence" when he is applying a definition to the term which is not the definition to be applied by the jury? Note that the difference in definitions would not have been disclosed at all had not the defense counsel asked. Further, it appears from the response that the witness is being somewhat less than candid: Why does he not know the legal definition, when he testifies on the subject on a regular basis? Is there a toxicology definition for under the influence at all? Is not the term itself a legal term rather than a toxicology term?

Although we always (hopefully) express our opinions truthfully, there are occasions when new technology or new information will disclose that our opinions were incorrect.

Consider the provisions of Article III of the C.A C. Code of Ethics, particularly Section B: *"The ethical expert does not take advantage of his privilege to express opinions by offering opinions on matters within his field of qualification to which he has not given formal consideration."*

The criminalist is certainly aware that the jury will be charged with applying the "legal" definition of "under the influence" to the facts of the case. If the criminalist has not given thought to the legal definition of the term, what justification does he have for using the term by applying a different definition? Consider, too, Section E:

"In all respects, the criminalist will avoid the use of terms and opinions which will be assigned greater weight than are due them. Where an opinion requires qualification or explanation, it is not only proper but incumbent upon the witness to offer such qualification."

Is it not reasonable that the jury will assign great weight to the term "under the influence," since it is ultimately their duty to determine if the defendant was under the influence?

Should the witness answer the prosecutor's question at all, if he is not to use the legal definition? Assume that the criminalist does not fully understand the legal definition. (E.g., the definition requires that a comparison be made between the caution of the defendant at the time his physical or mental capabilities have been impaired to the caution of the normal, sober driver of ordinary prudence under the same or similar circumstances; the criminalist may not know how to measure caution.) Would such failure to understand the definition excuse his use of a different definition?

If it is acceptable for the criminalist to use a definition other than the "legal" definition, is it then acceptable for each criminalist to use his own definition? For example, would it be ethical for an independent criminalist to use the following definition: "A person is under the influence when the alcohol has impaired his abilities to such an extent that he can no

longer operate the controls on a vehicle? Under this definition, very few drivers would ever be deemed under the influence.

As related questions, how many expert witnesses routinely testify in this area without knowing the definition of under the influence? And how many who know the definition can explain the definition? It seems that recently a number of criminalists have altered their opinion of the level at which all persons are under the influence—at about the same time the legislature changed the presumptive level. Is it ethically proper for a criminalist to consider the statutory level in forming his own opinion of the blood alcohol level where all persons are under the influence?

PART 5

Section F of Article II of the CAC Code of Ethics provides that,

"The scientific mind is unbiased and refuses to be swayed by evidence of matters outside the specific materials under consideration. It is immune to suggestion, pressures and coercions inconsistent with the evidence at hand, being interested only in ascertaining facts."

Unfortunately, a great number of the examinations that a criminalist makes require a subjective evaluation by the criminalist—how strong must the band be on the electrophoresis plate before a type is no longer inconclusive; how many striations must match on a bullet comparison, etc.? While we may all attempt to be immune from the impact of all considerations except the evidence itself, can we truly be free from the effects of other suggestions? If the serologist is told that the defendant has confessed and admitted that he left his blood at the scene, does that not make the band look a little stronger? In most areas of science, attempts will be made to create experiments that provide for a double blind study; i.e., the examiner will not know of the "correct" answer until after he reaches his own conclusion. The Ethical Discussion in Part 5 relates to the obligation of the criminalist to adhere to this principle.

Facts: In a burglary case the perpetrator cuts his arm on broken glass, and some of his arm hairs are cut off and left at the scene. The defendant is arrested a short time later with an injury to his arm. The police criminalist is later asked to remove some hairs from the defendant's arm and compare them to the questioned hairs from the scene. He then testifies at trial that he observed "overwhelming similarities between the known and unknown hairs, although, "because hairs are a biological growth and can vary within individuals as well as between individuals, they cannot be used as a positive means of identification." The defense attorney then retains an independent criminalist. The defense criminalist indicates to defense counsel that, in his opinion, based on his reading, limb hairs have much less value for comparison than head hairs, but he has never personally conducted a study to determine the relative values of head and limb hair. He then collects fifteen samples of arm hair to compare to the questioned samples; these are random, in the sense that they were taken from the fifteen people from whom he could most easily collect them. He finds that he cannot eliminate the defendant's hair as a source of the questioned hairs, but he also cannot eliminate one of the fifteen other known samples. He then testifies at trial to his findings, indicating that he feels this validates his prior opinion that arm hairs have less value than head hairs for comparison. The district attorney then requests an order from the court requiring the defense criminalist to return the questioned samples and defendant's known hairs to the police criminalist and to turn over the known sample which the defense criminalist could not distinguish, indicating that if the police criminalist can distinguish all known samples except the defendant's from the questioned hairs, she will recall him to testify. The defense criminalist then requests permission from the court to code the samples so that when the police criminalist reexamines them, he will not know which known sample is the defendant's and which is not. Although he does not articulate it, the defense criminalist feels that the police criminalist will be swayed to some extent by the knowledge of which sample the prosecution wants to match, and he knows that the prosecutor is pressuring the police criminalist strongly to make such a finding. The police criminalist then refuses to examine the evidence under the conditions of a blind study. He argues that at the time the defense criminalist examined the hairs, he knew the identity of the person from whom the hairs were taken. He states that it would only be fair for him to make his own examination under the same conditions. As the district attorney phrases it to the court, "Why should our criminalist be blinded, when the defense criminalist was able to act with his eyes open?"

Issues: Is there any justification for the police criminalist's insistence on knowing the identities of the known hairs before he will compare them to the questioned hairs? For that matter, is it proper at all in making comparisons of this type to know the identities of the known samples? Certainly, if there is only one known sample to be compared to one questioned sample, it will be difficult to avoid disclosing to the examiner the identity of the sample. Would it be preferable, though, in all such cases to have a coworker prepare additional negative controls and present them as blind samples to the examiner? If preferable, would it be ethically required under section C of Article II of the CAC Code of Ethics? Since the vast majority of literature relating to hair examinations is restricted to head hair and pubic hair, is the police criminalist justified in stating his opinion that these samples exhibited overwhelming similarities, or would this violate the spirit of Sections C and D of Article III?

John Nelson responded to the last Ethical Discussion (regarding the criminalist who did not know the "legal" definition of under the influence) as follows:

Criminalists should present testimony so the lay juror understands the meaning of their work and opinions. Attorneys should apply this testimony to the "legal" definitions for the jury. When the criminalist is asked the definition of a keyword or phrase in the area of his expertise, he should state the source of the definition whether or not he is familiar with the legal definition or of its existence. This would clue the attorneys and judge that he may not be using the definition in which they are interested.

It should be appropriate for a criminalist to use his own definition, if it conveys the correct meaning. I have routinely testified in the area of alcohol impairment in driving under the influence cases and have not been able to state the "legal" definition of under the influence. When asked I have said, "I don't know." No longer will this be the case as of this writing. But if asked, a criminalist in this area should be able to give *a* definition of "under the influence" and indicate its source (i.e., personal, based on training and study within the area).

In the hypothetical, the DA blew it by using "under the influence." The definition uses "impairment" to define under the influence. The criminalist would be better able to discuss impairment since

this is where scientific studies are aimed. It appears that the police criminalist does not know the difference between "under the influence" and "impairment" (there is a difference). He could be in violation of Article III, Section B: *"The ethical expert does not take advantage of his privilege to express opinions by offering opinions on matters within his field of qualifications to which he has not given formal consideration,* or D: *"When circumstances indicate it to be proper, the expert will not hesitate to indicate that while he has an opinion, derived of study and judgment within his field, the opinion may lack the certainty of other opinions he might offer. By this or other means, he takes care to leave no false impressions in the minds of the jurors or the court."*

It would not be proper for a criminalist to use the statutory level in forming his opinion as to the level at which all people are impaired for the purposes of driving. To do so could be violation of CAC Ethics Code, Section II F.

PART 6

This part deals with the relationship between criminalists retained by adversaries. In order to avoid digressions relating to the technical merits of the examination, the facts will be intentionally vague. Further, to eliminate any prejudice as to "defense" or "prosecution" criminalists, such terms will not be used.

Section E of Article IV of the Code of Ethics provides as follows:

It shall be ethical for one of this profession to serve an attorney in an advisory capacity regarding the interrogation of another expert who may be presenting testimony. This service must be performed in good faith and not maliciously. Its purpose is to prevent incompetent testimony but not to thwart justice.

Consider the following hypothetical:

Criminalist A is retained by an attorney representing one litigant. Criminalist B is retained by an attorney representing an adversary in the same litigation. Both criminalists examine the same evidence. Criminalist B has access to the report and notes of Criminalist A. Criminalist B reaches the same conclusion as Criminalist A and further believes that Criminalist A's methodology was appropriate and that his notes reflect sufficient justification for his opinion. The attorney retaining Criminalist B advises that he will not be calling Criminalist B as a witness,

First, "not under the influence" and "sober" are not the same thing. Forensic scientists working in DUI evidence should avoid the use of sober. It is unfortunate that CJIC uses the word.

but he requests Criminalist B's help in preparing cross-examination of Criminalist A.

Which of the following are appropriate or inappropriate for Criminalist B under the circumstances of each situation?

1. Criminalist B knows that Criminalist A was once disciplined in a prior job for "dry-labbing," i.e., writing a report without actually examining the evidence. In this case, however, it is clear that Criminalist A examined the evidence, as indicated by his notes. Is it proper for Criminalist B to divulge to the attorney Criminalist A's background?

2. Criminalist B knows that Criminalist A left his prior employment under very bitter circumstances, and that Criminalist A has a great hatred for his former supervisor. Criminalist B believes that the mere mention of Criminalist A's former supervisor is a psychological "button" that will cause Criminalist A to start ranting and lose all credibility in front of the jury. Should he suggest to the attorney that the attorney could "punch this buttons?

3. Criminalist B knows that Criminalist A was erroneously reported in a publication as the inventor of the forensic gizmo; in fact, Criminalist A was merely working for Professor Gadget, the true inventor of the forensic gismo at the time the professor invented it. Criminalist B further knows that Criminalist A has been criticized for allegedly puffing his credentials with such invention. However, Criminalist B also believes that Criminalist A was innocent of any intentional wrongdoing and believes Criminalist A's explanation of the event as an error on the part of the editor of the publication. Should he advise the attorney of this incident, so that the attorney can imply in front of the jury that Criminalist A has previously puffed his credentials?

4. Criminalist B believes that, although Criminalist A reached the correct conclusion for the correct reasons in this case, Criminalist A is, in general, incompetent in this particular area. He believes that he can craft some generalized technical questions in the area, to which Criminalist A will have to respond to each, "I don't know." These generalized questions do not relate directly to the issue of the case, but they deal with a subject area that any criminalist doing this work should know. Should he suggest to the attorney that he generate such questions?

5. Criminalist A was previously the subject of a CAC ethics investigation, which was presented to the membership. Although the membership found that the ethics charges against Criminalist A were unfounded, Criminalist B believes that the charges were founded. Should Criminalist B suggest to the attorney that cross-examination of Criminalist A on these charges could impair his credibility? Does it matter whether Criminalist B learned of these charges only through the presentation of the case to the CAC, or whether he knew of the allegations before the ethics investigation began?

6. The method used by Criminalists A and B is a method generally in use in the field. Criminalist B believes that such method is valid. However, he is also aware that a minority of criminalists believe that such method is invalid. Should he advise the attorney of such dispute? Should he provide the attorney with literature which supports the minority viewpoint or advise him of the identity of the leading proponent of the minority viewpoint (whom Criminalist B personally believes to be a charlatan)?

In answering these questions, please give particular care to the meaning to be given the Code of Ethics to the tempts "maliciously" and "good faith." These are terms which are often used but rarely defined. In most instances, the term "maliciously" is not restricted to actual ill will, but includes instances where the actor has no reasonable basis for the statement. If the criminalist does have a reasonable basis for making the statement about the other criminalist, however, is he precluded merely because he also has actual ill will? On the other hand, should "good faith" include the situation where the actual information given may be correct, but the informer knows that the purpose for which it is to be used will implant a somewhat

erroneous impression in the minds of the jury?

Although we always (hopefully) express our opinions truthfully, there are occasions when new technology or new information will disclose that our opinions were incorrect. Are the terms "good faith" and "malicious" to be given such a broad meaning as to say that we must not aid an attorney in minimizing the opinion of another criminalist simply because we believe his opinion is correct? If we refrain from aiding the attorney in such a situation and we are subsequently proven incorrect, what interest of justice has been served by our silence?

Should the interpretation of "good faith" and "maliciously" be so limited that the criminalist aiding the attorney's cross-examination may give any information, so long as he believes the information he is giving is factually correct? If this is the meaning to be given, should the section be redrafted to read "honest," rather than using the terms "good faith" and "maliciously?

One of the bases upon which the association is founded is the free exchange of information. If the broad interpretation of these terms is given, are we then limiting the information that we should allow to be disseminated, or do we wish to limit "information" to just technical information and not information dealing with the background of a witness?

Pete Barnett responded to Ethical Discussion Part 5

If the police criminalist is satisfied that he has complied with the requirements in Code of Ethics Sections II.A (use of proven methods), I.B (requiring an adequate examination), and II.H (aware of his own limitations), he will be able to state his opinion confidently and the reasons for it. He should explain to the prosecutor that a hastily conducted experiment would not change his opinion in light of the knowledge and experience he has about the subject matter.

However, if the police criminalist is at all familiar with the literature concerning hair comparison, he must realize that if he undertakes the blind trial proposed by the defense it will likely result in conclusions that are not only different from the conclusions reached by the defense criminalist, but in conclusions that very possibly will differ from his own initial opinion. The police criminalist should advise the prosecutor of this possibility and the prosecutor will then decide, one hopes, to forget the experiment and just argue the evidence as it exists. Personally, I find the data from the defense criminalist's experiment (the evidence hair matches 2 of 15 people) quite good. I would have expected more matches so I think the prosecutor should quit while she is ahead.

The only reasonable way to conduct this experiment would be to submit similar, or identical, blind samples to both criminalists. I would predict that if the same 15 samples were relabeled and submitted to the defense criminalist, his results would be different. The result of that experiment (one not dissimilar to one conducted a few years ago by the Northern Trace Study Group) would be revealing. The Study Group's experiment resulted in 44% incorrect associations and 18% incorrect eliminations.

The implication of the statement that two hairs (or any other items) share "overwhelming similarities" is that they are somehow related. I believe that this testimony, given without explicit and strongly stated qualification violates Sections III.E and III.I of the Code of Ethics which require avoidance of "terms...which would be assigned greater weight than are due them" and "use [of] understandable language...in order that the jury will obtain a true and valid concept of the testimony." To clarify the "overwhelming similarity" by saying that hairs are not a means of positive identification is like Saddam Hussein saying that the Mother of All Battles was not a complete rout of the infidel invaders. Testimony by a serologist that the blood from the scene exhibited "overwhelming similarity" to the defendant's, but that blood was not a positive means of identification, would probably be considered unacceptable—especially if the only genetic information was that the blood at the scene was ABO type O. The serologist would be expected to be somewhat more quantitative in his response. No less should be expected from the hair examiner.

I do not believe that the refusal of the police criminalist to accept the conditions of the test is unethical—indeed, accepting the conditions might arguably be assisting the contestants by "tactics...[which] will implant a false impression in the minds of the jury," a violation of Code of Ethics Section III.H. I think the spirit of scientific inquiry might prompt both criminalists to participate in a blind experiment. Gosh, it might not even be a bad idea to conduct such an experiment before the matter reaches the point of risking someone's life or liberty.

Lowell Bradford responded to the Ethical Discussion Part 4 (which discussed a criminalist's obligation to know the "legal" definition of "under the influenced") as follows:

First, "not under the influence" and "sober" are not the same thing. Forensic scientists working in DUI evidence should avoid the use of sober. It is unfortunate that CJIC No. 16.831 uses the word.

Sober refers to the absence of obvious intoxication, primarily noticed by impairment of speech, balance or walking ability or bizarre behavior. A person can be "under the influence" with consequent impaired driving ability and appear to be sober. The catch is in the language "ordinary prudence." A person of ordinary prudence would not drive when his ability is impaired.

The original definition of "under the influence of intoxicating liquor" comes from *People v. Dingle*, 56 Cal. App. 445, 205 P. 705.

Anyone who is to give opinion testimony in the interpretation of blood alcohol tests should know as much about the law as possible. Criminalists must not consider the statutory level in forming their own opinions of the blood alcohol level where all persons are under the influence. An opinion defining the condition of "under the influence" must be based upon the intensive study and experimental facts of the witness' own experience. Nothing less than that. Changes of opinion with time are reasonable if newer knowledge becomes available.

It would be an appropriate duty for the CAC to prevail upon the authors of CJIC No. 16.831 to make a change to a realistic definition of "under the influence" which is technically correct.

Removing Evidence from the Body at the Scene

Questions frequently arise regarding the legality of removing evidence from bodies at crime scenes. The types of evidence that might be recovered by the criminalist at the scene includes but is not limited to the clothing (preservation of bloodstains and/or trace evidence); trace evidence (recovered with tweezers or via tape lift); blood stains; semen stains; gunpowder particles; vaginal, anal, and oral swabs; or fingerprints.

The laws regarding the coroner's control of the property of the decedent are found in the California Government Code, Sec. 27491. The relevant portions of the sections are provided at the end of this article.

The body itself is frequently the best source of evidence that links the suspect to the victim or for reconstructing the events. The coroner's permission must be obtained prior to taking anything from the body *or the estate*. The law enforcement agency having jurisdiction is responsible for obtaining permission from the coroner. A list of the evidence items collected should be given to the case agent to add to the agency's evidence list for the coroner. This is seldom done in a formal manner. In many cases, the coroner is not contacted until the evidence is already collected. Legally the coroner is to be notified "immediately upon discovery." The criminalist is not legally restricted from the body any more than from the rest of the scene.

The personal working relationship that the agency (or the criminalist) has with the coroner or local pathologist may determine whether or not permission can be obtained for collecting evidence from the body. When the reasons are explained in advance why there is a need to collect the materials at the scene, permission will usually be forthcoming but may be restricted to the criminalist. A meeting with the district attorney, the coroner, the pathologist, and the laboratory director on this issue with a protocol clearly outlined is recommended. (The CCI Crime Scene Program Manager can make an exemplar protocol available upon request.)

Since taking material without the coroner's knowledge and permission is a misdemeanor, the coroner could arrest you. The district attorney would probably dismiss the charges as they would rather you use the evidence to solve a homicide than prosecute you for a misdemeanor for collecting it. However why run the risk when it can be easily avoided.

—Jerry Chisum, CCI

California Government Code excerpts regarding the coroner

Sec. 27491 (in part) It shall be the duty of the coroner to inquire into and determine the circumstances manner and cause of all violent sudden or unusual deaths;...known or suspected homicide, suicide, or in accidental poisoning; ... death in whole or in part occasioned by criminal means; deaths associated with a known or alleged rape or crime against nature; ...deaths under such circumstances as to afford a reasonable ground to suspect that the death was caused by the criminal act of another;.... Inquiry pursuant to this section does not include those investigative functions usually performed by other law enforcement agencies.

Sec. 27491.2 (b) For purposes of inquiry, the body of one who is known to be dead from any of the causes or under any of the circumstances described in Section 27491 shall not be disturbed or moved from the position or place of death without permission of the coroner or the coroner's appointed deputy. Any violation of this subdivision is a misdemeanor.

Sec. 27491.3 (a) In any death into which the coroner is to inquire, the coroner may take charge of any and all personal effects, valuables, and property of the deceased at the scene of death or related to the inquiry and hold or safeguard them until lawful disposition thereof can be made. The coroner may lock the premises and apply a seal to the door or doors prohibiting entrance to the premises pending arrival of a legally authorized representative of the deceased. However, this shall not be done in such a manner as to interfere with the investigation being conducted by other law enforcement agencies.

(b) Any property or evidence related to the investigation or prosecution of any known or suspect criminal death may with the knowledge of the coroner be delivered to a law enforcement agency or district attorney receipt for which shall be acknowledged.

(c) ...any person who searches for or removes any papers, moneys, valuable property or weapons constituting the estate of the deceased from the person of the deceased or from the premises prior to arrival of the coroner or without the permission of the coroner is guilty of a misdemeanor. At the scene of any death when it is immediately apparent or when it has not been previously recognized and the coroner's examination reveals that police investigation or criminal prosecution may ensue the coroner shall not further disturb the body or any related evidence until the law enforcement agency has had reasonable opportunity to respond to the scene if their purposes so require and they so request....

http://www.criminalistics.com/CAC/

Q&A

"How Much Should the Analyst Know?"

Q: How much should the analyst know about the case while analyzing and interpreting physical evidence?

A: This is a classic question in forensic science: How much should the analyst know about the case in which he has been tasked to analyze and interpret physical evidence? Our collective quarter century of experience in the field leads us to this answer: As much as possible.

There are two reasons for knowing the case circumstances when performing an analysis. One is well-recognized; the interpretation of results is done in the context of the history of the sample prior to its collection and preservation (and sometimes after as well). This will assist in distinguishing between "explainable" and "unexplainable differences" between the evidence and a reference sample. But the other reason for knowing something about the case seems overlooked by many analysts: it helps frame the proper question.

While it is true that an analyst can maliciously or subconsciously bias her examination and interpretation, several good checks and balances for this issue exist and we will cover them in a bit. But in our experience both as public and private lab analysts (not prosecution and defense analyst, as so many seem to characterize these roles), bias is most likely to enter a case at the level of the question that's being asked, rather than the meaning or interpretation of a result.

One of the greatest unrecognized contributions that a criminalist can provide is in framing the correct question about the physical evidence, both in the context of the legal question and of the particular circumstances of the case. Given that we as criminalists are experts in understanding the capabilities and limitations of physical evidence, we are in a unique position to offer the criminal justice system a way of providing information about a disputed or unknown fact. When individuals with a stake in the outcome or a hunch as to the culprit (e.g. the detective or prosecutor) are allowed to determine what analysis is done by requesting some specific examination, there is potential not necessarily for a bad analysis, but for an irrelevant one. With access to vital case information, the analyst has a chance to retrieve the relevant analysis from the jaws of oblivion. So the participation of the analyst in determining both the kinds of evidence that will be examined and the types of examinations to be performed is, in our mind, a vital prerequisite to a competent analysis.

Two examples that illustrate exactly these points come to mind: The first was an indoor rape-homicide where a piece of facial tissue was recovered from an area outside of a door that might have been the escape route of the assailant. Because homicide detectives, either through training or experience, commonly associate facial tissue with a rapist wiping his penis after intercourse, they specifically and only requested the lab to analyze the tissue for semen. The lab returned a report indicating that "semen was not detected." The lab report completely failed to mention the trace blood on the tissue. In fact, it is doubtful that they even saw it! This blood was ultimately a key in the reconstruction of the crime.

The second instance involved a homicide in a motel room, where the victim was found lying dead in the bathtub with her head bludgeoned. It was clear from the scene that the victim was beaten at the same location where she was found; blood spatter was evident all around and the immediate scene presented no alternative interpretations. On the bathtub near her feet amongst some spatter, there was a 3mm spatter of blood in the middle of a latent palm print. The print was matched to a suspect who was an employee of the motel, and who had that morning cleaned the room, including the bathtub. His palm print in that location would not be unlikely given that history. The primary issue became whether one could determine if the blood was deposited before or after the palm print. This blood/print combination was lifted on fingerprint tape and submitted initially to the serology section of the local lab. Because it was an extremely small stain (at least considered so at that time), the analyst performed the only test that could be run on a sample of that size—species determination! She dutifully wrote a completely useless report that the stain in question was human. In fact, absolutely no doubt existed of either the species or origin of the blood (the victim). More important, the choice of analysis could have effectively obliterated any chance of answering the only relevant question in the case—which came first?. Fortunately, someone had the foresight to take excellent photomicrographs before the analyst destroyed the evidence. The denouement of this exam is another topic.

Technicians perform analyses when requested. A criminalist (or scientist, or forensic scientist, fill in your favorite term) will evaluate the efficacy of any requested exam in light of the case circumstances and the legal question(s). You will not get the right answer if you do not ask the right question, no matter how brilliant your examination. And knowing as much as

The subject is criminalistics.

Any Questions?

Q&A is a new periodic feature of *The CACNews* offering questions and answers pertaining to every aspect of criminalistics. Maybe you work in the Alcohol section but always wanted to know how hair roots can be typed for DNA. Now you can ask your questions in complete anonymity! Send them in care of Raymond Davis, Editor. We will seek out experts in the field, pose your questions and print the answers here.

(Opinions expressed are those of the author only and do not necessarily reflect those of the CAC or the author's employer.)

you can about the case will assist in asking relevant questions. Because we are all human, we cannot help but have our own personal and professional prejudices. But one key to a competent professional life is understanding your own limitations and biases, and taking them into consideration in your work.

So on to the specifics of DNA and RFLP band interpretation. An understanding of the sample (its source and history) is necessary in order to incorporate all that we know about DNA and its behavior under various conditions into our interpretation. The results from a DNA analysis are much more likely to falsely exclude a sample from a source than they are to falsely include a sample (barring wholesale contamination), because validation studies have documented the loss of only part of a profile under certain conditions. In order to address the concern of unintentional bias (we will leave the malicious evildoers out of this discussion), we believe it is wise to adopt "rules of interpretation" (for lack of a better phrase) based on the aforementioned validation studies and then apply them religiously. As examples, we raise the issue of whether one would tend to see a band in a sample if it is also present in a reference sample that it is "supposed" to match.

In the CAL/DNA laboratory, a hierarchy of interpretation rules is invoked in the following order: Assess each lane independently for the presence and identity of bands (and we have defined what constitutes a band.)

Visually identify where concordance exists between lanes (which samples "match", for those who don't like the word concordance).

Size the bands identified in the first step.

Size the known and unknown quality control samples (we place a known and a blind QC sample on every gel) and assess whether they are within or outside of a pre-determined acceptable range.

Mathematically compare concordant bands according to valid statistical criteria; do any other comparisons (mathematical or visual) that are appropriate for a case (e.g., ensuring that a victims e. cell DNA is concordant with her reference DNA).

Have a second qualified analyst repeat the entire interpretation process with no knowledge of the details of the case except what samples are in what lane (not who is suspect or victim, or what should match whom).

The second sizing must agree with respect to the bands chosen as real within a profile (some artifacts are not bands), and must meet yet another mathematical criteria for acceptance. Thus each case is independently interpreted twice by different qualified individuals, one of whom formulated the question and ran the test(s), and the other with little knowledge of the issues.

With competent and well trained analysts, we can testify that this system works well for ameliorating analytical and interpretation bias (you should hear the fights!). Of course it is not perfect, and we generally welcome competent independent assessment by a qualified individual for an "outside-the-lab" evaluation as a legitimate form of quality control. Please see our commentary on the NIJ report in *Jurimetrics* Spring 1997, Vol. 37, Issue 3.

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The Exterior Ballistics of Contemporary Air Guns and BB Guns

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Keywords: **air gun, BB gun, pellet gun, pellet, BB, ballistics**

Abstract

Air guns and BB guns are popular training, recreational and target guns which range from low powered BB pistols of marginal accuracy to very sophisticated arms capable of great accuracy and relatively high muzzle velocities. Their designs vary from simple spring-plunger types (e.g. the classic Red Ryder lever action BB gun) to multi-pump pneumatic types and CO_2 charged guns.

These guns are available in calibers from .177 inch to .25 in. with projectiles consisting of .173 in. steel spheres to soft lead projectiles in a variety of shapes in .177, .20, .22 and .25 caliber.

All of these projectiles, if driven to sufficiently high velocity and at close range, are capable of serious injury and even death in some special circumstances. Their low ballistic coefficients however, cause them to lose velocity rapidly over distance.

This paper examines the exterior ballistic performance of some representative examples of these projectiles as a means of setting some limits on the ranges at which these projectiles might be capable of producing injuries or property damage.

Introduction

One of the primary reasons for conducting this study is the ability of some of these guns and ammunition combinations to produce serious injuries and even fatalities. Insofar as air gun injuries, many of these appear to go unreported because of the age of the individuals involved, their post-injury conduct and perhaps even that of some of the parents of the juvenile actors in such incidents. When such injuries become so serious as to require medical attention and/or police involvement, they often find their way into the forensic literature. A South African study[1] cites 85 penetrating injuries in a 9 year period. One hundred and five ocular injuries were reported by Bowen[2] in Liverpool over a 10 year period. In the United States at least 4 fatal (but accidental) head injuries have been reported with .177 and .20 caliber projectiles up to 1985 according to Green and Good[3]. This article was especially interesting due to 2 pellets having been loaded at once and fired in tandem to produce a fatal head injury. DiMaio[4] described the first known homicidal use of an air gun in the U.S. Brunt and Pacey[5] reported 7 fatal air gun accidents in England in a three year period. No doubt, there have been additional fatalities since these reports and indeed the authors are presently involved in the investigation of a fatal shooting with a .177 caliber pellet fired from a pump-up type rifle.

The ability of such projectiles to produce serious injuries at close ranges (inches to perhaps a few yards) is not too difficult to understand in most cases particularly with high-powered air guns with muzzle velocities frequently in excess of 500f/s. But what of shots alleged to have come from some considerable distance such as from another person's property, across a field, etc.? The exterior ballistic performance of these small caliber, light weight missiles stands to be relatively poor compared to contemporary bulleted ammunition. Actual, measured data on this subject appears to be nonexistent however. Likewise ballistic coefficients for the various calibers, weights and styles of air gun projectiles are presently unavailable. Such values would allow relatively reliable calculations of down range velocity to be carried out with any of a number of inexpensive exterior ballistic programs for PCs. The data derived from down range calculations can be integrated with other information to assess these projectiles' injury production capabilities or their ability to cause specific types of property damage.

Doppler radar tracking systems allow for a detailed study of the flight of small arms projectiles of all types including pellets and shot but such equipment is very rare in forensic laboratories due to its high cost. These systems provide highly accurate data on the exterior ballistic performance of projectiles over long distances and all velocity ranges. The actual drag coefficient of the particular projectile is also calculated by these systems.

While it may be correctly said that there are inherent inaccuracies in the use of ballistic coefficients (rather than the actual drag coefficient for a particular projectile), the ballistic coefficient method is employed in virtually all the programs available to the criminalistics laboratory. Given some of the insurmountable uncertainties associated with forensic case work (e.g.— the muzzle velocity of the actual shot), the inaccuracies associated with the ballistic coefficient method become a minor concern.

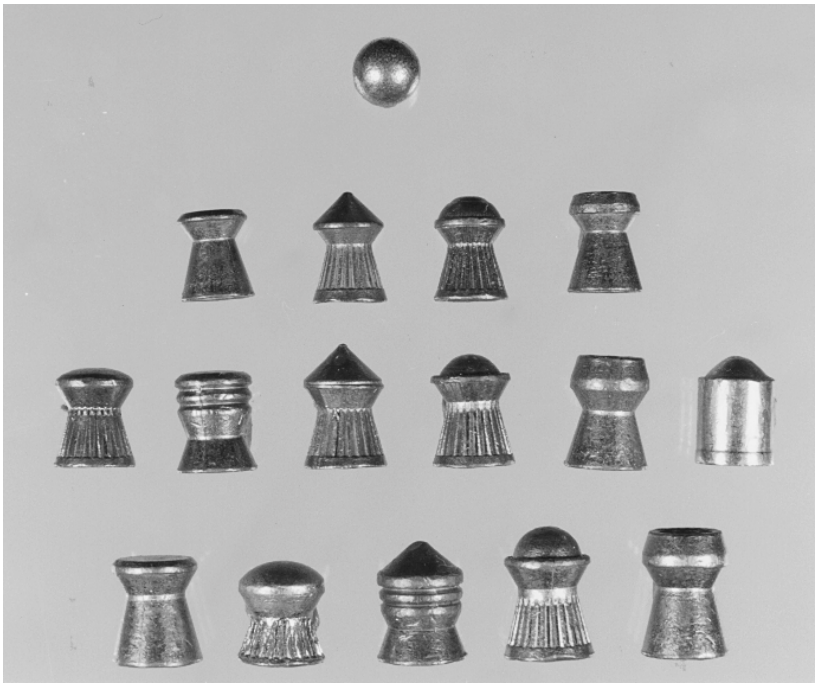
The Oehler Model 43 PBL* (*Personal Ballistics Laboratory) chronograph system shown in Photograph 1 offers a

Photograph 1: *Oehler Model 43 PBL System, set up for the measurement of ballistic coefficients. (l-r) Laptop computer, M43 Counter/Relay unit, 100 yds of cable and amplifier unit for downrange Skyscreens. (on tripods) Muzzle skyscreens, downrange Skyscreens.*

*Forensic Science Services, Inc., Carefree, AZ. Presented at the 2nd Joint Meeting of the CAC and FSS in Harrogate, England—July 1997.

relatively inexpensive means of determining ballistic coefficients, down range performance and other properties of interest to both forensic investigators and shooting enthusiasts alike. This system, manufactured by Oehler Research, P.O. Box 9135, Austin, TX 78766, consists of the M43 counter and relay module, two sets of down range skyscreens and a DOS-based program. The user provides the PC or laptop computer. The unit is battery-powered and can therefore be used in remote, outdoor locations. By carefully positioning the first set of skyscreens at a known distance such as 5 feet in front of the muzzle and the second set of screens at a suitable distance (e.g.-100 feet down-range), the velocity of each fired pellet will be measured by the same crystal oscillator at two locations. The program will automatically calculate muzzle velocity, time of flight, the ballistic coefficient (on the user-selected basis of either the G_1, G_5, G_6, G_L, G_S or RA-4 drag functions), and other computations of interest. The G_1 table is the most common and was utilized in this study. (This is the drag function used by the ammunition industry when they list a ballistic coefficient for a particular bullet.)

Once armed with a satisfactory ballistic coefficient for a steel BB or particular lead pellet, a variety of ballistic programs for PCs can be used to carry out calculations ranging from the most fundamental (velocity at various down range distances) to relatively sophisticated computations such as those through Nennstiel's EBV4[6] program which will allow the user to set a muzzle velocity and angle of departure, with or without wind components, station conditions, terrain features and then calculate the distance to impact with the terrain, velocity throughout the projectile's flight, angle of fall, impact velocity and other matters of interest.



Photograph 2: *Projectiles used in this study.*

Top: .173" copper plated steel BB, 5.3 gr. (Crosman). *Second Row:* .177 cat. Iead pellets—7.8 gr.H&N Match, 8.6 gr. Silver Sting, 9.6 gr. Ram Jet, 8.5 gr. Crow Magnum H.P. (Beeman). *Third Row:* .20 cat. Iead pellets—10.4 gr. Laser, 12.8 gr. Silver Ace, 10.8 gr. Silver Sting, 11.4 gr. Ram Jet, 13.0 gr. Silver Bear H.P. (Beeman) and 15.4 gr. Sheridan "trash can". *Fourth Row:* .22 cat. Iead pellets—13.9 gr. H&N Match, 15.1 Bear Cub, 17.0 gr. Silver Arrow, 16.4 Ram Jet, 18.0 gr. Crow Magnum H.P. (Beeman).

Procedure

The three most popular calibers of lead pellets, .177, .20 and .22 caliber, wee chosen for this study. A variety of weights and nose shapes within each caliber were also selected since both contribute to the ultimate ballistic coefficient (BC) value of the projectile. The BBs used in this study consisted of the common .172 to .173 inch diameter copper-plated steel spheres weighing approximately 5.30 grains each. Photograph 2 shows all the projectiles tested in this study.

Oehler's Model 43 PBL system with matched muzzle and down range sky screens were used to determine velocity at two distances (5 feet beyond the muzzle and 100 feet beyond the muzzle) for multiple shots with each pellet type and weight.

Photograph 3: *Representative Projectiles and their Approx. Ballistic Coefficients*

(l-r) .173" copper plated steel BB, 5.3 gr.—BC = 0.010; .20 cal. 15.4 gr. Sheridan "trash can" pellet—BC = 0.016; 5.56mm SS109/M855 FMJ-BT bullet, 62 gr.—BC = 0.31; 7. 62mm (.30 car.) FMJ-BT NATO bullet, 147 gr.—BC = 0.42; 9mm FMJ-RN bullet, 115 gr.—BC = 0.11; .45 cal. FMJ-RN bullet, 230 gr.—BC = 0.19.

This system automatically calculates muzzle velocity, BC (at standard conditions) and provides other exterior ballistic and statistical data.

The meteorological conditions and station elevation were entered into the M43 program and multiple shots with each pellet type carried out. Except where noted, the BC values in Table 1 are the averages of 3 shots corrected to standard sea level values. Typical shot-to-shot variation in these values was on the order of ±0.01 BC units.

Commonly available pump-up type pneumatic rifles in each caliber were used to produce shots in both high and low velocity regimes (e.g.- ca. 600f/s vs. 300f/s). This allowed a 'goodness-of-fit' to the G_1 drag function or, alternatively, a recalculation and evaluation with one of the other drag functions such as the G_S function for spherical projectiles.

With the exception of the standard .20 caliber Sheridan "trash can" pellets, all of the pellets were manufactured by Beeman. The Beeman product name, where appropriate, is shown in Table 1. Even in the absence of an Oehler M43 system, the reader, confronted by some other manufacturer's pellet should be able to compare its weight and shape to the Beeman pellet most closely matching the evidence pellet and select a suitable ballistic coefficient from Table 1. As can be seen from a quick review of this table, the ballistic coefficients for lead pellets are quite similar and subsequent multiple calculations using BCs slightly above and below the selected value will result in only small differences in down range performance. The BBs used in this testing were the common .172 to .173 inch copper plated steel spheres weighing approximately 5.30 grains each manufactured by Crosman.

Results

Lead Air Rifle Pellets. As expected, all values of BC were quite low and on the order of 0.013±0.002 (n=15) for lead pellets. The highest and lowest values obtained were 0.017 and .008 respectively. No clear correlation was found based or nose shape and/or weight. This may seem surprising at first but another important contribution to ballistic coefficient is the in-flight stability of the projectile. With the exception of spheres, all projectiles yaw to varying degrees in flight particularly during the initial portion of their journey. The more egregious this initial yawing (due to poor spin stabilization for the particular projectile design and muzzle velocity) the more aerodynamic drag and consequently the lower the BC upon calculation. Doppler radar tracks provide an excellent means of demonstrating this. It is more difficult, but not impossible, to illustrate with the two point velocity-over-distance method employed by the M43 system. This may also be the explanation for some of the substantial differences in BC at high vs. low velocity for some of the pellet designs tested rather than a poor fit to the G_1 drag table. (This subject will be treated in another paper on the forensic uses of the Oehler M43 system.)

Missing values (or single values) were a consequence of poor accuracy on the part of certain pellet/gun combinations at the 100 foot distance and the inability to obtain down range velocity measurements.

Steel BBs. The average BC value obtained over the 100 foot range in this study was 0.010. In a previous series of measurements over a wide velocity range (270f/s to 640f/s) and a separation distance of 21 feet between the two sets of skyscreens gave an average value of 0.009±0.0007 (n=6). By way of comparison the approximate G_1 values of BC for several well known projectiles are shown in Photograph 3.

TABLE 1: *BB and Pellet Data*

CAL.			high vel.		low vel.	
		wt (gr.)	BC -		BC -	
Shape	Name	(n=10)	ave.muz. vel.		ave. muz vel.	
			(ft./sec.)		(ft./sec.)	
.173"	Crosman					
sphere	Steel BB	5.30	.010	*653*	----	
.177						
flat	H&N Match	7.79	.011	*615*	.011	*391*
pointed	Silver Sting	8.64	.013	*590*	.014	*364*
rounded	Ram Jet	9.56	.014	*578*	.017	*367*
hollow point	Crow Magnum	8.54	.008	*599*	.010	*357*
.20						
flat	Laser	10.40	.014	*593*	.016	*378*
~ rounded	Silver Ace	12.82	.015	*646*	.017	*383*
pointed	Silver Sting	10.82	.016	*575*	$.014^{n=1}$	*357*
rounded	Ram Jet	11.42	.011	*570*	.015	*353*
hollow point	Silver Bear	12.97	.013	*577*	.014	*286*
cylindrical with skirt	Sheridan-"trash can"	15.39	.016	*508*	.021	*277*
.22						
flat	H&N Match	13.86	.011	*567*	----	
~rounded	Bear Cub	15.13	.017	*519*	----	
pointed	Silver Arrow	17.05	.016	*526*	$.012^{n=1}$	*334*
rounded	Ram Jet	16.35	.014	*538*	$.011^{n=1}$	*339*
hollow point	Crow Magnum	18.03	$.011^{n=1}$	*545*	$.011^{n=1}$	*325*

Discussion

Equipped with a suitable BC value, a muzzle velocity appropriate to the gun involved in the matter under investigation and most any of the presently available exterior ballistic programs for PCs, the criminalist can easily calculate down range velocity, flight time, drop and other matters of possible forensic interest. Down range velocity correspondingly bears a strong relationship to injury and/or property damage production capabilities. Since this paper is *not* a treatise on wound ballistics due to BBs or pellets, the authors will simply use a previously-derived threshold value for human skin penetration by a .177 caliber lead pellet as an example. DiMaio et al.[7] using .177 caliber wasp-waist, Diablo style lead pellets weighing 8.25 grains and the skin on freshly severed human legs found that it took 290f/s to embedded these pellets in the skin and nominally 330f/s to perforate the skin and enter the underlying tissue. From Table 1 it can be seen that a BC of 0.013 would be a good choice. to estimate the maximum range for such

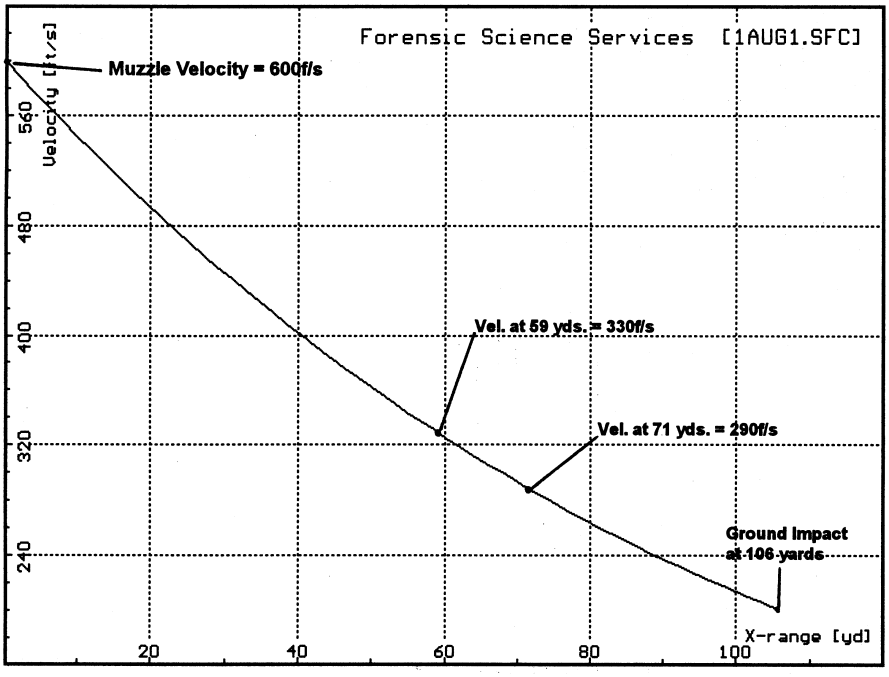
injuries (i.e.- the range at which the velocity drops to 330 and 290f/s). Nennstiel's EBV4 program was used along with a muzzle velocity of 600f/s and standard sea level conditions to derive the data in Table 2 and depicted in Graph 1. From these it can be determined that the 330f/s velocity is realized at a distance of 59 yards from the muzzle. The velocity drops to 290f/s at a distance of 71 yards.

This program can also be used to calculate maximum range, angle of fall, flight time, down range velocity, etc. for shots at selected departure angles and muzzle velocity. The final example uses a hypothetical case where two boys are shooting at aluminum soft drink cans perched on a back fence. Their shooting position from a table 5 feet above ground level on the patio is found to create a 5^0 departure angle. Subject "A" was shooting .173" steel BBs (BC=0.010) in a pump-up type air rifle capable of a maximum velocity of 750f/s. Subject "B" was shooting a .22 caliber CO_2 powered rifle and 16.4 grain lead pellets with rounded noses (MV = 520f/s by actual measurement) and a BC of ca. 0.014. A neighbor, who lives down range has a glass greenhouse located 200 yards from the boys' shooting position. One of the 1/8 inch thick single strength glass windows facing the boys' location is found to be broken. Although no projectile is found, a complaint to the authorities is made and an investigation insues. Before any testing is carried out to determine the impact velocity necessary for either of these missiles to break this type of glass, the program is used to calculate the following data shown in Table 3 and Graph 2A and 2B. As can be seen, neither of these projectiles can go the distance if the shooters missed their targets (e.g. ground impact at 158 yards with a velocity of 92f/s for the BB and impact at 154 yards for the .22 caliber pellet at a velocity of 119f/s). By way of comparison, the standard 230 grain FMJ 45 Automatic bullet fired at the same departure angle of 5^0 with a muzzle velocity of 835f/s and a BC of approximately 0.19 would travel about 840 yards and impact the terrain with a residual velocity of 470f/s.

These calculations assumed the shooters missed their intended target by either pulling to the left or right at the moment of discharge. It is recognized that they could have also fired well over the top of their targets and thereby created much higher departure angles but this can be evaluated by rerunning the program with new (higher) departure angles. If, in so doing, one finds that a BB or pellet *can* actually go the distance, then the calculated arrival (impact) velocities will provide a useful starting point in setting up some projectile/glass breakage tests.

Table 3 may also be illuminating to those readers less versed or familiar with exterior ballistic calculations and projectile performance. Note that although the muzzle velocity of the steel BB is much higher than that of the .22 caliber pellet (750f/s vs. 520f/s), the B.C. of the pellet is about 40% higher than that of the BB. Consequently the lead pellet retains its velocity better than the BB and both end up traveling about the same distance (impacting with the terrain at 158 and 154 ards respectively). Note also that the BB took 2.214 seconds to cover this distance and has an angle of fall of -20.1^0 at the end of its flight whereas the time for the .22 caliber lead pellet to reach its 154 yard impact site was 2.067 seconds and its angle of fall was -14.8^0.

Graph 1: Velocity vs. distance for an 8.25 gr., .177 cal. Diablo-style lead pellet fired from a height of 5 feet above ground level at a departure angle of $+1^0$ with a muzzle velocity of 600 f/s and a BC of 0.013. (Calc. with EBV4 exterior ballistics program.)



Summary

This work provides some insight into the exterior ballistic performance of steel air rifle shot (BBs) and a variety of lead pellets in three popular calibers. As expected, the ballistic coefficients of these projectiles are all quite low compared to common handgun and rifle bullets. The values for ballistic coefficients derived in this work can be used to calculate down range velocities, flight time, angle of fall, maximum range and other matters of forensic interest in future case work involving these types of projectiles.

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7 DiMaio, V.J.M., M.D., A.R. Copeland, M.D., P.E. Besant-Matthews, M.D., L.A. Fletcher and A. Jones, Minimal Velocities Necessary for Perforation of Skin by Air Gun Pellets and Bullets", *JAFS* 27:4 (Oct. 1982) pp. 894-898.

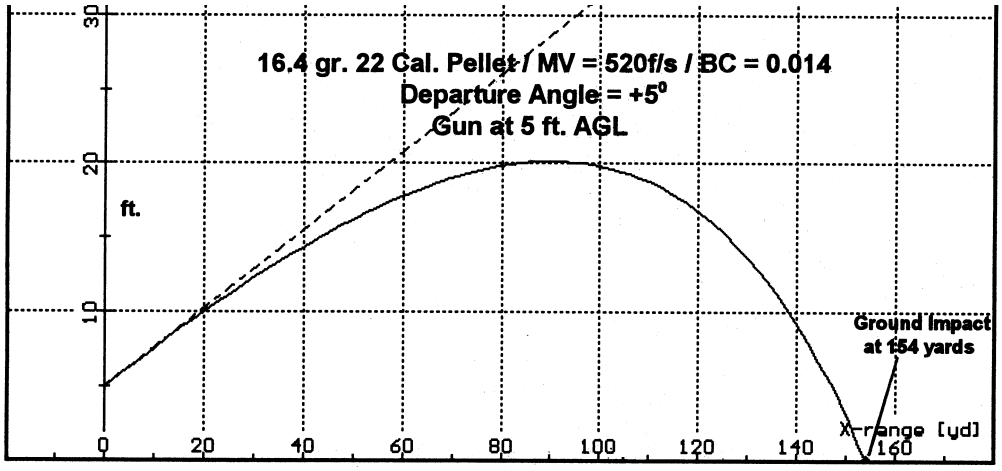
TABLE 2: Downrange performance of an 8.25 gr., .177 cal. Diablo-style lead pellet fired from a height of 5 feet above ground level at a departure angle of +1° with a muzzle velocity of 600 f/s and a BC of 0.013. (Calc. with EBV4 exterior ballistics program.)

Dist. (yards)	Vel. (f/s)	Flight Time (seconds)	Angle of Incl. (degrees)
00.0	600	0.000	+1.00
10.0	544	0.053	+0.83
20.0	492	0.111	+0.62
30.0	445	0.175	+0.37
40.0	402	0.246	+0.06
50.0	362	0.324	-0.32
60.0	326	0.412	-0.79
70.0	293	0.509	-1.37
80.0	264	0.617	-2.09
90.0	237	0.737	-2.97
100.0	214	0.870	-4.06
105.5(impact)	202	0.951	-4.77

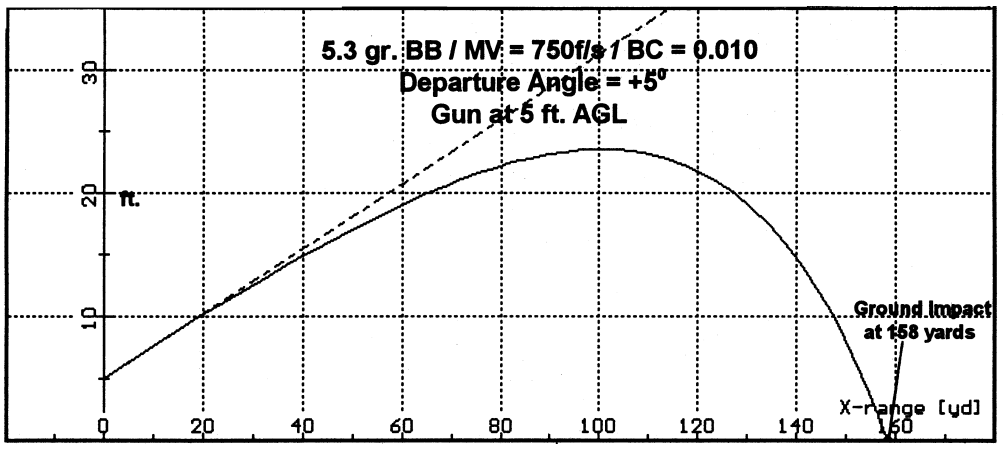
TABLE 3: Downrange Performance of a 5.30 grain, .173" Steel BB (MV = 750f/s / BC = 0.010) vs. a .22 cal. 16.4 gr. lead pellet (MV = 520f/s / BC = 0.014). Both fired from heights of 5' above ground level and at a departure angle of +5°. (Calc. with EBV4 exterior ballistics program.)

Dist (yards)	Vel. (f/s)	Flight Time (secs)	Angle of Incl. (degrees)
.173" Steel BB			
000	750	0.000	+5.00
20	579	0.092	+4.74
40	446	0.210	+4.31
60	340	0.365	+3.57
80	258	0.568	+2.30
100	196	0.836	+0.08
120	149	1.189	-3.76
140	115	1.654	-10.3
158 (impact)	92	2.214	-20.1
.22 cal. Lead Pellet			
000	520	0.000	+5.00
20	431	0.127	+4.50
40	355	0.281	+3.78
60	291	0.469	+2.70
80	239	0.697	+1.10
100	196	0.974	-1.28
120	162	1.312	-4.78
140	134	1.724	-9.92
154 (impact)	119	2.067	-14.8

Graph 2A: 5.3 grain BB, muzzle velocity=750 feet per sec, ballistic coefficient=0.010, gun is 5 feet above ground level, departure angle is +5°



Graph 2B: 16.4 grain, .22 cal pellet, muzzle velocity=520 feet per sec, ballistic coefficient=0.014, gun is 5 feet above ground level, departure angle is +5°



Changing World

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ten critical microscopy that is called upon to solve the problem. Individuals in many of today's private microscopy laboratories are more apt to be provided with training and time to develop skills necessary to provide appropriate microscopical analyses and substantiate their interpretation. Unfortunately, the fate of forensic microscopy is to accept the current state of affairs, continue working to "promote success", and to be patient. Sooner or later a high profile case will present itself where critical forensic microscopy will play a major role. When this occurs, forensic microscopy will be ready and microscopical techniques will be given a higher priority for consistent use in casework.

□

Criticism

or, "I'm from the IRS and I'm here to help you."

Richard Konieczka,
Sound Communication, Seattle, WA

The most common reaction to criticism is to become defensive. Reacting defensively implies guilt and escalates tensions. It also assumes the person offering the criticism is intending to attack you. This its rarely the case, and when *you* criticize other people, your intention is generally to help them. Yet, the normal, emotionally charged dynamics cause this communication transaction to be a leading killer of budding relationships.

Defensive reactions include denial, attack, withdrawal, and other offensive reactions which only diminish our stock in the other person's eyes. If you have truly made a mistake, you would certainly want to know about it—so you don't repeat it. If there are mitigating circumstances or inaccurate allegations, they certainly are worth noting and correcting, but without anger and retribution. Someone who can admit they made a mistake, or even its possibility, enhances their reputation in the eyes of others. We only enhance our credibility and trust when we graciously and thankfully accept this feedback.

If you find yourself in the position of offering criticism, tread very gently. In fact, eliminate the "C" word from your vocabulary entirely. Instead, have a dialog with the other person and discover the intention behind their action. Invariably, you will discover their intention was noble, while their action reflected a lack of understanding or training. In some cases, their unique action will lead to an improved result when combined with standard procedures. Handled appropriately, these can be occasions to build rapport rather than destroy it.

What about *constructive criticism?* I liken that to friendly fire. It's well intentioned, but just as deadly. A close cousin of criticism and one that can have a negative effect on relationships is *advice*. I had a brother who had a lung removed due to asbestosis and was given six moths to live. For the next five years I lectured him on the dangers of smoking every time I saw him. Finally, we had a dialog where I found out why he continued to smoke. Faced with the certainty of death in the next few months (in his mind), he didn't want to compound his suffering with the added stress of quitting smoking. How very logical and how insensitive of me to offer advice to him during every visit. As if he would put the cigarette out and thank me for the profound knowledge. The last time I saw my brother, he asked me why I wasn't lecturing him on the evils of smoking. I said I supported him in his decision and this crusty ex-marine said " I love you Brother" —his most cherished words.

When receiving criticism, don't be so sensitive. When offering criticism, be as sensitive as possible!

—Richard is a facilitator for the CCI

□

Ed Jones' Face Game

Your CAC-Board

History Wanted

The American Academy of Forensic Sciences is hosting its 50th Anniversary Meeting in San Francisco, February 9-14, 1998. Mary Gibbons is Program Chair for criminalistics and she promises a technical program worthy of this Golden Anniversary. I have been asked to put together a historical display for the reception area and I am asking your help. It would be fun to make "50 Years Ago—A Look Back" the theme of this exhibit. To that end I would like to have microscopes, spectrometers (all types) and other analytical equipment from the 1940-1955 period to display, as well as photographs, evidence exhibits, and other memorabilia. These need not be from California labs; photos, plans or displays from any forensic lab (toxicology, trace, firearms, fingerprints, and photography, too) will be welcome. Transportation (and even cleaning) can be provided. Security will be arranged (even if I have to sleep in the room—now there's a scary thought.

So, dust off those boxes, check the desk drawers way in back and dig in those old cabinets and help us appreciate how much progress we've made!

Contact John DeHaan at CCI (916) 227-3575 or fax (916) 454-5433.

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History Lesson

A New Orleans lawyer sought an FHA (Federal Housing Administration) loan for a client. He was told that the loan would be granted if he could prove satisfactory title to a parcel of property being offered as collateral.

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The title to the property dated back to 1803, which took the lawyer three months to track down. After sending the information to FHA, he received the following reply: "Upon review of your letter adjoining your client's loan application, we note that the request is supported by an Abstract of Title. While we compliment the able manner in which you prepared and presented the application, we must point out that you have only cleared the Title to the proposed collateral property back to the year 1803. Before final approval can be accorded, it will be necessary to clear the title back to it's origin."

Annoyed, the lawyer responded as follows: "Your letter regarding Titles in Case No.189156 has been received. I note that you wish to have Titles extended further than the 194 years covered by the present application. I was unaware that any educated person in this country, particularly those working in the property arena, would not know that Louisiana was purchased by the U.S. from France in 1803, the year of origin identified in our application. For the edification of uninformed FHA bureaucrats, the title to the land prior to U.S. ownership was obtained from France, which had acquired it by Right of Conquest from Spain. The land came into possession of Spain by Right of Discovery made in the year 1492 by a sea captain named Christopher Columbus, who had been granted the privilege of seeking a new route to India by the then reigning monarch, Isabella. The good queen, being a pious woman and careful about titles, almost as much as the FHA, took the precaution of securing the blessing of the Pope before she sold her jewels to fund Columbus' expedition. Now the Pope, as I'm sure you know, is the emissary of Jesus Christ, the Son of God. And God, it is commonly accepted, created this world. Therefore, I believe it is safe to presume that He also made that part of the world called Louisiana. I hope to hell you are satisfied. Now, may we have our damn loan?

Photo credits: Cover, FSS meeting, Peter Barnett

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A Final Word

Alfred A. Biasotti
1925-1997

August 22, 1997 would have been the seventy-second birthday for my friend Al Biasotti. He was born in Oakland, California to immigrant parents and grew up in Albany, where he attended high school. He graduated in February,1944 and three days later joined active duty with the United States Air Force. He served from 1944 to 1946, flying on 19 combat missions as a gunner and bombardier, with the ninth air force, 322 bomb group over liberated enemy air bases V.E. Day.

Upon his release from the Air Force he enrolled in the University of California, Berkeley and received his B.A. in 1950 in Dr. Paul Kirk's criminalistics program. He then continued on as a graduate student. His landmark study on a mathematical basis for bullet identification became his Master's thesis, published in 1955.

He married Patricia on July 1, 1950 after they met in Yosemite Valley where both had summer jobs. Pat was a waitress and Al was a truck driver for a government road crew. In 1951, their first of seven children was born, and Al and his young family moved to Madison, Wisconsin to start his job with the Wisconsin State Crime Laboratory as a laboratory technician. In 1953 he served as a criminalist at the Pittsburgh and Allegheny County Crime Laboratory.

In 1956 they returned to California where Al joined the Santa Clara Co. Crime Lab and then the Dept. of Justice as a criminalist manager in 1972. Two years later he was promoted to assistant bureau chief in charge of laboratory operations, a position he held until his retirement in 1990.

During his career with the Department of Justice, Al contributed 34 technical articles on miscellaneous subjects in the disciplines of blood alcohol and firearms identification, to four international forensic science journals and the state crime lab journal *Tieline*. He was the principle instructor for the first organized firearms and toolmarks course given in California. He designed, produced, and instructed in the first Forensic Academy class for newly assigned laboratory staff.

Al's contributions to the forensic service were many and varied. He chaired the Association of Firearms and Toolmarks Examiners (AFTE) Peer Group Review Committee to define Expert Certification. He was designated Key Member of the Year by AFTE in 1981. Al implemented the use of the Intoxilyzer Breath Alcohol Tester for DUI cases in all of the Department of Justice Laboratories, serving 46 counties of the state. He served on court appointed referee groups to reexamine firearms evidence in major cases, including the assassination of Senator Robert Kennedy. He served as forensic consultant and helped define procedural guidelines for the Department's shooting review board. Al defined test and acceptance criteria for body armor procured for peace officers of the California Highway Patrol and the Department of Justice. Throughout his career he continued work with colleagues, at home and abroad, developing objective criteria for identifications between unknowns and test-fired bullets. At various times Al managed the Latent Print, Questioned Document, Audio-Visual, Polygraph, Blood-Alcohol, Drugs While Driving/Toxicology, Instrument Repair, Quality Assurance, Grants and Forensic Technical Support Programs Governor George Deukmejian once described him as one of our state's most skilled and respected forensic scientists. After 17 years of dedicated service with the California Department of Justice, Bureau of Forensic Services, Al retired as Assistant Bureau Chief.

Even during his retirement, Al continued to participate in the firearms and toolmarks training provided by the California Criminalistics Institute. Even in failing health, he continued in this role and maintained correspondence with other researchers on the bullet identification problems which he pioneered. He died on June 24, 1997 from complications due to Parkinson's disease. His family asked that; any remembrances be forwarded to their favorite charity of to the Parkinson's Institute of Sunnyvale of California.

First and foremost, Al Biasotti was dedicated to his family. Pat, Al's wife for 47 years and their six surviving children have continued the tradition of personal achievement for which Al was greatly admired. He believed his most important job in this life would be accomplished within the walls of his own home.

Thanks, Al, for all you gave to all of us.

—Lou Maucieri

Bryan John Culliford
1929-1997

I met Bryan in 1963 when I went to work at the Metropolitan Police Forensic Science Laboratory. I was employed as a chemist and was being given a tour of the lab. In response to some questions from Bryan I indicated that I preferred biology. He disappeared and within minutes I was summoned to the director's office and told that I was now in the Biology Division. This was my first experience of how Bryan Culliford did things. He was simply tenacious. When we started to do electrophoresis there was no money, no tanks, no power supply. So he made the tanks out of two plastic sandwich boxes and some platinum wire. He kept asking for a power supply but it was denied, so he simply used up 12 volt batteries until the cost of batteries forced the funding.

Bryan started his career at the Met. Lab. in 1955 after graduating from the University of Wales at Bangor with not one but two BSc. degrees, one of which was in Forestry. Always looking for something new, he very quickly realized the potential of electrophoresis. He used the procedure to show the differences between the plant peroxidases and blood even though both reacted to the presumptive tests for blood. Similarly, his development of the crossover electrophoresis technique for species identification simplified the confirmation of blood as human with greatly increased sensitivity.

Bryan's personality was such that he was not content to leave the work to others. He had been known to sweep everything off a bench so be had room to work and it was not unusual to see him pick up a gel when it was still running—sandwich boxes don't have safety interlocks!

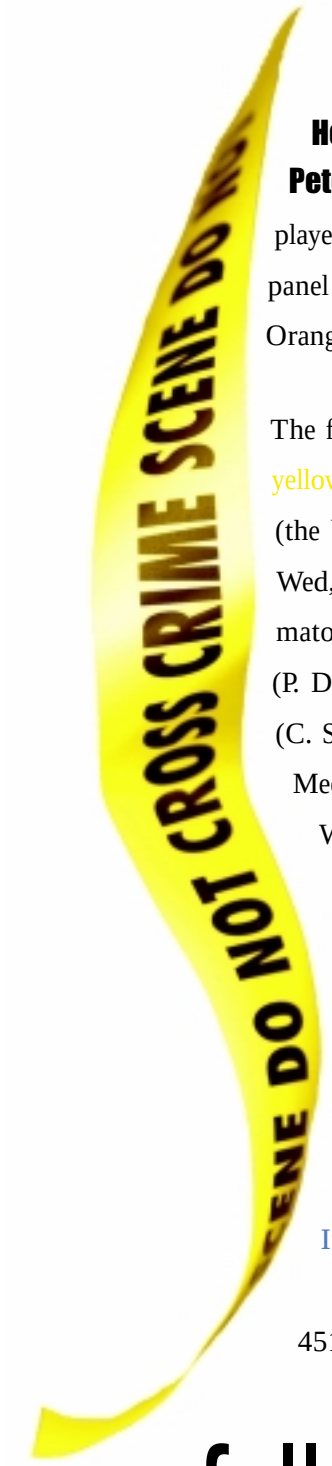
Bryan made a couple of trips across "the pond" to explain and promote the new procedures and in 1970 I accompanied him to New York where a workshop was conducted for 25 forensic scientists from across the United States. Although a few criminalists here were already experimenting with enzyme and protein typing, Bryan's training course really marked the start of the widespread use of these procedures in America. His book, "The Examination and Typing of Bloodstains in the Crime Laboratory" is still a bible to forensic serologists worldwide.

His drive and enthusiasm was catching and he rose through the ranks to Deputy Director overseeing many changes in the biology division. He started data banking the blood profiles of criminals at a time when a computer filled half a room and he believed long before DNA typing that an individual's blood was unique, we simply had to find a way to prove it! He retired in 1985 to the countryside to spend more time with his clay and kiln but still kept his interest in what we were doing at the bench.

I only met with Bryan a couple of times after I left the Met. Lab. but his "bible" is in my library and what he taught and encouraged me to do will always be with me. Bryan Culliford's incredible contribution to forensic science is sometimes under-recognized but his spirit lives on. He will be sorely missed.

—Brian Wraxall

Interact



Henry C. Lee. Barry Scheck. Woody Clarke. Greg Matheson. Ed Blake. Peter DeForest. What do they have in common besides being a few of the key players in the "Trial of the Century?" They will be participating in an interactive panel discussion at the upcoming 90th semiannual CAC seminar hosted by the Orange Co. Sheriff's Forensic Science Services.

The focus of the program is crime scene investigations. Come and peek behind the yellow tape in the O.J. Simpson case, the Linda Sobek case, the Denise Huber case (the body in the freezer), Heaven's Gate and many more! The program includes: Wed, Oct 8: DNA User's Group; Bullet Impact Workshop (L. Haag); Gas Chromatography Troubleshooting Workshop (D. Rood). Thu. Oct 9: Founder's Lecture (P. DeForest); Fire Scenes as Crime Scenes (J. DeHaan); Bombing Investigations (C. Stumph); Online Access to CCI Library (Spatola & Silvia); CAC Business Meeting. Fri. Oct 10: Interactive panel discussion on the O.J. Simpson case: Woody Clarke, Ed Blake, Peter DeForest, Henry Lee, Greg Matheson, Barry Scheck. Crime Scene Reconstruction (H. Lee); M.E. at the Death Scene (B. Blackbourne); Behavioral Analysis (P. Dietz); Dinner / Casino Night. Sat, Oct 11: Burial Sites (J. Suchey); CHP Shooting Reconstruction (G. Laskowski); Body in a Freezer (L. Crutchfield); ABC Certification Exams.

The Airport Hilton in Irvine will be the place; call 1-800-HILTONS to reserve a room. Banquet theme is "Evening at Monte Carlo and Buffet Internationale."

Contact Seminar Co-chairs Liz Thompson or Kenny Wong at (714) 834-4510 with any questions.

fall '97 Beyond the Yellow Tape: Science at the scene

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